



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

UTILIZATION OF GRADUATE EDUCATION IN THE UNITED STATES MARINE CORPS

by

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March 2015

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REPORT DOCUMENTATION PAGE			<i>Form Approved OMB No. 0704-0188</i>	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 2015	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE UTILIZATION OF GRADUATE EDUCATION IN THE UNITED STATES MARINE CORPS			5. FUNDING NUMBERS	
6. AUTHOR(S) Daniel A. Ealy				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) Attention: Dr. Susan Johnston, Director Marine Corps University 2076 South Street Quantico, VA 22134			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number NPS.2014.0066-IR-EM2-A.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE A	
13. ABSTRACT: This research was conducted at the request of Marine Corps University and examined the utilization of 344 graduate education billets within the Marine Corps. The research findings make two recommendations: 1) DC CD&I should charter a working group and use this research as a basis to review the reallocation of under-utilized BEEC BMOSs. 2) DC CD&I should also review BEEC BMOS structure and consider a new distribution plan that includes a new graduate education requirements assessment. These billets are highly desired by units due to their excepted manning precedence level. This thesis used survey methods to collect utilization data on Marine Corps Officers that graduated from the Special Education Program and the Advanced Degree Program between the years of 2009 and 2013. The survey is approved through the Naval Postgraduate School Institutional Review Board (NPS IRB), sponsored through Training and Education Command (TECOM) and supported by Headquarters Marine Corps (HQMC). The data collected from the survey was analyzed to identify significant factors that are highly correlated with low and high utilization in order to improve efficiencies. Findings include initial placement rate from school to billet of 93 percent and the utilization rate reflecting self-reported usage while in billet of 75 percent, identified throughout individual tours. This difference between placement utilization reflects the disparity between top-down and bottom-up planning. Collective review and reorganization of these billets is recommended to reduce further disparity between placement and utilization rates. Objective evaluation and fair reorganization based upon high utilization will ensure Marine Corps human resource assets remain a constant force multiplier and act as a model for high retention strategy.				
14. SUBJECT TERMS Utilization, united states marine corps, graduate education, multivariate regression, survey, special education program, advanced degree program, advanced graduate education program, probit regression, and master's degree.			15. NUMBER OF PAGES 87	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT U U	

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**UTILIZATION OF GRADUATE EDUCATION IN THE UNITED STATES
MARINE CORPS**

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requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ADP	Advanced Degree Program
ASR	Annual Strength Report
BEEC	Billet Education Evaluation Certificate
BIC	Billet Identification Code
BMOS	Billet Military Occupational Specialty
CCLEB	Commandants Career Level Education Board
CMC	Commandant of the Marine Corps
CPIB	Commandants Professional Intermediate-Level Education Board
DC CD&I	Deputy Commandant of Combat Development and Integration
DL	Distance Learning
DOD	Department of Defense
EDCOM	Education Command
EF21	Expeditionary Force 2021
ESR	Educational Skill Requirement
HQMC	Headquarters Marine Corps
IRB	Institutional Review Board
MCO	Marine Corps Order
MCU	Marine Corps University
M&RA	Manpower and Reserve Affairs
MET	Mission Essential Task
METL	Mission Essential Task List
NPS	Naval Postgraduate School
OCSP	Officer Career Satisfaction Program
OJT	On-the-job Training
PII	Personally Identifiable Information
PMOS	Primary Military Occupational Specialty
SEP	Special Education Program
TCOM	Training Command
TECOM	Training and Education Command
T&R	Training and Readiness

T/O	Table of Organization
TFDW	Total Force Data Warehouse
TFSMS	Total Force Structure Management System
TFSP	Total Force Structure Process
USMC	United States Marine Corps

ACKNOWLEDGMENTS

The product of this work is from a compilation of support, the nearest being my wife: Natalie, thank you for your patience, support, and understanding for time away from our family to accomplish this work.

Colonel McCarthy, thank you for your guidance and mentorship as a sponsor and second reader. You guided me throughout the whole body of work. Your meetings were insightful and very helpful in understanding the inner-workings of the Marine Corps.

Major Reifschneider, thank you for your support in providing information and understanding on the SEP/ADP process as well as the data to analyze.

Professor Hatch, thank you for your support as primary thesis advisor and mentor. Your wealth of knowledge on the manpower systems of the Navy and Marine Corps enabled me to orient focus and finish ahead of time.

Professor Tick, thank you for your support and guidance as co-advisor. Your expert knowledge of econometrics and data analysis enabled me to draw significance from the data and create pointed conclusions and recommendations.

Lastly, I would like to thank the organizations: EDCOM, M&RA and MCU for your support and/or sponsorship. I look forward to continuing work and research for the Marine Corps in order to create a more efficient and effective manpower system.

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I. INTRODUCTION

A. OVERVIEW

The United States Marine Corps' mission is to be a force in readiness regardless of size or budgetary constraints. The 35th Commandant of the Marine Corps, General Amos stated in the Expeditionary Force 21 (EF21) publication "Through EF21 we will chart a course over the next 10 years to field a Marine Corps that will be: the right force in the right place at the right time" (Amos, 2014). Over the past 15 years, the Marine Corps end strength has fluctuated from a low of 153,302 to a high of 204,153 Marines. Current congressional authorization allows 174,000 in end strength as of January 9, 2014. This is below an average of 189,000 calculated from 1950 to present (Feikert, 2014; USMC, 2014).

Marine Corps Manpower and Reserve Affairs (M&RA) is responsible to ensure personnel inventory fits during dynamic changes in force structure. In order to support dynamic changes in the Marine Corps, review and objective assessments of billets must be completed. This research will examine the concepts that support quality of "fit" in shaping the right force and in optimizing current human capital by administering a survey to collect and analyze data on utilization rates of billets that require graduate education.

This thesis hypothesizes that by surveying current and prior Marines on billet utilization, the Marine Corps will be able to objectively review the utilization rates of high-demand billets, or Billet Education Evaluation Certificate Billet Military Occupational Specialties (BEEC BMOSs). The investigation of utilization rates of BEEC BMOSs can increase efficiency and strengthen the manpower multiplier through human capital resources.

Increased utilization can potentially generate higher valuation of human capital by measuring military job performance outcomes (e.g., rank, grade, and retention). Although this population is narrowly scoped to graduate education degrees, this analysis method could be used service-wide to increase usage rates.

The following research questions will encase the work of this thesis.

B. RESEARCH QUESTIONS

1. What is an acceptable utilization rate for BEEC BMOSs in the Marine Corps?
2. How are BEEC BMOSs distributed and reviewed?

C. APPROACH TO RESEARCH

1. Strategic

An examination of service obligations and feedback received through satisfaction programs, military organizations may find healthy incentives to retain the correct grade and specialties. A review of Army strategy reveals effective methods for graduate education utilization.

2. Hands-On through Survey

The concept of satisfaction programs allows planners an inexpensive insight into what incentivizes increased efficiency or utilization. Continual research and refinement into more pointed and unbiased survey questions can improve value of the tools for shaping force structure.

3. Quantitatively through Statistical Analysis

Survey methodology using quantitative economic models can provide insight into empirical correlation or causation for specific changes and substantiate recommendations. Probit Regression is used to form binary response. Binary responses are categorized as one and zero; one being acceptable high performance against zero being unacceptable low performance. Data from survey form the model which is then regressed and interpreted. Interpretations are then analyzed and formed into conclusions and recommendations. Objective and properly formed survey questions are necessary to recommend valid, measurable, and unbiased recommendations to ensure maximum potential in reorganization. Utilization is target metric for this analysis.

The challenges of navigating the military organizational structure and understanding high-demand occupations in a constrained system, is best described by the current SEP/ADP monitor, Major Harry Reifschneider,

This requirement (graduate education) is defined by Deputy Commandant, Command Development and Integration (DC CD&I), and they are the keepers of the structure, i.e., the tables of organization (T/O). They define requirements and we fill as best we can with current assignable inventory. The BEEC is a special piece of the SEP/ADP billet identifier code (BIC) to make a SEP/ADP billet. This is all part of the Table of Organization and Equipment Change Process (TOECR). Clear as mud? (Reifschneider, 2014).

In simpler terms; command determines graduate needs, those needs are built through education programs, and finally certified through billets. The billets which are considered to be qualified as Billet Education Evaluation Certificate (BEEC) are seen in overview in Figure 1.

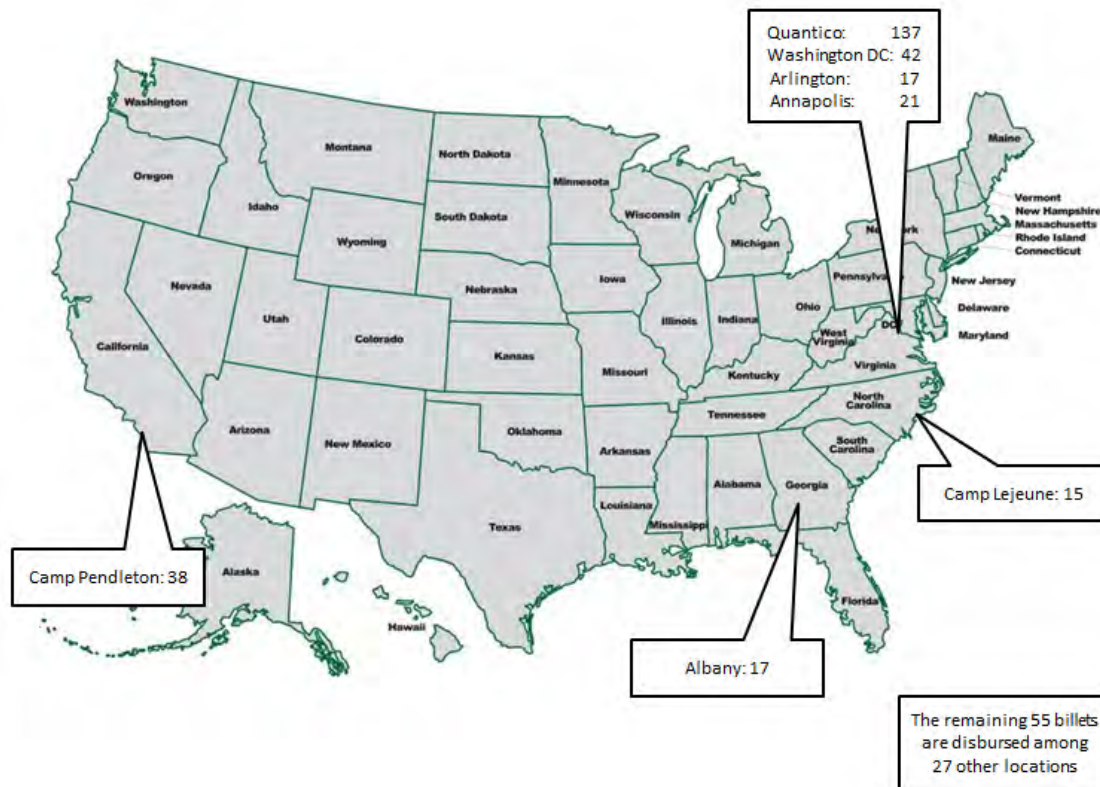


Figure 1. BEEC BMOS overlay (after freeusandworldmap, 2014)

This study begins midyear 2014 when there were 344 BEEC BMOSs. These BEEC BMOSs are distributed over 90 different units of variable size and composition.

The BEEC BMOSs are listed by occupation, title, and frequency in Figure 2. This represents the billet baseline for the follow-on assessments within this thesis.

#	BEEC BMOS	Occupation Title	QUANTITY
1	43XX	Regional Affairs Officer	7
2	8802	Training and Education Officer	9
3	8803	Leadership Development Specialist	7
4	8820	Aeronautical Engineer	3
5	8824	Electronics Engineer	26
6	8825	Modeling and Simulations Officer	14
7	8826	Ordnance Systems Engineer	4
8	8831	Environmental Engineer Management Officer	15
9	8832	Nuclear Engineer	1
10	8834	Technical Information Operations Officer	28
11	8840	Manpower Management Officer	25
12	8844	Financial Management Specialist	17
13	8846	Data Systems Specialist	35
14	8848	Management Data Systems Officer	47
15	8850	Operations Analyst	42
16	8852	Defense Systems Analyst	27
17	8858	C4&I Officer	6
18	8862	Material Management Officer	17
19	8866	Space Operations Officer	13
20	8878	Historian	1
		Total	344

Figure 2. BEEC BMOSs list as of 2014 (after USMC TFDW report, 2014)

In order to focus the scope of this research, the parameters will be limited to identifying the distribution of the BEEC BMOSs across their specialty, the process for review in the Total Force Structure Process (TFSP), and identify significantly low and high performance by using utilization as a metric. This research will not review each billet by location as this would be infeasible and create conflict with anonymity for

survey respondents. Results are expected to provide sufficient data that will give substantiation for review which is based on utilization for each specialty. The end state of conclusions will be to improve utilization and not lower graduate education requirements. Chapter II reviews military directives and guidance in order to validate credible recommendations.

D. WHY IS THIS RESEARCH IMPORTANT TO THE MARINE CORPS?

The Marine Corps has requirements for 344 graduate education billets out of and end strength of 182,100 currently assigned (Amos, 2014). This equates to one tenth of one percent; these billets are small in number yet important to leadership and planning which is why it is important the Marine Corps utilize these positions to their maximum extent. These billets could be considered the work horse of strategic thinking. Therefore, if billets are not being utilized at acceptable rates, reorganization is assumedly warranted. New threats face the Nation and the Marine Corps every day; emerging threats such as cyber and unconventional warfare. Lastly, the Marine Corps does not plan and fill requirements when requirements do not exist. Requirements change, and reassessments identify new needs. Requirements are decided with a top-down approach and improvements are made through a bottom-up refinement process. This research supports that process; it identifies shortcomings and makes recommendations to fix them.

As stated in the 2015 36th Commandant's Planning Guidance; the Marine Corps is innovative, adaptable: a good steward of the Nation's resources (Dunford Jr., 2015, p 1). Also stated in General Dunford's guidance is a commitment to constantly improve the quality of manning and our capabilities (Dunford Jr., 2015). The spirit of these two references encapsulates the work herein.

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II. BACKGROUND

A. OVERVIEW

The following policy guidance issues graduate education assignment process guidance for the mapping and measuring of competency in graduate education. The purpose of providing and examining these documents is to orient and evaluate the current system on clarity, transparency, and efficiency. A review of these documents will also support the conclusions and recommendations provided to manpower planning and development.

1. Department of Defense Instruction 1322.10 (2008)

The purpose of DOD instruction 1322.10 is to issue guidance and authority to implement the policy for graduate education for military officers (Department of Defense, 2008). It states that funded graduate education will raise competency, develop incentives for professional growth, enhance capability, and enable officers to more effectively perform their duties and responsibilities (Department of Defense, 2008).

Paragraph 5.2.6 instructs that positions requiring graduate education be validated; it also states the requirement for the specified “payback” time for officers who receive funded education. This letter of instruction states that military officers who have received fully or partially funded graduate education shall be obligated to a period equal to three times the number of months of education completed during the first year of graduate school (Department of Defense, 2008).

2. Marine Corps Order 1520.9G Ch 1 (2012) “SEP”

“The Marine Corps has identified and validated several hundred billets, which are required to be staffed by officers who possess postgraduate level education” (MMAA-3 & Commandant, 2012). Marine Corps Order 1520.9G Ch 1, titled the “Special Education Program” (SEP), publishes the requirements and process to apply for graduate education through several institutions: Naval Postgraduate School, United States Naval Academy, and Air Force Institute of Technology. This program provides 90 percent of the graduate

educational requirements for the Marine Corps. The other 10 percent is provided from the “Advanced Degree Program” (ADP).

This thesis research assumes the Marine Corps knows what skills and education requirements it needs, has properly communicated those skills to the institution, and the institutions are meeting the standard via corresponding curricula.

3. Marine Corps Order 1560.19E Ch 1 (2012) “ADP”

Marine Corps Order 1560.19E Ch 1, titled the “Advanced Degree Program (ADP),” identifies the process to apply for accredited civilian institutions that augments the SEP and completes the remaining ten percent of the graduate educational requirements of the Marine Corps. The curricula are broader in scope and provide additional degrees such as education and history. The SEP and ADP documents are clear in their endstate and how they intend to meet graduate needs analysis; a macro view of requirements.

4. Marine Corps Order 5320.12H (2012)

Marine Corps Order 5320.12H, titled “Precedence Levels for Manning and Staffing,” gives the Marine Corps direction for manning when staffing requirements outnumber resources, which is generally the case. This order affects all three forms of analysis: organizational, needs-based, and program. The process for establishing precedence is founded on the Annual Strength Report (ASR) which is the Marine Corps’ annual personnel budget. There are four levels of precedence: Excepted Commands manned at 100 percent; OpFor Commands manned minimally with 95 percent officer and 97 percent enlisted; Priority Commands manned minimally with 95 percent officer and enlisted; and Proportionate Share Commands manned minimally with 92 percent officer and 94 percent enlisted (C18 & CMC, 2012). Billets requiring graduate education are typically excepted billets which are manned at 100 percent.

The attractiveness of these billets to units is high. Based on this order, a review of change requests will be conducted every four years. Even though a routine review of precedence is regularly conducted, BEEC BMOS billets are difficult to

validate/revalidate given the higher level units of measure that would be needed for criteria. Anecdotal evidence suggests these billets have not been readjusted for many years. This lack of movement in manpower alludes to several possible reasons: no incentive to do so; the process is not conducted objectively; or no changes have been needed.

5. Marine Corps Order 5311.1D (2009)

Marine Corps Order 5311.1D establishes the Total Force Structure Process (TFSP). This manual provides guidance to ensure optimal use of forces and resources to accomplish Mission Essential Tasks (METs) given to the Marine Corps. Mission statements are created by the Deputy Commandant of Combat Development and Integration (DC CD&I) and advocates establish the force structure to support them. Billets are a result of task bundling and as such must be evaluated for reasonable troop-to-task ratio. This order encloses a template for this process that follows three steps: (1) develop implied tasks, (2) describe the requirement, and (3) develop proposed organization reflecting troop-to-task analysis (CD&I & CMC, 2009).

If manpower requirements need to be updated, a Table of Organization and Equipment Change Request (TOECR) is used. Changes are founded on needs of the unit's Mission Essential Task List (METL). It is noted that billets requiring additional college or graduate education will need an associated Billet Education Evaluation Certificate (BEEC). All changes or additions involve both the Training and Education Command (TECOM) and the director of the Total Force Structure Division (TFSD) (CD&I & CMC, 2009).

The TFSP provides contacts to seek guidance from in reference to the anecdotal evidence of under-utilized BEEC billets. Any conclusions or recommendations made from this research should align and follow the methodology listed within the TFSP. There will be no attempt to change the Total Force Structure Management System (TFSMS); rather, this research works within the constraints of TFSMS policies.

6. MARADMIN 191 (2014)

The purpose of this MARADMIN is to solicit applicants for a distance learning advanced degree, or graduate degree, administered through Naval Postgraduate School. Funding is directed to senior O3-O5 grades as well as senior E6-E9 grades (limited to more technical programs). The purpose is to advance skills and experience within military specialties as well as professional and formal development. This recent distant learning (DL) movement acknowledges effectiveness of DL curricula while enabling cost-saving techniques. The importance of this movement is to allow Marines who are developing their military careers to stay more relevant in their careers as they progress. With respect to utilization, overburdening an individual could cause greater damage than benefit if not conducted correctly; however, the bigger picture of expanding the learning opportunities for advancement is applauded.

7. NPS Educational Skill Requirements (1996)

The Naval Postgraduate School (NPS), along with Marine Corps Occupational Field representatives and subject matter experts, determines educational skill requirements (ESRs) that are required for certain tasks the Marine Corps must accomplish; these ESRs validate the BEEC BMOSs (NPS, ESR, 1996, p. 4). This process allows the Marine Corps to properly train and educate billet holders on their responsibilities, while meeting the educational needs of the Marine Corps (NPS Curricular Office, 1996). It also, understandably, is a dynamic process as professions and technologies change and should be reviewed regularly. The ESRs are assumed by this thesis to be credible and function properly. This assumption allows the scope of this research to focus on billet validity.

In summary of Chapter II findings, the Marine corps through the TFSP identifies graduate education needs through analysis and fills those needs with programs such as SEP and ADP. The SEP and ADP are managed by boards such as the CCLEB and CPIB. The CCLEB and CPIB place the human asset into the need. The human asset is accredited not only through the institution, but more specifically through ESRs. The process of identifying needs, creating capabilities, and successfully filling those needs is

a lengthy process. The process, through its whole cycle takes approximately 4–5 years at any given time. Created by the author of this thesis, a rough timeline of SEP/ADP selection and utilization process is shown in Figure 3. If a new need for graduate education is identified, it would take a minimum of two years to fill that gap, assuming the current process is used. Lastly, if a need is incorrectly assessed or misaligned it would take a minimum of 5 years to course-correct, assuming the current process is used.

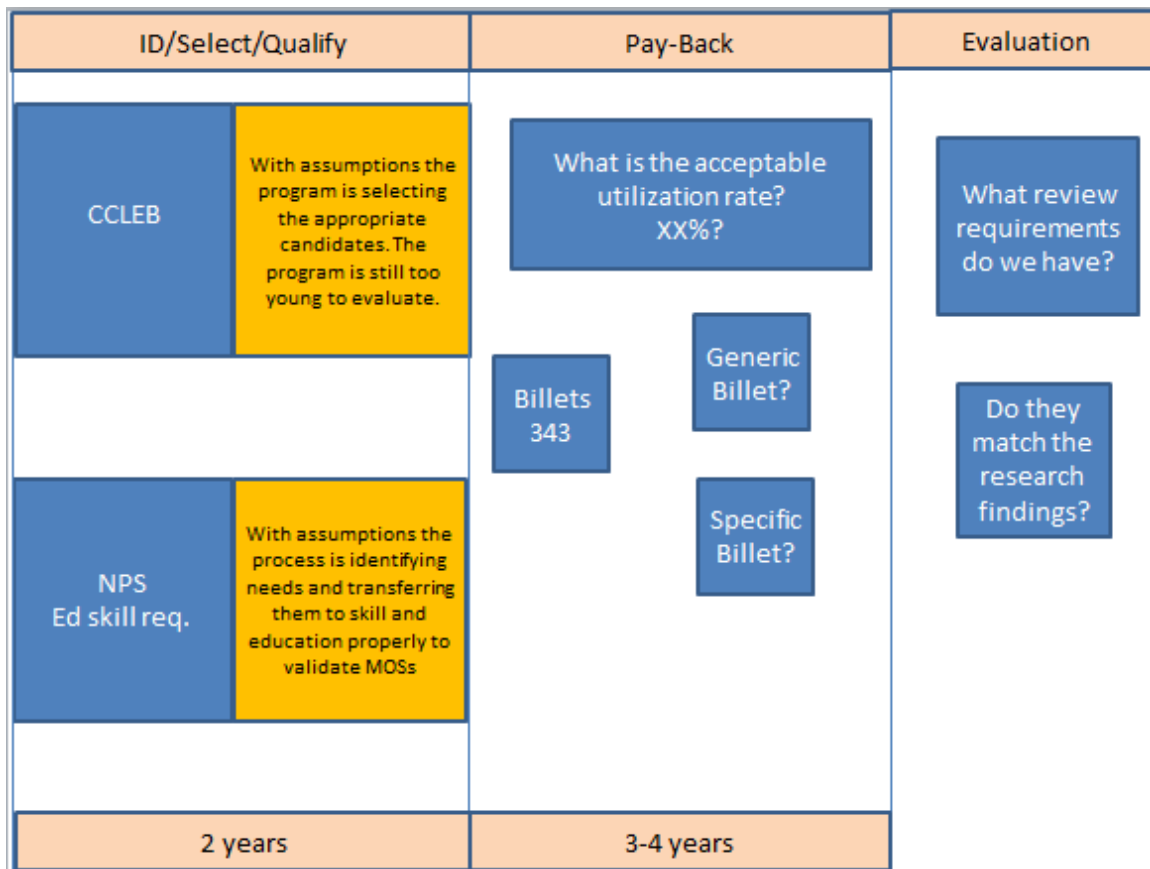


Figure 3. Rough timeline of SEP/ADP selection and utilization process

The review portion of the guidance may be found for review on page 5–7 of enclosure 1 in the TFSP (MCO 5311.1D, USMC, 2009).

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III. LITERATURE REVIEW

A. OVERVIEW

This chapter reviews the most relevant and current studies on manpower utilization with focus on managing officer talent and evaluation of military graduate education using regression analysis of survey data.

As stated by Ealy in an unpublished work (2014), there have been many studies that considered the individual's perspective of graduate education on promotion and retention (e.g., Oros, 2008; Simboli, 1993; Branigan, 2008). Ealy found there are fewer studies on organizational utilization of graduate education; however, his overall findings of studies on the effect of funded graduate education on career show negative effects on career retention (Ealy, 2014). As a result, in 2011, in order to reduce the negative impact of graduate education on retention, the Marine Corps tasked two selection boards; the Commandant's Career-Level Education Board (CCLEB), and Commandant's Professional Intermediate-Level Education Board (CPIB) to review all graduate education applicants to ensure timing and future career considerations are reviewed, as well to create a comprehensive competitive process to select the best and fully qualified (USMC - CCLEB, 2014). This process also serves to mitigate the perception of self-serving bias; which explains the negative view of anyone who voluntarily participates in approved graduate educational program. The elimination of bias from retention review boards would cause graduate education to be seen as more of a requirement than a sabbatical from high-tempo operations (Ealy, 2014). Due to the recent implementation of CCLEB, it has not been possible for any study to review the effects on the Marine Officer population. There is anecdotal evidence which suggest there is higher approval to SEP and ADP (Ealy 2014).

B. ASSIGNMENTS

1. Strategy Research: Strategy-Based Utilization

Officer manpower strategy, with focus on career incentives such as education for optimal performers, was examined in the 2010 study "Towards a U.S. Army Officer

Corps Strategy for Success: Retaining Talent” by Wardynski, Lyle, and Colarusso. The study proposes the hypothesis that retention of high quality officers is a function of properly timed educational incentives. The data used in this study represents Army personnel databases containing observations on more than 7,000 officers, ranging from Lieutenant to Colonel from 1978 to 2010. This study is only one in four monographs on officer labor models: accessing, developing, employing, and retaining talent; or optimal utilization. The results of Wardynski et al. support this research by framing some key elements of utilization such as: timing, and grade selection for utilization. The hypothesized benefits of earlier graduate education is more time the organization can benefit from attributes acquired in school, such as: critical thinking, written and oral communication skills, broad knowledge of one’s own service, knowledge of other services, knowledge of joint operations, skills in operational planning, skills in fiscal planning as well as cultural and social skills. The counter thesis is that more education, acquired early on in a career, increases the risk of lower retention. To refute or the answer to lower retention is through service obligations.

Findings from the study show that extending active duty service obligations for servicemembers who are optimal performers in exchange for graduate education at the 7–8 year time-in-service mark will produce a retention rate of 96 percent at the 15–16 years of service mark (Wardynski, 2010). Other findings include that generic transferrable skills should not be the focus of educational incentives due to the susceptibility of talent poaching. The study also recognizes the limiting conditions of (1) promoting within and (2) matching work and talent through limited inventory. A negative result of ignoring the limiting conditions will result in low retention and utilization rates. Positive variables that increase retention and assumedly utilization analyzed in the study were the Officer Career Satisfaction Program (OCSP) which raised retention rates 50 percentage points. The Marine Corps does not have an OCSP rather the CCLEB acts in lieu to ensure the optimal performers are provided the opportunity to receive education in return for service obligations.

The application or relevancy of the Wardynski study to this thesis is an acknowledgment that education is and should be used as an incentive to retain talent.

However, the counter thesis to using education as a retention tool must be aligned with utilization and Title 10 requirements or funded/supported through other means. This supports the use of reviewing agents such as the CCLEB to ensure top performers have incentive to stay and are in accordance with utilization requirements.

2. Survey Research: Survey-Based Utilization: O’Sullivan (2006)

The 2006 NPS thesis titled “Measuring the Value of Graduate Manpower Systems Analysis Education for Naval Officers” by O’Sullivan creates surveys to measure utilization for those whom have gone through graduate educational programs in the military. The study explains the Navy’s human resource system and how utilization has traditionally been measured through codes. These codes identify subspecialties which are acquired through graduating from recognized navy graduate programs.

The Navy must adhere to the same Title 10 requirements as all of the other service branches; as listed in the background. The study acknowledged that economic return is not the only measure of success in utilization. Human capital and talent retention as listed in the strategic portion of this literature review is also very important. This study attempts to measure this human capital via survey and create a feedback loop to provide reciprocation in measuring a programs’ success.

The research questions determine what value is measured and how education should be validated (O’Sullivan, 2006). The study created two questionnaires; one for billet holders and one for supervisors; that are able to be completed anonymously. It recognizes surveys are inexpensive and a simple tool for gathering quantitative metrics. As cited in O’Sullivan’s thesis, problems associated with surveys identified were honesty, response rate, determining sample size, and wording pitfalls (Nowak, 1990; Johnson, 1993). The O’Sullivan survey identifies three goals, of which only one is applicable to this thesis, which validates existing billet structures and positions (O’Sullivan, 2006). To reiterate, there will be no intention in this thesis to confirm or validate the curriculum that aligns billets which are deemed as requirements. The ESRs are assumed to be appropriate and necessary for all graduate billets or BEEC BMOSs.

Though the O'Sullivan thesis describes the method to evaluate surveys, it does not actually complete the cycle of publishing, receiving and analyzing the results of a survey. The goal of this thesis is to complete the cycle and provide meaningful quantifiable information to allow decision makers to make informed choices about the trends of particular billets. O'Sullivan recommends using a survey to poll the immediate supervisor and the billet holder. Two detailed surveys were attached to the thesis but they were not distributed. The two objectives of the survey were (1) to create a tool to analyze value of education on utilization and (2) to create a tool to validate existing billets.

To truly achieve a "bottom up refinement," Ealy will survey only the billet holders and not the leadership or commands of the units that hold BEEC BMOSs to acquire an unbiased assessment of utilization of graduate needs. The O'Sullivan recommendations were taken into considerations such as: additional target audiences, looking at different measures of value, and keeping each individual survey brief (O'Sullivan, 2006, p. 60).

In summary, where O'Sullivan's thesis and survey has intentions of valuing the education to validate education, this thesis intends to survey billet holders to validate billets. It is already assumed that the need for education has been identified and validated, and it is assumed that the identifiers of those needs have properly conveyed to the educational institutions the educational skill requirements (ESRs). Further, it is assumed that the educational institutions have properly met those requirements. Therefore, the take away from the O'Sullivan thesis is (1) how do identify usage and (2) a means how to collect quantifiable data via survey.

3. Multivariate Regression Research: Probit Regression-Based Utilization: Bowman and Mehay (1998)

The study by Bowman and Mehay (1998) "Graduate education and employee performance: evidence from military personnel" focuses on the relationship between productivity and graduate education through probit regression analysis of promotion outcomes, the military's measure of potential. The populations in the study are naval officers at the office grade of O-3 whom are considered for promotion to O-4. To

examine the success of naval officers with graduate education, the (Bowman & Mehay, 1998) study used a data set containing observations on over 7,000 naval officers that were entering a phase in their career labeled as the “up or out” 10 year mark between 1985 and 1990. This phase is synonymous with promotion to the grade of O-4. There are two major categories of officers evaluated, 4,230 line officers and 2,353 staff officers (Bowman & Mehay, 1998).

The promotion probability is modeled as the aggregate of ability, effort, and the promotion rate (Bowman & Mehay, 1998) and it is estimated using a probit regression model. The dependent variable is the probability of promotion which is displayed in percentage points with limits of 0 that equals “do not promote” and 1 that equals “promote.” The independent variables are characteristics such as performance measurements and whether an individual attended graduate school. Considerations annotated were demographic inequalities between male and female in some occupations, as well as unequal representation for all minorities in all occupational specialties. The supply size of the cohort and the demand allowed to promote were both controlled through annual cohort and fiscal promotion dummy variables.

(1) Promotion probit model

This method is as displayed by the formula:

$$Y_i = x_i\beta + I_{G_i}\gamma + \epsilon_{yi}$$

where:

Y_i = marginal probability of promotion

X_i = set of individual characteristics

β = coefficient

I = variable equal to 1 if individual attended graduate school

G_i = latent value of completing graduate school

γ = coefficient

ϵ = error term

This type of model can be applied to utilization rates by modeling utilization to be a binary function where the number one would equal utilized and zero not utilized. This is deemed a reasonable model on the basis that individuals can measure their own utilization.

Variable	Dependent variable – promotion to grade 4			
	1.	2.	3.	4.
Master's degree	0.376 (0.059) [0.098]	0.342 (0.060) [0.087]	0.345 (0.060) [0.085]	0.265 (0.065) [0.065]
Female	0.710 (0.244)	0.628 (0.246)	0.636 (0.246)	0.502 (0.249)
Age	-0.064 (0.010)	-0.064 (0.010)	-0.074 (0.015)	-0.071 (0.016)
Married	0.191 (0.064)	0.188 (0.064)	0.186 (0.064)	0.137 (0.069)
Married with children	0.260 (0.057)	0.257 (0.057)	0.255 (0.057)	0.252 (0.062)
Divorced with children	0.014 (0.164)	0.037 (0.165)	0.035 (0.165)	0.006 (0.179)
ROTC program	-	-	-0.275 (0.054)	-0.266 (0.059)
OCS program	-	-	-0.038 (0.069)	-0.104 (0.074)
NESEP program	-	-	-0.095 (0.119)	-0.124 (0.130)
College GPA	-	0.183 (0.027)	0.175 (0.027)	0.142 (0.030)
Technical B.A.	-	-0.032 (0.047)	-0.030 (0.049)	-0.010 (0.052)
Minority	-0.227 (0.106)	-0.164 (0.106)	-0.181 (0.107)	-0.103 (0.115)
Early performance ratings	-	-	-	0.009 (0.000)
Constant	1.947	1.439	1.781	1.598
- 2 Log L	4289.0	4242.9	4215.0	3590.2
N	4214	4214	4214	4039

Notes: Standard errors in parentheses; marginal effects in brackets. All specifications include fiscal year dummy variables.

Figure 4. Probit regression output (from Bowman & Mehay, 1998)

The Bowman and Mehay (1998) research results indicate those who possess graduate education increase their marginal probability for promotion through percentage points, which is dependent upon the specificity of the model... alternatively stated, naval officers who possess graduate education have a higher probability for promotion than those who do not have graduate education. Probit regression reflects a dichotomous outcome over a linear regression. As with any multivariate model, the utility and validity of the model is based on exogeneity, or all things which are considered under the parameter of the formula. In addition, this thesis assumes probit regression to be the best fit to support this hypothesis of SEP/ADP billet utilization. In review, probability and single stage estimators indicate a result which is in percentage points. Relationships between differing models can allude to unobserved attributes in the error term, and finally this study is the lead reference for regression (Bowman & Mehay, 1998).

A counter thesis to first-term utilization requirements must be recognized which is that federal regulators are trending towards promoting broader and more extensive use of

graduate education (Kamarack, 2010). A recognized rebuttal suggests there are soft skills that are acquired in graduate school that are useful across a broad spectrum of jobs and there should not be a mindset of filling to a requirement, rather educate for the future. Presently, to refute this counter thesis, the USMC remains under first-term utilization title 10 regulations. Additionally, trending away from any means of accountability is not supported in this thesis.

In summary, this chapter reviewed the literature that represents a strategy to follow, a method of data collection to follow, and one formula for regression analysis to use. The strategy concisely explained is to fill graduate education requirements with Marine Officers who are nearing who have as little time on service as possible to ensure the benefits of the graduate education can be replicated through as many tours as possible and retaining that talent by obligating those Marines to terms that end past the 10 years of service mark. This will guarantee higher rates of retention and higher compounding effects of graduate education. The data collection methodology summarized is to gather utilization information through survey means of Marines who are or have participated in a utilization tour to use in statistical and econometric analysis. The analysis summarization is an econometric device to categorize binary results and marginal probability of success in categories. Combined, the effects should produce a “bottom-up” refinement to the “top-down” process that is currently in place.

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IV. METHODOLOGY

A. OVERVIEW

This chapter presents: (1) the initial data that guided the design of the survey, (2) the survey used to collect the additional, in-depth data to be used in analysis, and (3) a brief presentation of the multivariate regression model used in this thesis to analyze USMC graduate education billets (BEEC BMOSs). The collection of data and the distribution of the survey was approved by the Naval Postgraduate Institutional Review Board (IRB).

B. STRATEGY

The survey questions were developed to provide decision makers a measure of BEEC BMOS efficiency. It will allude to incentives for target audiences about the incentives of graduate education population and how the Marine Corps can maximize their utilization by examining factors such as rank and organizational structure. The findings should present highly correlated relationships that will allow leaders and planners a quantifiable base to make informed decisions. The results from the survey data and regression data should highlight particular skills or organizational behaviors that contribute to greater utilization than others.

C. DATA

Two Total Force Data Warehouse (TFDW) sources were used for an initial extract of data identifying Marines with graduate education and billet information. This initial data extract provided guidance to identify the target population for the survey designed to collect additional, in-depth information to be used in the analysis. The extraction of data was completed by the SEP Monitor, while the design, administration, and collection of the survey was completed by the thesis. The survey was specifically designed for this research.

The TFDW is a repository of many databases that has the capacity to query and assemble data for a variety of reasons. In this instance, The TFDW identified Marine

Officers who served in BEEC BMOSs within a five year bracket from 2009 to 2013. Once subjects were identified, personally identifiable information (PII) was removed to ensure individuals who participated in the survey were anonymous. The query identified 948 Marines who were eligible to participate in the survey. Marines currently separating or recently retired were still considered valid respondents.

The second query possessed BEEC BMOS billet information, dated at approximately midyear 2014. As of 2014, there were 344 active Marine Corps billets. These billets require graduate level education and were primarily filled through the Special Education Program (SEP) and Advanced Degree Program (ADP). The process of manning these billets requires a continuous training cycle that, on average, obligates a Marine to a minimum of 36 months. For every one active billet there are approximately three persons in the training pipeline for that billet, who are being educated or conducting on-the-job (OJT) training. Having three Marines to one billet equates to 1,032 Marines cycling to ensure requirements and manned and maintained for consistency and proficiency.

The motivation for this thesis is to examine any possible inefficiency derived from the lack of incentive to remove BEEC BMOSs from Tables of Organization (T/O), where the requirements are no longer valid. BEEC BMOSs are excepted command billets filled at 100 percent; theoretically, there is no incentive for units or billet owners to remove a BEEC BMOS from a troop list when it is not needed due to this manning incentive.

Training and Readiness (T&R) evaluations validate Primary Military Occupation Specialties (PMOS) and are conducted annually or prior to deployment, however there is no such device for BEEC BMOSs which makes validation more difficult or low utilization easier to overlook. Therefore, this thesis uses self-reported bottom-up survey based utilization responses as the measurement for validity (NAVMC 3500.18C, 2013).

D. SURVEY

A survey, by definition is “a systematic method of gathering information from a sample of entities for the purposes of constructing quantitative descriptors of the

attributes of the larger population of which the entities are members” (Fricker, 2014). As referenced in the literature review in Sullivan (2006), the author suggests a survey be conducted to extrapolate quantitative measures of value, or in this thesis utilization.

1. Surveys and Selection Bias

A sample is considered biased if it does not represent the population. A biased sample will distort results and conclude inaccurate findings. The specific style of biasedness that can effect a survey is called “nonresponse bias” when a very low number of the target population responds to a survey, thus increasing the chance for inaccurate representation (Studenmund, A. H. Occidental College, 2001, p. 544). This thesis approaches and counters this type of bias through three means, with the first being a high response rate to the survey. As previously stated the target population was 948 Marines and of those 457 responded and 414 were eligible. This response rate of more than 40 percent of the population indicates that a fair and balanced sample was examined. The second counter to biasedness in the sample was the anonymity of the survey responses. One who had possible negative comments or experiences may tend to not participate if the results of the survey were published with personal responses; however this was not the case. The third and last counter to biasedness in the survey was that every question was voluntary, with the exception of the waiver to participate. Voluntary questions open up the possibility of “item non-response” or the refusal to answer particular questions which will negate a random sample, however there were no significant itemized non-responses which would lead to non-random or biased sampling (OECD, 2014).

2. Measure of Utilization

Because there is no supplemental measure for utilization within the TFDW, a survey was designed and administered by the author to the pool of Marines Officers identified by the TFDW. Once the survey was complete, all personally identifiable variables were eliminated from the data to ensure each survey response was anonymous. This allowed the survey respondents to complete the survey anonymously and provide unbiased opinions on utilization.

3. LimeSurvey

The software used was LimeSurvey © and an inactive version of the survey is located at: <https://survey.nps.edu/355736/lang-en>. The survey contains skip logic or conditional branching, which means the survey is of one origin, with four branches dependent upon the subject's circumstances after graduate education. The skip logic branches are listed in Figure 5.

short title	variable description
have not	Those who were not utilized
current	Those who are currently being utilized
have	Those who have completed one utilization tour
multiple	Those who have completed more than one utilization tour

Figure 5. Survey branch methodology for categorization of survey respondents

Branching and categorizing the control subjects for differences between categories which will be further discussed in the regression portion of methodology. Subsequently this division supports the principle of treatment and control groups. Defined by a North Carolina State University,

A control group is used as a baseline measure. The control group is identical to all other items or subjects that you are examining with the exception that it does not receive the treatment or the experimental manipulation that the treatment group receives. For example, when examining test tubes for catalytic reactions of enzymes when added to a specific substrate, the control test tube would be identical to all other test tubes with the exception of lacking the enzyme. The treatment group is the item or subject that is manipulated. In our example, all other test tubes containing enzyme would be part of the treatment group. (NCSU, 2014)

In analysis, control groups will be t-tested for statistically different responses based on category of respondent. Control groups will be those who do not fall into the category of test. Tests will evaluate differences in utilization response to see if one category rates significantly different than another. The null hypothesis of these t-tests for control groups would test for no difference.

Once the design of the survey is completed and beta tested for clarity, the survey will gather quantitative descriptors or variables which are then constructed into a multivariate equation for regression. A total of 948 subjects from 2009–2013 BEEC BMOS service qualified and were contacted to participate in the survey. All four status categories (h, c, m, hn) were represented in the subject pool, as seen in Figure 5. The statistical description of this data or body of subjects is defined as pooled cross-sectional data (Fricker, 2014). Of the 948 subjects who were contacted, 457 responded and participated in the survey. The 43 subjects still in school were eliminated; leaving 414 valid respondents. Eliminating the unintended subjects from the population lowered the total subject population to 905, creating a 45.7 percent response rate. The survey was approved through the Naval Postgraduate School Institutional Review Board (NPS IRB), sponsored through Training and Education Command (TECOM) and supported by Headquarters Marine Corps (HQMC).

a. Variables Derived from the Survey for Regression Analysis

This research does not attempt to attain an exogenous pool of data and solely uses survey answers to represent variables; conclusions must be associated with correlation and not causation. This means the survey variables only allow interpretation of items that are significant in correlation or relationship of one another. The following variables in Figure 6 were designed via the survey.

Type	Description of variable	behavior
Dep	Percentage of utilization with basis of time served in tour 0–25% = time spent in tour utilizing BMOS 26–50% = time spent in tour utilizing BMOS 51–75% = time spent in tour utilizing BMOS 76–100% = time spent in tour utilizing BMOS	ordinal nominal
Ind	BMOS dummy categories (20); 1 if, 0 otherwise	nominal
Ind	Status dummy (4) c = currently serving a utilization tour h = served one utilization tour m = served more than one utilization tour hn = have not served a utilization tour	nominal
Ind	utilization (likert) rating for multiple tour Marine Officers	ordinal
Ind	Rank when assumed billet dummy; 1 if, 0 otherwise ra1 = assumed as O1 ra2 = assumed as O2 ra3 = assumed as O3 ra4 = assumed as O4 ra5 = assumed as O5	nominal
Ind	Rank suggested for assumed billet dummy; 1 if, 0 otherwise re1 = should be O1 re2 = should be O2 re3 = should be O3 re4 = should be O4 re5 = should be O5	nominal
Ind	Location of billet with reference to others with similar billet cl = centralized dl = decentralized nl = neither or no comment	nominal
Ind	Preference of location of billet with respect to utilization cp = centralized preference dp = decentralized preference np = neither or no preference	nominal
Ind	Positive contribution to requirement pc = 1 for yes, 0 otherwise	nominal
Ind	Additional school requirements as = 1 for yes, 0 otherwise	nominal

Figure 6. Variables derived from survey questions

b. MCO 5311.1D Total Force Structure Process Guidance

The TFSP order contains evaluative survey questions, which are already developed to measure billets and their requirements. The questions within the enclosure, M-2, focuses on billets that are external to the Marine Corps; however, the structure of the questionnaire is relevant to current billets, such as BEEC BMOSs. Some of the questions in particular that were identified as relevant are listed in Figure 7 (USMC, 2009).

1.	What do you believe is the minimum grade required for this billet?
2.	Does the billet MOS accurately reflect particular skills that are required?
3.	Should the completion of a particular Service school or course be required prior to assignment? If yes, name the school or course and give the reason.
4.	How often are your duties required?
5.	By virtue of your position, how often are you able to influence actions which are relevant to the Marine Corps?
6.	What is the evaluation of your billet in relation to its overall value to the Marine Corps?
7.	If more than one Marine is assigned to your office, is it possible to consolidate those billets and reduce the manpower requirements associated with them?

Figure 7. MCO 5311.1D N-4 Enclosure (1) Billet Questionnaire

E. REGRESSION ANALYSIS

To address the questions examined in this thesis, the data will be analyzed using multivariate regression analysis in order to identify factors that explain documented utilization outcomes.

1. Types of Models and Variables

The variable of interest in this study is the utilization rate, recorded in the survey responses as being in one of the four categories: 0–25 percent, 25–50 percent, 50–75 percent or 75–100 percent. From here, to generate more insightful findings, the utilization rate variable was further aggregated into bottom 75 percent utilization, and top 25 percent utilization, and it is captured by a binomial variable that takes the value of 1 if the condition of being in the top 25 percent is met and zero otherwise. In order to

accommodate the binomial utilization variable to be studied, the multivariate model used is a probit regression model (Laerd Statistics, 2014).

a. Categories of Participants

As listed in Figure 5, there are four different categories of participants. This allows for a control variable for t-testing. The mean of each category/variable (c, h, m, and hn) was tested against the mean of all others for statistically significant difference in the measure of utilization. For example, Marines who are currently serving in utilization tours may have statistically different answers than Marines who have already successfully served a utilization tour. Combining their answers could make a type II error. A type II error occurs when analysis fails to reject a false null hypothesis, or simply put, when one believes in something that is false. Therefore, in this thesis, if categories are statistically different they are analyzed separately. The dataset is pooled across several years, which defines a pooled cross-sectional data set. It is not considered panel data since this research will not extrapolate yearly trends and simply identify low utilization with correlated factors as to why (Studenmund, A. H. Occidental College, 2001, p. 243).

b. The Generic Probit Regression Format

The generic probit regression model used in this thesis is described below:

$$Y_i = \beta_0 + \beta_1 AS_i + \beta_2 RM_i + \beta_3 PC_i + \beta_4 OM_i + \epsilon_i$$

where:

Y_i = marginal probability of utilization at top quartile

AS_i = dependent variable for additional schooling; 1=yes, 0=otherwise

RM_i = dependent variable for correct rank capitulation; 1=yes, 0=otherwise

PC_i = dependent variable for positive contribution; 1=yes, 0=otherwise

OM_i = dependent variable for organization match; 1=yes, 0=otherwise

B_j = regression coefficients, $j=0, 4$

ϵ_i = error term

Probit regression indicates if an independent variable explains variation in the probability of high utilization (>75 percent). This is verified by statistical significance of

the coefficient. Magnitude of the coefficient does not equal magnitude of the relation between independent variable and dependent variable. Marginal effects are needed for causation. Marginal effects show the percentage point increase (if positive coefficient) or decrease (if negative coefficient) in probability of a binary solution (Studenmund, A. H. Occidental College, 2001). While this chapter described the data collection and provided a brief description of the multivariate regression model that will be used in the analysis, the next chapter will present the analysis

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V. ANALYSIS

A. OVERVIEW

This chapter focuses on the descriptive statistics and analysis that supports the research questions:

1. What is an acceptable utilization rate for BEEC BMOSs in the Marine Corps?
2. How are BEEC BMOSs distributed and reviewed?

B. STRATEGIC ANALYSIS

The Wardynski (2010) study concludes that incentivizing Marines as early as possible with education and ensuring retention through service obligations that reach into the career phase of service will ensure the maximum utility of benefits from education. More specifically, CCLEB selection creates a foundation for success in time-evaluated retention. This may take 10 years of collecting panel data to evaluate long-term organizational success, but if the Marine Corps can retain talent via SEP and ADP as quickly as possible after augmentation, that may generate a higher utilization output frontier. This can be done through analysis of survey data and can be controlled and measured.

C. SURVEY FINDINGS

Voluntary survey respondents answered all or any combination of questions as applicable. This ensures there are no forced responses yet it changes total observations in some of the descriptive figures. The survey is comprised of 414 participants' responses, of which 385 were placed in billets that serve as a utilization or payback tour. The overall placement rate calculated by summing the "have," "currently," and "multiple" and dividing by total valid respondents, is 93 percent (Figure 8). This descriptive statistic was calculated by placement alone and does not answer whether or not the individuals were performing BEEC BMOS duties and if that work was relevant and made positive contributions to their field of work. In other words, placement does not measure use.

Overall totals	
short title (as described in figure 5)	total = 414
havenot	29
currently	154
have	197
multiple	34
Placement rate	385/414 = 0.93 = 93%

Figure 8. Placement rates of BEEC BMOSs Categorical Survey Respondent Testing

Subsample t-tests listed in Figure 9 fail to reject the null of ‘no difference...’, thus proving consistency in reporting throughout those who are currently serving, have served, and those who have multiple tours. In other words, all respondents answer utilization questions in the same manner and relative rate. This also means there does not need to separate analysis for each category. The t-test compares distributions of specific BMOSs against the total.

T-tests against utilization rates by category of respondent being:	
(c) = those who are currently in utilization billets	
(h) = those who have served in one utilization billet	
(m) = those who have served more than one utilization billet	
(c) = pvalue =	0.9839
(h) = pvalue =	0.4101
(m) = pvalue =	0.1441

Figure 9. T-testing survey respondent categories (c, h, & m)

1. Those who Participated in the Dependent Variable

The total distribution of utilization rates and survey respondents, by category are displayed in Figure 10. 375 of 385 eligible respondents participated in the question. The unit of measure is utilization defined by time. Reference Appendix A for further explanation and specific survey questions related to utilization. In the “current tour” category there were 152 Marines out of 154 who elected to participate; two Marines elected not to respond. In the “single tour” category there were 192 out of 197 who

elected to participate; 5 Marines elected not to respond. In the “multiple tour” category 31 of 34 elected to participate; 3 Marines elected not to respond.

“Current tour”	
percent	Freq.
-----+-----	
0	26
26	24
51	24
76	78
-----+-----	
Total	152
* Two Marines opted out of answering this question from this category	
“Single tour”	
percent	Freq.
-----+-----	
0	24
26	39
51	49
76	80
-----+-----	
Total	192
*Five Marines opted out of answering this question from this category	
“Multiple tour”	
percent	Freq.
-----+-----	
0	4
26	1
51	8
76	18
-----+-----	
Total	31
*Three Marines opted out of answering this question from this category	
*** accountability of survey respondents ***	
current	152 + 2 = 154
have	192 + 5 = 197
multiple	31 + 3 = 34
have not (could not respond to question)	29
total	414

Figure 10. Dependent variable survey respondent compilation

2. Findings from Marines who Have Served Multiple Utilization Tours

The data shows that multiple-tour Marines are not significantly different than the other categories of participants based on utilization rates. Subparagraphs a-c all pertain to multiple-tour Marines.

a. What Best Served Marines to Prepare for Multiple Tours

Of the 34 multiple tour observations and 3 Likert scales used to rate the three methods for preparation for a tour (which were 1) skill training, 2) educational training, and 3) On-the-job training) the findings show educational training scored the highest when aggregated.

b. Utilization Rates above 51 Percent

Of the 34 multiple tour observations, the average utilization rating was 63 percent and of the 7 observations that conducted three or more utilization tours, the average utilization rating was 72 percent; with all averaged being based on categorical rating scales. These findings are not surprising as senior billet monitors choose performers that are historically effective for these select few billets.

c. Organizational Structure

Marines with multiple billet tours were still in predominately centrally located billets. Only in the third tour for multiple tour Marines were decentralized billets predominant.

3. Marines who Have Not Served a Utilization Tour

Of the 29 Marines who have not completed a utilization tour, 9 Marines are scheduled to conduct a utilization tour in the future, and 16 would freely consider a tour now. When asked the reason for not executing a utilization tour, 6 stated there was no need for their billet at the time, 13 responded their PMOS took precedence over the utilization tour, and other various reasons such as retirement, command and special duty; 8 Marines had no reason for not completing a utilization tour.

The total distribution of utilization by category is displayed in Figure 10. Of the 385 eligible survey respondents, 375 participated in this question. Utilization is categorical in this question with categories being 0–25, 26–50, 51–75, and 76–100. Respondents were asked at what percentage they used their BEEC BMOS skills over the course of their utilization tour based on time. The predominant bar “76” is explained just

as the variable described before which states that the individual believes their skills were utilized more than 75 percent of the time in their billet.

The last research question addresses the complexity and acceptability in which respondents were questioned. Utilization, defined by the survey question, is the portion of time dedicated to the duties to which the billet was designed. The framing of the estimation and question allows for the respondent, regardless of length of tour, or daily hours worked, to answer in a category of usage that is based on a percentage measurement. However, just estimating the time dedicated to work does not address the level of acceptability. This is not a focus of this research; however it does provide a starting point for manpower planners and managers to view utility. Logically, one could consider 50 percent can be estimated as the lowest acceptable standard. Scores with less than fifty percent theoretically can be combined with a similar centrally located billet holder. Moreover, the focus of later regression will be the lowest quartile, or the billets that responded to 0–25 percent utility, which alludes to an apparent opportunity for increased utilization.

In Figure 11, utilization is displayed in a distribution chart for every BMOS by quartile. The lowest quartile is listed as “0” and the highest quartile is listed as “76.” By identifying higher and lower performing BMOSs, one can decipher if there are apparent characteristics that are highly correlated to those quartiles. Solely revealing predominantly high and low rates can display billet validation and demand.

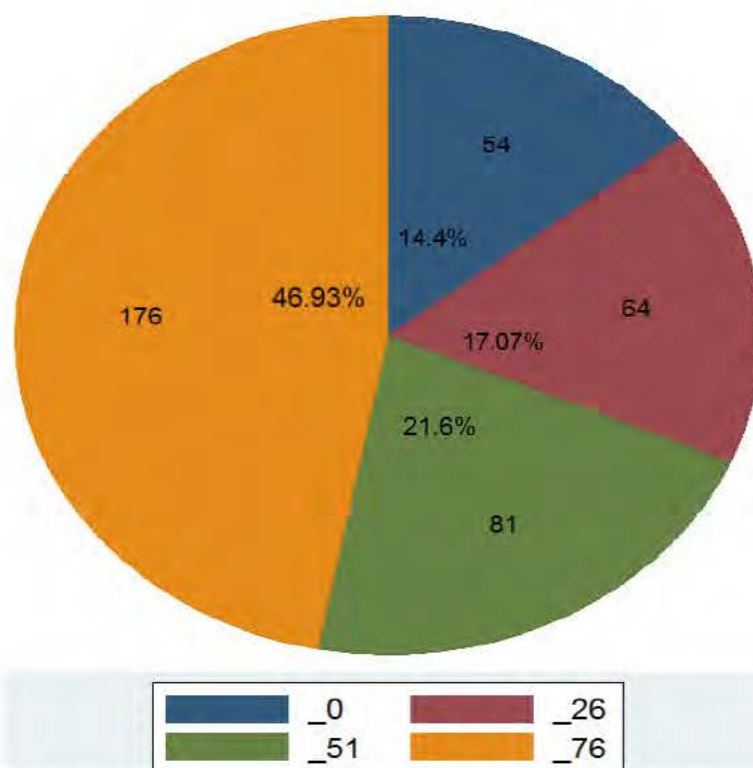
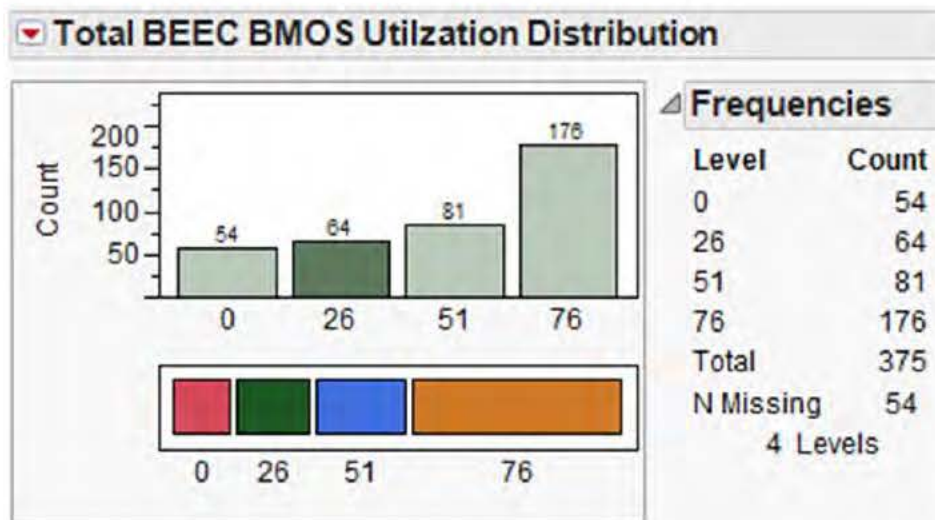


Figure 11. Distribution of Utilization for BEEC BMOSs

Using share chart programming in JMP Pro 10, data are distributed by BMOS and by percent or utilization category. This chart does not display those who did not serve in a utilization tour as they did not have the capability to respond to the dependent variable or the survey question that relates to utilization. A distribution of total participation is shown in Figure 12.

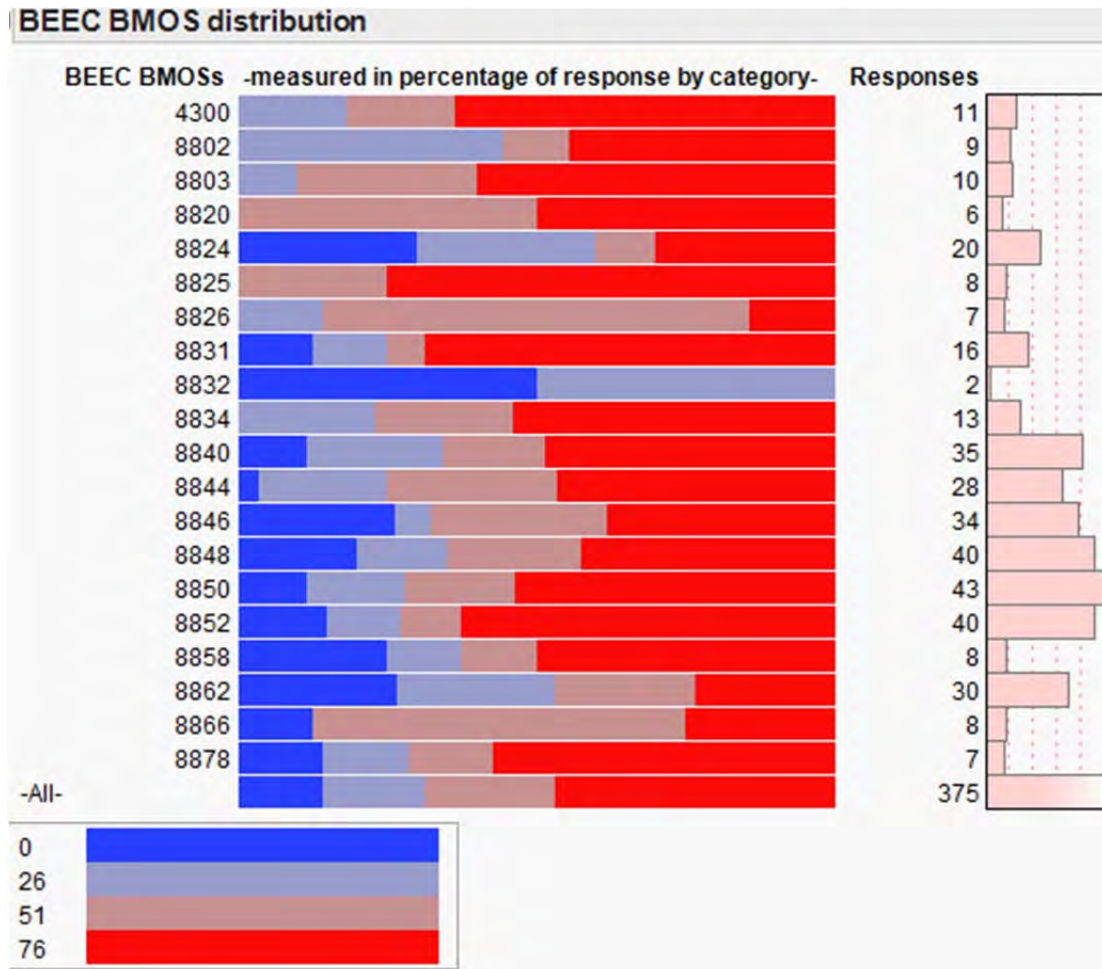


Figure 12. Utilization distribution across all BEEC BMOSs

Two sample t-tests display significant performance, either high or low, for each BMOS by calculating the mean of the sample individually with each BMOSs removed and calculating the mean of each and then testing as shown in Figure 13. Appendix F displays complete sample distribution for top and bottom quartile for reference to quantity of BMOSs which reside in each.

Two-sample t-test with equal variance (percent = BMOS)					
billet	overall mean	billet mean	t value	p value	significance
4300	50.79	88.58	4.05	0.00***	higher
8802	52.01	51.00	0.09	0.93	none
8803	51.67	63.50	1.14	0.26	none
8824	52.90	35.70	2.32	0.01***	lower
8825	51.60	69.75	1.57	0.12	none
8826	52.00	51.00	0.08	0.94	none
8831	51.69	58.69	0.84	0.40	none
8832	52.19	13.00	1.71	0.04**	lower
8834	51.75	58.69	0.76	0.22	none
8840	52.02	51.60	0.07	0.94	none
8844	51.71	55.43	0.58	0.56	none
8846	52.62	45.59	1.21	0.23	none
8848	52.49	47.68	0.89	0.37	none
8850	51.68	54.37	0.51	0.61	none
8852	51.52	55.85	0.80	0.43	none
8858	52.08	47.63	0.38	0.70	none
8862	53.31	36.57	2.74	0.00***	lower
8866	52.01	50.88	0.10	0.92	none
8878	51.94	54.43	0.20	0.84	none
legend	*	significant at the 10 percent level			
	**	significant at the 5 percent level			
	***	significant at the 1 percent level			

Figure 13. Two-sample t-test between BMOS utilization and overall utilization

Associating this representative survey to the population, the averages were transferred to the current BEEC billet list as listed in “current #'s” and recalculated with the “survey billet %.” Therefore, the real time manpower loss is 85 Marines. If utility is corrected through organizational realignment, or individual reassignment loss will decrease but most likely never reach zero. The more realistic estimation of regained losses can be seen in Appendix F or in in Figure 14, column “25%” that displays the frequency of billets which are in the lowest quartile [(54) or $344/414 = 85\% \times 54 = 45$].

billet	25%	50%	75%	100%	survey #'s	weighted	loss	survey billet %	current #'s	weighted	loss
4300	0	2	2	7	11	9.5	2	86%	6	5.18	1
8802	0	4	1	4	9	6.75	2	75%	9	6.75	2
8803	0	1	3	6	10	8.75	1	88%	7	6.13	1
8820	0	0	3	3	6	5.25	1	88%	3	2.63	0
8824	6	6	2	6	20	12	8	60%	27	16.20	11
8825	0	0	2	6	8	7.5	1	94%	14	13.13	1
8826	0	1	5	1	7	5.25	2	75%	4	3.00	1
8831	2	2	1	11	16	13.25	3	83%	15	12.42	3
8832	1	1	0	0	2	0.75	1	38%	1	0.38	1
8834	0	3	3	7	13	10.75	2	83%	28	23.15	5
8840	4	8	6	17	35	26.5	9	76%	25	18.93	6
8844	1	6	8	13	28	22.25	6	79%	17	13.51	3
8846	9	2	10	13	34	23.75	10	70%	35	24.45	11
8848	8	6	9	17	40	28.75	11	72%	47	33.78	13
8850	5	7	8	23	43	33.75	9	78%	42	32.97	9
8852	6	5	4	25	40	32	8	80%	27	21.60	5
8858	2	1	1	4	8	5.75	2	72%	6	4.31	2
8862	8	8	7	7	30	18.25	12	61%	17	10.34	7
8866	1	0	5	2	8	6	2	75%	13	9.75	3
8878	1	1	1	4	7	5.5	2	79%	1	0.79	0
sum	54	64	81	176	375	282.25	93	75%	344	259.38	85

Figure 14. Total weighted billet loss for survey and estimated for current billet list

D. REGRESSION ANALYSIS

1. Categorical Dependent Variable Regression

To identify what variables are likely to explain differences in utilization rates, multivariate analysis is conducted, using probit regression models. The derivation of answers of utility in the survey generated a quartile response. If the utility response was open to interpretation verse binning, the linear function could be used. This could be considered for future regressions if desired, however currently the testing function that must be used for this thesis must adhere to the principles that support ordinal, categorical dependent variables. Ordinal data are data that has place value and an order such as first, second third, etc. Categorical data are data that has a binning effect placed on it such as the quartile descriptors in this dependent variable. Based on the literature review, the basis for the multivariate regression analysis model is binomial or probit modeling, specifically designed to accommodate binary variables (0, 1 variables). . There are other models that can be used such as quartile regressions and ordinal logit regressions; however this research will simplify the results to standard acceptable utilization as equal to or greater than 75 percent. (Park, 2005) A number of regressions were conducted to view the results from many different perspectives such as ordinal probit modeling, multinomial modeling, quadratic regression modeling, and OLS modeling (Pema, Probit and Logistic Estimation, 2014, p. 5).

2. Dprobit Regression Analysis on Utilization

The formulation of the probit models test if there is any correlation between high or low scoring and environmental factors from the survey such as correct organizational structure (om), correct rank capitulation (rm), additional schooling is needed (as), and whether or not respondents felt as if they positively contributed to their work (pc). The high performance model shows there is significance between high utilization rates and positive contribution. This demonstrates utilization equates to effective and productive work. This can also equate to correctly assessed mission needs and validates general current billet assignments. These assumptions can be related to any BMOSs that are categorized in the highest quartile. Interpretation: survey respondents say that having the

ability to positively contribute to the need upon which the billet was created raises utilization by 31.5 percentage points as seen in Figure 15. Even though the other regression were not utilized nor interpreted in this thesis you can see there is a resounding significance with the variable of positive contribution or “pc.”

		(1) Dprobit	(2) OLS	(3)ologit	(4)oprobit	(5) qreg	(6)mprobit
*** significant at 1 percent		upper half	upper half	upper half	upperhalf	percent	percent (76 base outcome on 0 percent)
rm	coef	0.0003	0	-0.001	0.001	0	-0.1628
	se	0.054	0.053	0.25	0.15	5.607	0.248
	p	0.995	0.997	0.996	0.995	1	0.511
as	coef	-0.024	-0.022	-0.107	-0.067	0	0.0433
	se	0.052	0.051	0.242	0.147	5.47	0.246
	p	0.647	0.663	0.66	0.647	1	0.86
pc	coef	0.315	0.315	1.325	0.819	25	-1.589
	se	0.089	0.091	0.379	0.233	9.025	0.361
	p	.000***	.001***	.000***	.000***	.006***	.000***
om	coef	0.029	0.027	0.128	0.082	0	-0.067
	se	0.053	0.05	0.244	0.148	5.47	0.247
	p	0.577	0.597	0.599	0.577	1	0.787
obs		332	332	332	332	332	332

Figure 15. The Effects of positive contribution based on dprobit modeling

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VI. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

As of 2014, the Marine Corps possessed 344 billets that required graduate education. These billets hold the manning precedence level of “excepted command” status and are manned at 100 percent. Commands in the Quantico, VA, and Washington, DC, areas maintain the majority of graduate education billets, with Camp Pendleton and then Camp Lejeune maintaining the next-highest number of billets. Department of Defense directives guide Marine Corps Orders relating to graduate education. Marine Corps Orders such as the Special Education Process and Advanced Degree Process orders are managed by boards such as Commanders Career Level Education Board. Washington, DC and Quantico, where requirements are decided, are the same two locations where the majority of Graduate Education Billets reside. There are many studies relating to career progression and promotion on graduate education programs and few studies that focus on organizational studies and the effect of utilization. There is an inherent difficulty in measuring utilization in billets, aside from personal performance. The primary means to measure utilization was derived from a survey based study conducted by O’Sullivan in combination with a Total Force Structure Process billet validation questionnaire and were used to model data collection. A Multivariate regression model analyzed variables derived from the survey data to determine significant high and low utilization. Anonymity of survey respondents does not permit further thesis recommendations beyond what is enclosed, due to the track-ability of smaller density billets. If a recommendation to reallocate “xx” billets from “xx” units was made, based on this research, a possible breach of confidentiality could be discovered and therefore was not reported in that fashion, however an organizational review has more privilege and power to be pointed in billet reorganization which this thesis lays a foundation. In this thesis, low billet utilization is equated to a lower demand, and should be reorganized into higher demand requirements. This premise assumes no change in overall graduate education capacity is needed; rather a need lies in using graduate education more efficiently.

B. CONCLUSIONS AND RECOMMENDATIONS

1. What Is an Acceptable Utilization Rate for BEEC BMOSs in the Marine Corps?

Conclusion

Currently, the Marine corps has a graduate education placement rate of 93 percent with a weighted average rate across all BEEC BMOSs of 75 percent. The weighted average rate is the difference between putting a face in a space and actually determining whether that space is a validated requirement. The percentage or true use of graduate education in manpower shows a more realistic sense of utilization. The Total Force Structure Management System relies on a top-down methodology for planning and organizing BEEC BMOS; this research is the first to display a detailed bottom-up analysis of the graduate education population. The average of 75 percent appears to be the acceptable rate and any billets utilization residing significantly below this rate would be considered unacceptable in this thesis. Figure 13 and Appendix F illustrate target areas or billets that can be partially or fully reorganized to increase overall utilization rates.

Recommendation

DC CD&I should charter a working group and use this research as a basis to review the reallocation of under-utilized BEEC BMOSs. The BEEC BMOS assessment should examine each billet for knowledge, skills, and abilities relating to writing, general managerial and problem-solving criteria in support of operational force leadership requirements.

2. How Are BEEC BMOSs Distributed and Reviewed?

Conclusion

A macro analysis displays BEEC BMOSs are centrally organized in three locations, National Capital Region–Quantico/Washington, DC, Camp Pendleton, and Camp Lejeune. Although this resembles a highly centralized structure, when examined at a by unit level several units can be identified with particularly high and low utility unrelated to centrality. Aside from the published material in the TFSP, there was little

written or discussed about validation or review of BEEC BMOSs. The survey was found to be the best review tool that maintains unbiasedness and anonymity.

Recommendation

DC CD&I should also review BEEC BMOS structure and consider a new distribution plan that includes a new graduate education requirements assessment. DC CD&I or a third-superseding party should receive feedback from billet holders via survey or similar instrument. A survey/census from HQMC and operational commands should be distributed to identify any new needs for graduate education, to ensure a balance of BMOSs across the Marine Corps. The review process should incorporate an acceptable usage rate to measure unit and billet success in order to support of the total forces structure processes and timeline. This review should be conducted no longer than every four years followed by a standardized utilization survey to measure BMOS utility rates.

3. Recommendations for Further Research

This thesis examined a small portion of the Marine Corps' billets requiring graduate education; more occupations or billets could benefit from such a review. Receiving feedback from Marines on organizational structure and efficiency can greatly benefit the success and efficiency of the Marine Corps. This process can be replicated for any population and further research is recommended to determine if other Marine Corps billets can be measured similarly in order to increase effectiveness and utilization.

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APPENDIX A. SURVEY QUESTIONS

Consent

SEP/ADP Survey: USMC Organizational Analysis of Utilization Rates

(Coding has been removed for readability)

Consent Form

Introduction. You are invited to participate in a research study entitled *SEP/ADP utilization study*. The purpose of the research identify utilization rates of graduate education billets within the Marine Corps, as well as make recommendations for improvements if deemed fit.

Procedures. Billets within those organizations which are labeled as SEP/ADP billets will be given a survey. This survey will question the utilization of graduate education in SEP/ADP billets. The survey will take approximately 5 minutes to complete and the number of questions on average per person will be 12.

Location. The survey will take place *online*.

Cost. There is no cost to participate in this research study.

Voluntary Nature of the Study. Your participation in this study is strictly voluntary. If you choose to participate you can change your mind at any time and withdraw from the study. You will not be penalized in any way or lose any benefits to which you would otherwise be entitled if you choose not to participate in this study or to withdraw. The alternative to participating in the research is to not participate in the research.

Potential Risks and Discomforts. The potential risks of participating in this study are: *The low density billet assignments could result in a minimal risk of breach of confidentiality (inadvertent identification of subjects).*

Anticipated Benefits. Anticipated benefits from this study are possible realignment of billets to better utilize AGEF. You will not directly benefit from your participation in this research.

Compensation for Participation. No tangible compensation will be given.

Confidentiality & Privacy Act. Any information that is obtained during this study will be kept confidential to the full extent permitted by law. Individual responses will be anonymous and results of data will be generalized for statistical reporting. Information from the survey that has been recorded will be safeguarded through LimeSurvey and through NPS secure online network drives. Once the research is complete, the survey information that has been collected will be safely and permanently deleted.

Points of Contact. If you have any questions or comments about the research, or you experience an injury or have questions about any discomforts that you experience while taking part in this study please contact the Principal Investigator, Professor Tick at stlick@np.edu , and *Captain Daniel A. Ealy* at dealy@nps.edu Questions about your rights as a research subject or any other concerns may be addressed to the Navy Postgraduate School IRB Chair, Dr. Larry Shattuck, 831-656-2473, lgshattu@nps.edu.

Statement of Consent. I have read the information provided above. I have been given the opportunity to ask questions and all the questions have been answered to my satisfaction.

I have been provided a copy of this form for my records and I agree to participate in this study. I understand that by agreeing to participate in this research and signing this form, I do not waive any of my legal rights.

If you consent, click yes, otherwise click no.

Please choose only one of the following:

Yes

No

-logic: consent no

Thank you for responding, you may anonymously comment on why you did not decide to participate in this survey. Please write your answer here:

Question Bank

-logic: consent yes

Did you receive a BEEC BMOS? *reminder, BEEC stands for: Billet Education Evaluation, Certificate, for your SEP/ADP education*

Please choose only one of the following:

Yes

No

What billet did you receive?

Please choose only one of the following:

4302-5 PUBLIC AFFAIRS OFFICER

8802 TRAINING AND EDUCATION OFFICER

8803 LEADERSHIP DEVELOPMENT SPECIALIST

8820 AERONAUTICAL ENGINEER

8824 ELECTRONICS ENGINEER

8825 MODELING AND SIMULATIONS OFFICER

8826 ORDNANCE SYSTEMS ENGINEER

8831 ENVIRONMENTAL ENGINEERING MANAGEMENT OFFICER

8832 NUCLEAR ENGINEER

8834 TECHNICAL INFORMATION OPERATIONS OFFICER

8840 MANPOWER MANAGEMENT OFFICER

8844 FINANCIAL MANAGEMENT SPECIALIST

8846 DATA SYSTEMS SPECIALIST

8848 MANAGEMENT DATA SYSTEMS OFFICER

8850 OPERATIONS ANALYST

8852 DEFENSE SYSTEMS ANALYST

8858 C4&I OFFICER

8862 MATERIAL MANAGEMENT OFFICER
8866 SPACE OPERATIONS OFFICER
8878 HISTORIAN
Other

What best represents your status?

Please choose only one of the following:

- I have not conducted a utilization tour.
- I am currently conducting my utilization tour.
- I have conducted my utilization tour.
- I have conducted multiple utilization tours.

Group #1: have not conducted a tour

Are you scheduled for a utilization tour?

Please choose only one of the following:

- Yes
- No

Would you consider a utilization tour now?

Please choose only one of the following:

- Yes
- No

What was the reason for not conducting a utilization tour?

Please choose only one of the following:

- I retired before my utilization tour
- There wasn't a need for my BEEC BMOS at the time (after graduation from SEP/ADP)
- My primary MOS took precedence over my BEEC BMOS
- Other

Comments box if needed for any response

Group #2: currently conducting a tour

Based on your current position, estimate the percentage of time you will use your BMOS in your utilization tour. (This can be derived in any of the following ways: "hours in a week" or "months in a tour" or "years in a tour")

Please choose only one of the following:

- 0–25%
- 26–50%
- 51–75%
- 76–100%

On a scale from one to seven, with one being never used and seven being always used, rate your utilization.

Please choose only one of the following:

- 1
- 2
- 3
- 4
- 5
- 6
- 7

What was your rank when you assumed your BEEC BMOS?

Please choose only one of the following:

- O2 or O2E
- O3 or O3E
- O4
- O5
- O6
- Other

Without reference to the Table of Organization, what do you believe is the lowest paygrade needed to satisfy your current billet?

Please choose only one of the following:

- O1 or below
- O2
- O3
- O4
- O5
- O6 or higher

Does the BEEC BMOS accurately reflect the particular skills required for the billet?

Please choose only one of the following:

- Yes
- No

Make a comment on your choice here:

Excluding the preexisting graduate school and/or language school requirements; should the completion of additional schools or training be required for the billet you were assigned? If yes, please further explain the schooling or ability needed.

Please choose only one of the following:

Yes

No

Make a comment on your choice here:

What is your current title or position?

Please write your answer here:

Does the billet allow you to make a positive contribution to the requirement upon which the billet was created or does the billet's position allow for relevant influence on the subject which the billet was designed?

Please choose only one of the following:

Yes

No

Is your billet located in a centralized or decentralized location in reference to other similar BMOS billet holders?

Please choose only one of the following:

Centralized

Decentralized

Do you feel the billet would be better utilized in more of a centralized or decentralized setting based on a community of similar billets?

Please choose all that apply:

Centralized

Decentralized

Group #3: have conducted a tour

What was your rank when you assumed the BEEC billet? (BEEC - billet education evaluation certificate, for special education program and advanced degree program billets)

Please choose only one of the following:

O1 or O1E

O2 or O2E

O3 or O3E

O4

O5

O6 or higher

Without reference to the Table of Organization, what do you believe is the lowest paygrade necessary to satisfy your past BEEC BMOS?

Please choose only one of the following:

O1 or below

O2

O3

O4

O5

O6 or higher

Does the BEEC BMOS accurately reflect the particular skills required for the billet?

Please choose only one of the following:

Yes

No

Make a comment on your choice here:

Roughly estimate the time devoted to employing or utilizing your BEEC BMOS duties. (This can be derived in any of the following ways: "hours in a week" or "months in a tour" or "years in a tour")

Please choose only one of the following:

0–25%

26–50%

51–75%

76–100%

Excluding the preexisting graduate school and/or language school requirements; should the completion of additional schools or training be required for the billet you were assigned? If yes, please further explain the schooling or ability needed.

Please choose only one of the following:

Yes

No

Make a comment on your choice here:

In your BEEC BMOS, what was your title or position?

Please write your answer here:

Did the billet allow you to make a positive contribution to the requirement upon which the billet was created or does the billet's position allow for relevant influence on the subject which the billet was designed?

Please choose only one of the following:

Yes
No

Was your billet located in a centralized or decentralized location in reference to other similar BMOS billet holders?

Please choose all that apply:

Centralized
Decentralized

Do you feel the billet would be better utilized in a more centralized or decentralized setting based on a community of similar billets?

Please choose all that apply:

Centralized
Decentralized

On a scale from one to seven, with one being never used and seven being always used, rate your utilization.

Please choose only one of the following:

1
2
3
4
5
6
7

Group #4: have conducted multiple tours

How many tours related to your BEEC BMOS have you conducted?

Please choose only one of the following:

2
3 or more

Please indicate the extent to which you agree or disagree with the following statements regarding your time in BEEC BMOSs, with one being strongly disagree and seven being strongly agree.

Please choose the appropriate response for each item:

Array	1	2	3	4	5	6	7
-------	---	---	---	---	---	---	---

Array	1	2	3	4	5	6	7
The skills I learned best prepared me to perform well.							
The education I learned best prepared me to perform well.							
The on-the-job training best prepared me to perform well.							

For each of your BEEC BMOS tours, please list your rank upon entry.

Please choose the appropriate response for each item:

	O2	O3	O4	O5	O6 or higher	Not applicable
First BEEC BMOS tour						
Second BEEC BMOS tour						
Third BEEC BMOS tour						

Estimate the amount of requirement (BEEC BMOS) in time, in any of the following ways: “hours in a week” or “months in a tour” or “years in a tour”)

Please choose the appropriate response for each item:

	0–25%	26–50%	51–75%	76–100%	Not applicable
1st BMOS duty station					
2nd BMOS duty station					
3rd BMOS duty station					
any following, please conglomerate					

What do you believe to be the determining factor in selection for multiple BEEC BMOS utilization tours?

Please write your answer here:

Excluding the preexisting graduate school and/or language school requirements; should the completion of additional schools or training be required for the billet you were assigned? * there will be room for further explanation at end *

Please choose the appropriate response for each item:

	Yes	No	Not applicable
First BEEC BMOS tour			
Second BEEC BMOS tour			
Third BEEC BMOS tour			

Did the billet allow you to make a positive contribution to the requirement upon which the billet was created or does the billet's position allow for relevant influence on the subject which the billet was designed?

Please choose the appropriate response for each item:

	Yes	No	Not applicable
First BEEC BMOS tour			
Second BEEC BMOS tour			
Third BEEC BMOS tour			

For each of your BEEC BMOS billets, were they located in a centralized or decentralized location in reference to other similar BMOS billet holders?

Please choose the appropriate response for each item:

	Centralized	Decentralized	Not applicable
First BEEC BMOS tour			
Second BEEC BMOS tour			
Third BEEC BMOS tour			

On a scale from one to seven, with one being never used and seven being always used, rate your utilization.

Please choose only one of the following:

- 1
- 2
- 3
- 4
- 5
- 6
- 7

For all groups who consent: -logic: if consent was 'yes'

Lastly, how would you best employ or utilize your BEEC BMOS? (This can be specific to your personal billet or general to your field.)

Please write your answer here:

APPENDIX B. UTILIZATION RATING BY BMOS

Frequency						
billet	.	0-25	26-50	51-75	76-100	Responses
8800	4	0	2	2	7	15
8802	0	0	4	1	4	9
8803	0	0	1	3	6	10
8820	3	0	0	3	3	9
8824	3	6	6	2	6	23
8825	1	0	0	2	6	9
8826	1	0	1	5	1	8
8831	2	2	2	1	11	18
8832	0	1	1	0	0	2
8834	0	0	3	3	7	13
8840	2	4	8	6	17	37
8844	4	1	6	8	13	32
8846	3	9	2	10	13	37
8848	5	8	6	9	17	45
8850	2	5	7	8	23	45
8852	5	6	5	4	25	45
8858	0	2	1	1	4	8
8862	1	8	8	7	7	31
8866	1	1	0	5	2	9
8878	2	1	1	1	4	9
-All-	39	54	64	81	176	414

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APPENDIX C. T-TESTING BETWEEN SURVEY GROUPS

Ttest percent, by(c)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	223	51.09865	1.792558	26.7686	47.56605 54.63126
1	152	51.15789	2.392442	29.49601	46.43091 55.88488
Combined	375	51.12267	1.439074	27.86754	48.29298 53.95236
Diff		-.05924	2.935089	-5.830635	5.712155

Diff = mean (0) - mean (1) t = -0.0202

Ho: diff = 0 degrees of freedom = 373

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.4920 Pr(|T| > |t|) = **0.9839** Pr(T > t) = 0.5080

Ttest percent, by (h)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	183	52.3388	2.145597	29.02509	48.10536 56.57224
1	192	49.96354	1.929952	26.7422	46.15678 53.7703
Combined	375	51.12267	1.439074	27.86754	48.29298 53.95236
Diff		2.375256	2.880209	-3.288226	8.038738

Diff = mean (0) - mean (1) t = 0.8247

Ho: diff = 0 degrees of freedom = 373

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.7950 Pr(|T| > |t|) = **0.4101** Pr(T > t) = 0.2050

ttest percent, by (m)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	344	50.49128	1.507338	27.95696	47.52649 53.45607
1	31	58.12903	4.718242	26.27006	48.4931 67.76497
combined	375	51.12267	1.439074	27.86754	48.29298 53.95236
diff		-7.637753	5.217853	-17.89785	2.622342

diff = mean(0) - mean(1) t = -1.4638

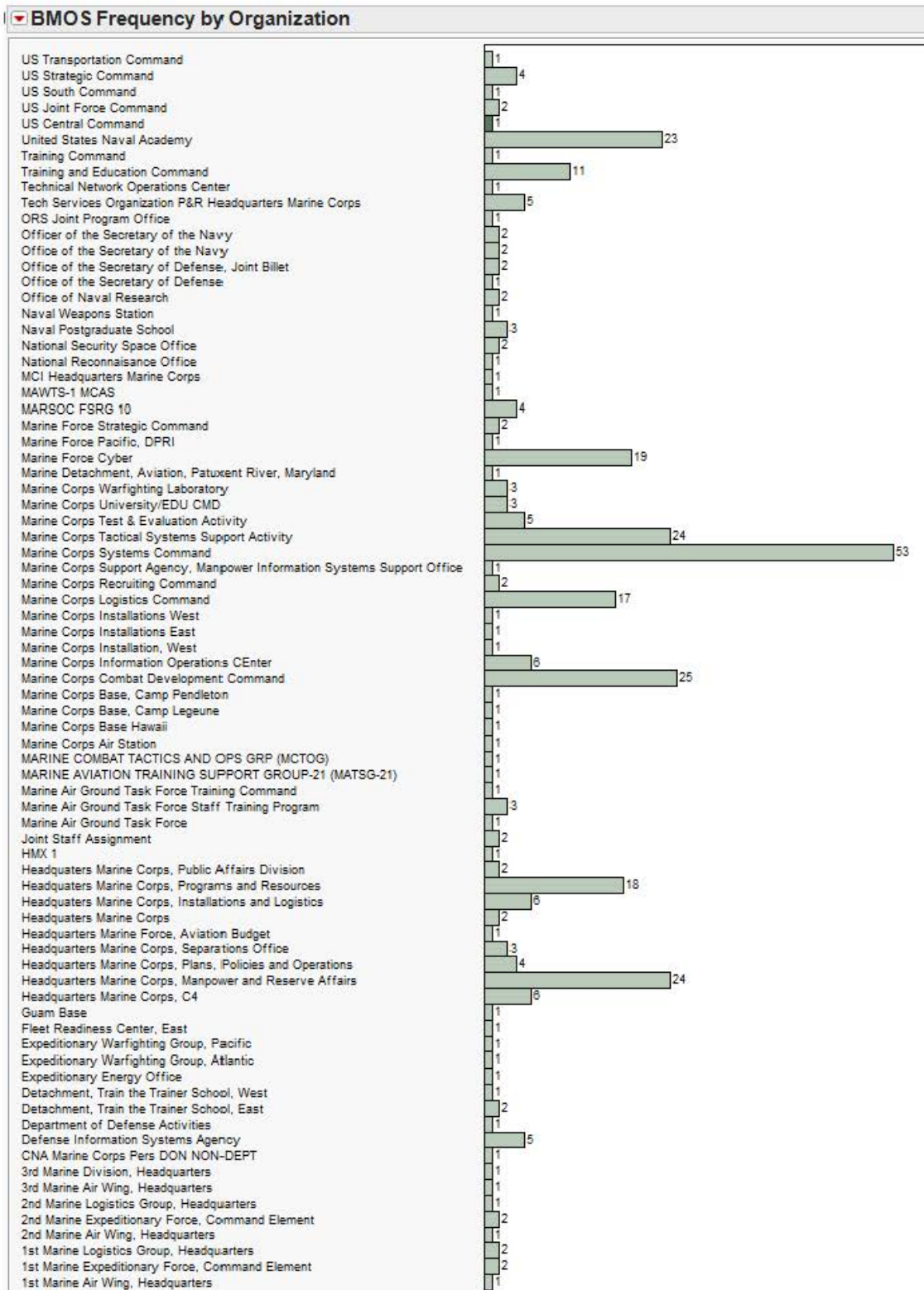
Ho: diff = 0 degrees of freedom = 373

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0720 Pr(|T| > |t|) = 0.1441 Pr(T > t) = 0.9280

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APPENDIX D. BMOS FREQUENCY BY ORGANIZATION



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APPENDIX E. DPROBIT REGRESSIONS

```
dprobit _76 rm as pc om, robust
Iteration 0: log pseudolikelihood = -229.39541
Iteration 1: log pseudolikelihood = -225.42021
Iteration 2: log pseudolikelihood = -225.40069
Iteration 3: log pseudolikelihood = -225.40069
Probit regression, reporting marginal effects Number of obs = 332
Wald chi2(4) = 7.97
Prob > chi2 = 0.0929
Log pseudolikelihood = -225.40069 Pseudo R2 = 0.0174
```

```
-----
| Robust
|_76 | dF/dx Std. Err. z P>|z| x-bar [ 95% C.I. ]
-----+-----
rm*| -.0225431 .0574974 -0.39 0.695 .63253 -.135236 .09015
as*| -.007765 .0559971 -0.14 0.890 .430723 -.117517 .101987
pc*| .2510302 .0791347 2.76 0.006 .900602 .095929 .406131
om*| -.0025373 .0557155 -0.05 0.964 .427711 -.111738 .106663
-----+-----
obs. P | .4668675
pred. P | .4647045 (at x-bar)
-----
```

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

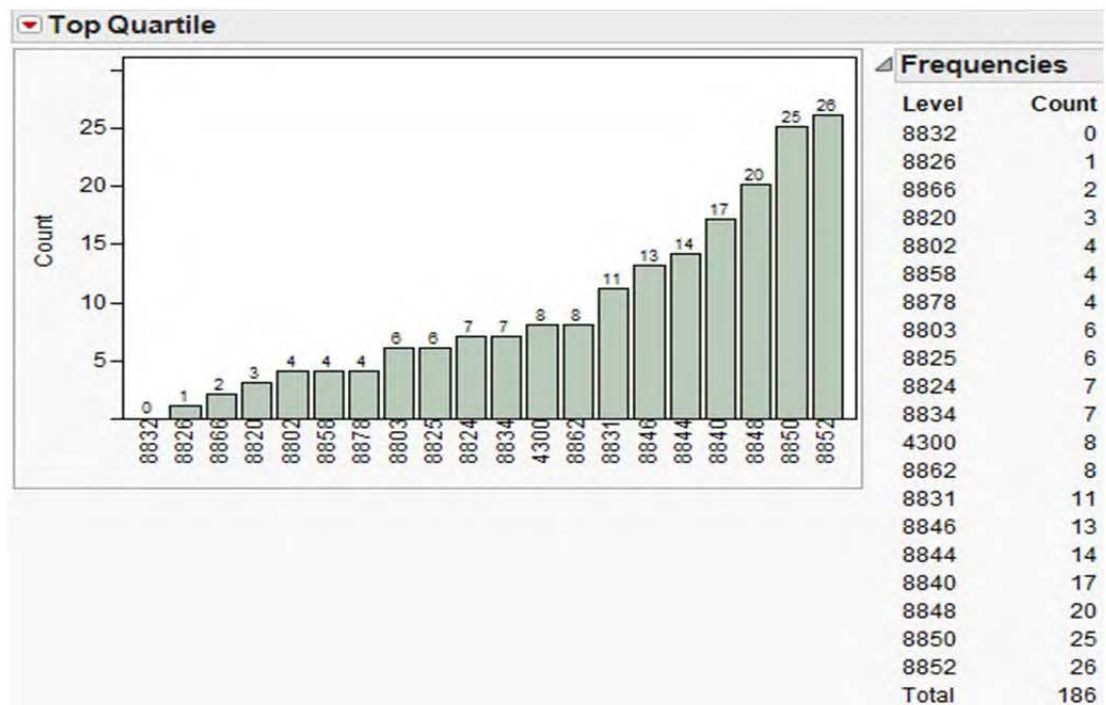
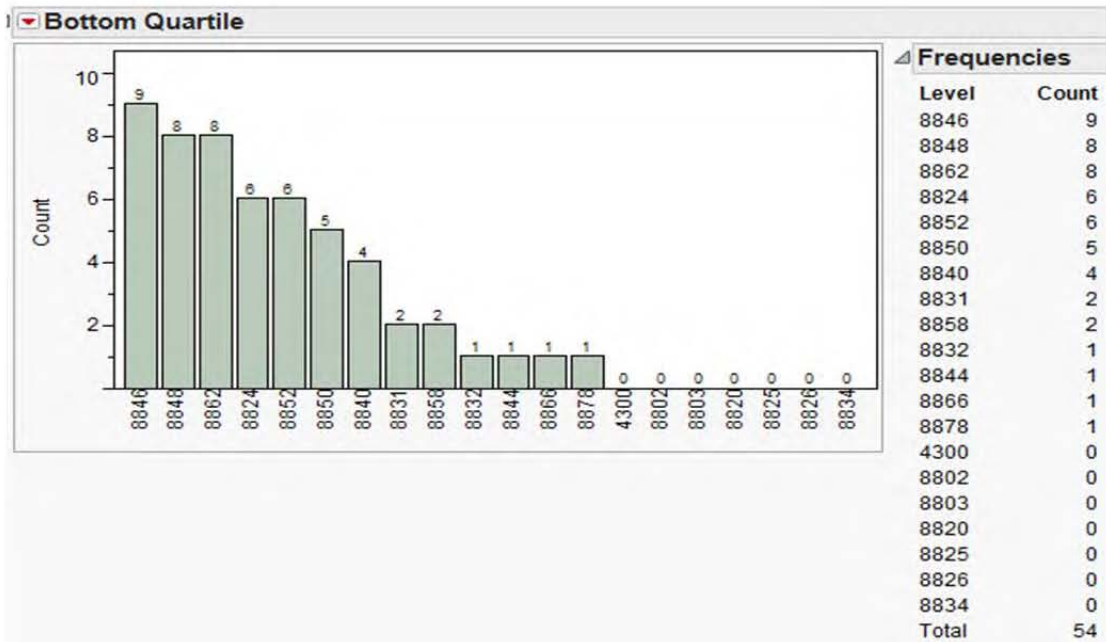
```
dprobit _0 rm as pc om, robust
Iteration 0: log pseudolikelihood = -137.17848
Iteration 1: log pseudolikelihood = -126.02619
Iteration 2: log pseudolikelihood = -125.93056
Iteration 3: log pseudolikelihood = -125.93056
Probit regression, reporting marginal effects Number of obs = 332
Wald chi2(4) = 22.82
Prob > chi2 = 0.0001
Log pseudolikelihood = -125.93056 Pseudo R2 = 0.0820
```

```
-----
| Robust
|_0 | dF/dx Std. Err. z P>|z| x-bar [ 95% C.I. ]
-----+-----
rm*| -.041646 .0407067 -1.06 0.291 .63253 -.12143 .038138
as*| .0045865 .0374362 0.12 0.902 .430723 -.068787 .07796
pc*| -.3422833 .0904847 -4.56 0.000 .900602 -.51963 -.164937
om*| -.0136471 .0370326 -0.37 0.713 .427711 -.08623 .058935
-----+-----
obs. P | .1445783
pred. P | .1309334 (at x-bar)
-----
```

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>|z| correspond to the test of the underlying coefficient being 0

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APPENDIX F. TOP AND BOTTOM QUARTILES



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