
# NAVAL POSTGRADUATE SCHOOL

**MONTEREY, CALIFORNIA**

# THESIS

**AN EMPIRICAL EXAMINATION OF THE IMPACT OF JROTC PARTICIPATION ON ENLISTMENT, RETENTION AND ATTRITION**

by

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December 2004

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**13. ABSTRACT (maximum 200 words)**

Our primary research interest is whether participation in the Junior Reserve Offices Training Corps (JROTC) program influences youths' propensity to enlist; and for those who subsequently enlist, the influence on retention rates and propensity to reenlist. The novelty of this thesis lies in conducting multivariate analysis of the impact of JROTC participation on enlistment, retention and reenlistment. Our data sources are (1) the 1980 High School and Beyond (HS&B) survey and (2) Defense Manpower Data Center (DMDC) enlisted personnel cohort files from Fiscal Year (FY) 1980 to 2000. We employ a number of econometric models with the HS&B data, including single equation PROBIT and LOGIT models, two-stage least squares (2SLS) with instrumental variables (IVs) and bivariate PROBIT equation. Our results show that JROTC positively influence enlistment when we treat JROTC participation as exogenous for both high school seniors and sophomores. The impact of JROTC participation on military enlistment decisions becomes negligible however, when we account for self-selection into the JROTC program of high school students. Using PROBIT and LOGIT models on the DMDC data, we find that enlisted personnel who graduated from JROTC are more likely to reenlist than non-JROTC graduates. Using the Cox proportional hazard survival analysis method, we find that JROTC graduates personnel tend to stay longer and complete their first-term than non-JROTC graduates. Synthesizing the results, we conclude that policy-makers might find it worthwhile to actively target JROTC cadets for enlistment because in the long run, it pays off in terms of higher first-term completion rates which results in cost savings in the form of enlistment bonuses and training costs. One possible extension of our study is to monetize our results for a cost-benefit analysis of the JROTC program vis-à-vis other recruitment programs. Quantifying the net benefits and costs of the JROTC program will allow policy-makers to make more informed decisions with regard to the future direction of the JROTC program.

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# ABSTRACT

Our primary research interest is whether participation in the Junior Reserve Offices Training Corps (JROTC) program influences youths' propensity to enlist; and for those who subsequently enlist, the influence on retention rates and attrition. The novelty of this thesis lies in conducting multivariate analysis of the impact of JROTC participation on enlistment, reenlistment and attrition. Our data sources are (1) the 1980 High School and Beyond (HS&B) survey and (2) Defense Manpower Data Center (DMDC) enlisted personnel cohort files from Fiscal Year (FY) 1980 to 2000.

We employ a number of econometric models with the HS&B data, including single equation PROBIT and LOGIT models, two-stage least squares (2SLS) with instrumental variables (IVs) and bivariate PROBIT equation. Our results show that JROTC positively influence enlistment when we treat JROTC participation as exogenous for both high school seniors and sophomores. The impact of JROTC participation on military enlistment decisions becomes negligible however, when we account for self-selection into the JROTC program of high school students.

Using PROBIT and LOGIT models on the DMDC data, we find that enlisted personnel who graduated from JROTC are more likely to reenlist than non-JROTC graduates. Using the Cox proportional hazard survival analysis method, we find that JROTC graduates personnel tend to stay longer and complete their first-term than non-JROTC graduates.

Synthesizing the results, we conclude that policy-makers might find it worthwhile to actively target JROTC cadets for enlistment because in the long run, it pays off in terms of higher first-term completion rates which results in cost savings in the form of enlistment bonuses and training costs. One possible extension of our study is to monetize our results for a cost-benefit analysis of the JROTC program vis-à-vis other recruitment programs. Quantifying the net benefits and costs of the JROTC program will allow policy-makers to make more informed decisions with regard to the future direction of the JROTC program.

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# I. INTRODUCTION

## A. INTRODUCTION

As of the 2003 Fiscal Year (FY)[1], there are 3,145 Junior Reserve Officer Training Corps (JROTC) units in high schools across the United States with a total enrollment of 485,220 high school students. With total expenditures of 191 million dollars in FY 2003, the JROTC program is thought not only to be a method of developing citizenship values and leadership skills but also an indirect recruiting tool for the military.

Anecdotal evidence and previous studies do suggest that JROTC participants ascend to military service at a rate higher than their non-JROTC peers. However, there is a paucity of empirical evidence whether such an effect actually exists. Even if, as suggested by previous studies, JROTC does influence enlistment propensity, questions remain as to the magnitude of JROTC's influence and whether this influence is similar to other recruiting methods. There is an absence of evidence upon which we can determine whether the costs of JROTC are balanced by quantifiable benefits in terms of an increased number of accessions to the armed forces.

If JROTC positively influences enlistment propensity at a unit cost lower or comparable to other recruiting methods, than the policy implications are relatively straightforward. JROTC, as a cost-effective recruiting tool, should be continued at its current funding level, or, if relatively cheaper than other tools, expanded. On the other hand, if JROTC does not positively influence enlistment propensity or does so at a higher unit cost relative to other recruiting methods, then the implications are also clear. JROTC, as a cost-ineffective program, should be reduced or cancelled altogether and the funds reallocated to other recruiting methods.

Related to the question of whether JROTC influences enlistment propensity is the heretofore-unaddressed question of whether JROTC participation influences retention and attrition. Previous research noted that JROTC graduates attrited at a consistently lower rate over the first-term attrition relative to non-JROTC enlistees. While these

1 Estimates from FY2004/2005 President's Budget.

findings were based on descriptive data from the Defense Manpower Data Centre (DMDC), they suggested that JROTC may provide a more realistic job preview (RJP) and that JROTC graduates are better able to adapt to military lifestyle. Higher retention rates or first-term completion rates reduce the need for the military to sustain a given end-strength with large recruitment numbers. If those who have successfully completed their first-terms are also more likely to re-enlist, costs are reduced in the form of enlistment bonuses and training costs. Again, to the best of our knowledge, the literature is silent on this issue.

However, examining the impact of JROTC on retention and attrition alone does not present the whole picture. By examining the joint effects of JROTC on propensity to enlist and retention and attrition, we may be better able to assess the total impact of JROTC on military accessions and first-term completion. Ignoring this potential joint effect may bias our conclusions in an unknown direction.

If JROTC positively influences the propensity to enlist and retention behavior, JROTC should be continued at its current funding level or further expanded, if relatively cheaper than other recruiting tools or programs. The policy implications are the same if JROTC positively influences either one and has no impact on the other. If JROTC negatively influences or have no impact on propensity to enlist and retention or attrition, the policy implications are also clear. JROTC should be reduced or cancelled altogether. On the other hand, if JROTC positively influences propensity to enlist while negatively influences retention, or vice versa, further research will be needed to quantify the aggregate impact of JROTC participation.

## B. THESIS

In this thesis, we review the current state of knowledge on the influence of JROTC on enlistment propensity, retention and attrition. We examine whether JROTC participants have a higher propensity to enlist in the military compared to non-JROTC participants. This requires data that track the post-secondary movements of high school students, as JROTC graduates may not enlist in the military directly from high school. However, the military only has information on enlistees that have participated in a

JROTC program prior to enlistment. This poses a serious selection bias in our empirical study of JROTC's propensity to enlist. We employ proprietary educational survey data that tracks the post-secondary movements of JROTC participants from 1980 to 1996 to conduct our study. We believe that we will not only be able to track participants' accession decision but also control for self-selection issues.

Next, we examine if JROTC graduates are more likely to successfully complete their first-term than non-JROTC graduates. Success is indicated by the first-term attrition rate (failure to complete first-term service) as depicted in most retention studies. Previous studies compared the attrition rates of enlisted JROTC graduates to enlisted non-JROTC graduates using descriptive statistics and concluded that the first-term attrition rates of JROTC graduates were consistently lower than those of all recruits who entered the military in a given year. The above findings need further research due to the perception of JROTC participants are "at-risk" youths who would have not fared well in the military if not for the positive intervention of JROTC in their lives. We, therefore, examine the effect of JROTC on retention and attrition, using survival analysis, taking into account the demographic make-up of the JROTC graduates, the Armed Forces Qualification Test (AFQT) category and the separation category.

The third portion of our thesis examines if JROTC graduates are most likely to reenlist then non-JROTC graduates. We deploy the same explanatory variables used in the retention model with reenlistment behavior as the dependent variable.

The final portion of our thesis synthesizes all the findings and evaluates if JROTC adds value to the military by examining the joint impact of JROTC on propensity to enlist, retention, and attrition. We study both the aggregate impact of JROTC on the military and the impact of JROTC on individual services (Army, Navy, Marine Corp and Air Force).

We find that this is a topic worth pursuing, considering that the JROTC program is federally funded and its appropriation is under the recruiting and training sub-group activity of the Operations and Maintenance section of the services' budget reports. Our background study of the funding for the JROTC program reveals that the services face pressures to provide better programs within limited resources. The military finds itself

periodically questioning the worth of the JROTC program (primarily in terms of supporting DoD mission), and seeking justification on the social benefits of the program without necessarily being rewarded by increased financial resources for the program.

## C. ORGANIZATION

The next chapter traces the history and development of the JROTC program to allow the reader adequate background information regarding the program. We present our literature review in Chapter III. Here we discuss the empirical models traditionally employed to explore military manpower issues to include enlistment decisions and attrition. We discuss the two main data sources that we have for the purpose of this study, the High School & Beyond (HSB) data and Defense Manpower Data Centre (DMDC) data in Chapter IV. From our literature search, we conceptualize the models that we can utilize and develop the theoretical framework in Chapter V, followed by the analysis of the findings in Chapter VI and VII for HS&B and DMDC data respectively. Chapter VIII concludes our study and discusses ways in which our findings could lead to other areas of study.

# II. BACKGROUND OF JROTC

## A. INTRODUCTION

In this chapter, we review the history and structure of the Junior Reserve Officers' Training Corps (JROTC) program. We examine the differences in the program offered by the four military branches of service. We also look at the benefits of the JROTC program, especially the unintended consequences on military recruitment.

## B. HISTORICAL OVERVIEW

The birth of the JROTC came about in 1916 with the passing of the National Defense Act of 1916. JROTC remained the sole program of the U.S. Army until 1964, when it was expanded to the other services. The stated purpose of JROTC was to develop good citizenship and responsibility in young people. The program included military-based courses taught by retired military personnel, hosted by high schools who agreed to participate in the program. The original course included a three-hour period of instruction per week over a three-year time frame. Graduates of the three-year program received a certificate of eligibility for a reserve commission at the age of 21.

In the first three decades since its inception, JROTC experienced modest growth. By 1939, there were 295 units established in high schools across the nation, however, the JROTC program was relatively stagnant from 1947 to 1964 due to personnel and funding shortages. [2]

The passage of the Reserve Officer Training Corps (ROTC) Revitalization Act of 1964 improved the prospects of the JROTC program. In the early 1960s, Secretary of Defense Robert S. McNamara ordered an evaluation of defense spending. Upon review, he felt that the benefits of the program (in terms of producing officers or making direct contributions to the military) did not justify the financial outlay of $4.7 million. JROTC thus faced a drastic reduction in its budget. Concerned community leaders, parents and

[2] Centre for Strategic & International Studies (CSIS), Junior Reserve Officers' Training Corps: Contributions to America's Communities: Final Report of the CSIS Political-Military Studies Project on the JROTC (CSIS May 1999),41.

teachers, who were convinced of the citizenship values of JROTC, beseeched members of Congress to re-consider McNamara's decision. An ad-hoc committee, consisting of nine military and two non-military members, was formed to assess the value of JROTC and National Defense Cadet Corps (NDCC). The committee, as there was substantial national interest in the continuation and expansion of JROTC, reported that JROTC should be continued, if not expanded. NDCC was not as popular due to the lack of direct Army personnel support and funding.

The committee findings and a proposed bill by the House of Representatives to extend the program to other services culminated in the passage of the ROTC Vitalization Act of 1964. The passage of the Act resulted in significant changes to the JROTC program. First, the number of JROTC units increased substantially with increase in the cap for Army (up to 650 units) and the expansion of the program to the other services. The program grew from 294 units with student enrollment at 74,421 in the academic year 1963-1964 to a total of 646 units with student enrollment at 110,839 ten years later for Army.[3]

The JROTC program was also made more appealing to the high school students by establishing a multi-track program that included academic and technical tracks. The expanded program allowed placement of students entering the Senior ROTC program or the Armed Services. Finally, all JROTC instructor positions had to be filled by retired military personnel, increasing the connection between the program and the services.

The end of the Vietnam War and the introduction of the All Volunteer Force (AVF) in 1973 resulted in an effort to improve the program's recruiting potential to improve the accession numbers for the military. JROTC graduates could now enter at higher pay grades (E-2 through E-4), depending on their performance and experience in JROTC. In addition, qualified graduates were given a special "honors" category for nomination to a military academy. The passage of Public Law 94-361 also saw an expansion of JROTC units from 1,200 to 1,600. Young women, for the first time, were allowed to participate in the JROTC program in 1972 but were not counted toward

[3] Coumbe, A.T. & Harford, L.S, "US Army cadet command: The 10 year history", *US Army Cadet Command*, 1996: 261.

enrollment. In 1973, female participation was recognized with the passage of Public Law 93-165 which stated that females could be counted for enrollment in JROTC.

In the 1980s, budget constraints limited the growth of JROTC. While the passage of laws had authorized the expansion of JROTC units, the growth of the program was impeded by the lack of resources. At the same time, concerns about the worth of the JROTC program cropped up again and this led to the establishment of the JROTC Improvement Plan (JRIP). The JRIP called for many changes, to include increasing staffing levels, a co-coordinated growth policy for JROTC and utilizing JROTC for recruiting purposes. The final recommendations, however, focused on enhancing the JROTC's image, raising the cadet performance and quality and improving the management of JROTC program.[4].

The JROTC program was revitalized in the 1990s by President George H.W. Bush who initiated a marked increase in the program (from 1,500 to 2,900 units). His ardent support came from the justifications that JROTC increased high school completion rate, reduced drug use, raised self-esteem, and kept kids on the "right track". The National Defense Authorization Act of 1993 raised the maximum allowable number of JROTC units to 3,500 while the issue of funding was left to the discretion of the DoD and the individual Services. The services worked toward the 2,900 number and there was a 60% increase in JROTC units during this period. The expansion of the program focused on placing units in areas like the northern plains, northeast and New England where it was underrepresented and in inner-city areas, defined as cities with populations greater than 150,000.[5] In the FY2005 budget submittal, the plan is to have 3312 units, with the Army planning to establish JROTC units at 45 more high schools.[6]

## C. JROTC PROGRAMS BY THE SERVICES

The Navy, Marine Corps and Air Force quickly developed their respective JROTC programs with the passage of the ROTC Vitalization Act of 1964. The major

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[4] Ibid, p. 267.

[5] The new units in urban areas were primarily concentrated in California, Florida, Georgia, Maryland and Texas.

[6] FY2005 President's Budget.

elements were modeled after the more established Army program and where differences occur; it reflects the different branch of services that it represents. The Army and the Marine Corps prefer to emphasize the leadership and citizenship aspects of the JROTC mission, while the Navy and the Air Force programs have extensive instruction in naval science and aerospace science, respectively.

### 1. Army JROTC (AJROTC)

The Army supported 1,510 JROTC units in FY2002 and will support 1,600 JROTC units in FY2004. The AJROTC program has the stated goal of being a "public service program available to high school students" that "fosters good citizenship, patriotism, and leadership skills for this valuable potential pool of military applicants."[7] This is encapsulated in its mission "to motivate young people to be better citizens". The management of AJROTC falls under the command and control of the U.S. Army Cadet Command.

The program of instruction (POI), the primary vehicle for achieving the stated objectives of AJROTC, has gone through several changes to adapt to the changing needs of society. The POI following the birth of JROTC till the 1970s was focused on military related training. The JRIP initiative in the 1980s saw the POI's shift in emphasis toward a more academic program within science and technology emphasis. The latest version of the curriculum, as of June 2004, incorporated the latest educational theories used in secondary education and with each chapter being linked with National Secondary School standards to show a cross-connection with the standard high school curriculum.[8]

### 2. Air Force JROTC (AFJROTC)

The Air Force JROTC program is the second largest with 744 units worldwide. The AFJROTC program has the stated goal that "its program is primarily designed to motivate young Americans to be better citizens with emphasis on self-discipline, personal

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[7] Department of the Army FY2004/2005 Biennial Budget Estimates: Operation and Maintenance, February 2003: 335-1.

[8] More details can be found the Army JROTC website: https://gateway.usarmyjrotc.com/http://portal.usarmyjrotc.com/jrotc/dt/estunit.html. Accessed 15 Aug, 2004.

responsibility, values, and graduation from high school."[9] Its mission is similar to the Army's and worded simply as "to build better citizens for America". The AFJROTC program falls under the command and control of the Air Force Officer Accession and Training Schools (AFOATS/CC) command.

The AFJROTC curriculum is based on the Air Force's core values of integrity first, service before self and excellence. It emphasizes both aerospace studies and leadership/life skills. Therefore, students get to study and discuss the heritage of flight and navigation, aerospace vehicles, rocketry propulsion, space travel, and aviation careers, and at the same time are exposed military customs and courtesies, flag etiquette, basic drill, management, human relations and communication skills. The hosting schools could emphasize either portion of this curriculum, depending on the needs of the students. The AFJROTC program mentions that it aims to provide students promising future either with the Air Force or in the private sector.[10]

### 3. Naval JROTC (NJROTC)

The Navy supported 584 JROTC units in FY2002 and will support 662 units in FY2004, with a full authorization goal of 700 units by FY2005. The NJROTC program "provides the opportunity for secondary school students to learn the basic elements of and requirements for national security and their personal obligations as Americans".[11] It falls under the command and control of the Chief of Naval Education and Training (CNET).

Like the Air Force curriculum, the Navy POI emphasizes nautical and maritime related topics and leadership education. Besides classroom instruction, the program is augmented by community service activities that encourage students to participate in civic programs like drug and alcohol awareness programs, food drives and so on.[12]

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[9] Department of the Air Force FY2004/2005 Biennial Budget Estimates: Operation and Maintenance, February 2003: 625.

[10] More details can be found on the Air Force Officer Accession and Training Schools website: http://www.afoats.af.mil/AFJROTC/default.htm. Accessed June 2004.

[11] Department of the Navy FY2004/2005 Biennial Budget Estimates: Operation and Maintenance, February 2003: Exhibit OP-5.

[12] More details can be found on the Naval JROTC website: https://www.njrotc.navy.mil/. Accessed June 2004.

### 4. Marine Corps JROTC (MCJROTC)

The MCJROTC program is the smallest of the service program with 223 high school units in FY2002. The MCJROTC program seeks "to provide a course in leadership education to develop informed citizens, strengthen character by teaching of discipline, and develop an understanding of the responsibilities of citizenship."[13] The MCJROTC program office falls under the command of the Training and Education Division and there is no reported intent to expand the program as of FY2005.

The MCJROTC curriculum emphasizes citizenship, character building, service to the United States, personal responsibility, and a sense of accomplishment in the high school student.[14]

## D. JROTC FUNDING

JROTC funding comes from the DoD Operation and Maintenance (O&M) appropriation. It provides for instructor salaries/travel, curriculum, equipment, and supplies, printing/mail, maintenance repairs, and headquarters and staff. Table 1 shows the funding of JROTC across all services for FY1999-2005. Table 2 provides the corresponding unit cost per cadet and per unit.

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[13] U.S. Marine Corps, Junior Reserve Officers' Training Corps Program Pamphlet, HQ Marine Corps Training Command, Quantico, Virginia, 1989.

[14] More details can be found on the Marine Corps JROTC website: http://www.tecom.usmc.mil/jrotc/curriculum.cfm. Accessed June 2004.

Table 1. JROTC Funding by Services for FY 1999-2005

| SERVICE PROGRAM | FY1999 | FY2000 | FY2001 | FY2002 | FY2003* | FY2004* | FY2005* |
|---|---|---|---|---|---|---|---|
| Army JROTC | | | | | | | |
| Appropriations ($ thousands) | 73,300 | 83,000 | 83,836 | 92,043 | 97,061 | 129,978 | 136,628 |
| Average Cadet Enrollment | 227,000 | 230,000 | 245,250 | 250,008 | 272,579 | 280,079 | 287,579 |
| No of Units | 1,370 | 1,420 | 1,465 | 1,510 | 1,555 | 1,600 | 1,645 |
| Navy JROTC | | | | | | | |
| Appropriations ($ thousands) | 23,121 | 25,913 | 28,183 | 32,283 | 36,817 | 40,333 | 44,544 |
| Average Cadet Enrollment | 63,395 | 69,749 | 74,513 | 77,958 | 82,732 | 87,441 | 91,973 |
| No of Units | 434 | 490 | 560 | 584 | 623 | 662 | 700 |
| Marine Corps JROTC | | | | | | | |
| Appropriations ($ thousands) | 10,547 | 11,039 | 12,628 | 13,074 | 13,299 | 13,200 | 13,291 |
| Average Cadet Enrollment | 22,215 | 22,374 | 23,770 | 25,557 | 26,781 | 28,066 | 29,461 |
| No of Units | 178 | 210 | 220 | 223 | 223 | 223 | 223 |
| Air Force JROTC | | | | | | | |
| Appropriations ($ thousands) | 26,105 | 32,263 | 34,766 | 41,574 | 43,363 | 43,413 | 45,197 |
| Average Cadet Enrollment | 91,656 | 97,426 | 106,284 | 113,017 | 103,128 | 103,128 | 113,927 |
| No of Units | 609 | 669 | 729 | 744 | 744 | 744 | 744 |
| JROTC Totals | | | | | | | |
| Appropriations ($ thousands) | 133,073 | 152,215 | 159,413 | 178,974 | 190,540 | 226,924 | 239,660 |
| Average Cadet Enrollment | 404,266 | 419,549 | 449,817 | 466,540 | 485,220 | 498,714 | 522,940 |
| No of Units | 2,591 | 2,789 | 2,974 | 3,061 | 3,145 | 3,229 | 3,312 |

Source: Office of the Under Secretary of Defense and President's Budget: FY2001 – 2004/2005.
* Projected estimates.

Table 2. Cost per Cadet and per JROTC Unit by Services for FY 1999-2005

| SERVICE PROGRAM | FY1999 | FY2000 | FY2001 | FY2002 | FY2003* | FY2004* | FY2005* |
|---|---|---|---|---|---|---|---|
| Army JROTC | | | | | | | |
| Cost per Cadet ($) | 323 | 361 | 342 | 368 | 356 | 464 | 475 |
| Cost per JROTC unit ($) | 53,504 | 58,451 | 57,226 | 60,956 | 62,419 | 81,236 | 83,057 |
| Navy JROTC | | | | | | | |
| Cost per Cadet ($) | 365 | 372 | 378 | 414 | 445 | 461 | 484 |
| Cost per JROTC unit ($) | 53,274 | 52,884 | 50,327 | 55,279 | 59,096 | 60,926 | 63,634 |
| Marine Corps JROTC | | | | | | | |
| Cost per Cadet ($) | 475 | 493 | 531 | 512 | 497 | 470 | 451 |
| Cost per JROTC unit ($) | 59,253 | 52,567 | 57,400 | 58,628 | 59,637 | 59,193 | 59,601 |
| Air Force JROTC | | | | | | | |
| Cost per Cadet ($) | 285 | 331 | 327 | 368 | 420 | 421 | 397 |
| Cost per JROTC unit ($) | 42,865 | 48,226 | 47,690 | 55,879 | 58,284 | 58,351 | 60,749 |
| JROTC Totals | | | | | | | |
| Cost per Cadet ($) | 329 | 363 | 354 | 384 | 393 | 455 | 458 |
| Cost per JROTC unit ($) | 51,360 | 54,577 | 53,602 | 58,469 | 60,585 | 70,277 | 72,361 |

Derived by author

The Naval Postgraduate School (NPS) study on the JROTC program in 2003 opined that the services are likely to reach the legislative authorization of 3,500 JROTC units by FY06, provided the services receive necessary funds.[15] The NPS study observed that the projected austere budget environment in the future mean tighter budget for JROTC program. In order to meet the increasing demands of the JROTC program as well as its expansion, the current funding level is not adequate. The NPS study suggested asking Congress for additional funding but it also acknowledged that the request requires huge congressional support. This is not likely in view of the costs already associated with the current war on terrorism.

15 Graduate School of Business, Naval Postgraduate School, A Comprehensive Study of the Junior Reserve Officer Training Corps Program: Review of Curricular Materials, Budgeting Issues and Recruitment, 2003,8.

## E. PROGRAM OUTCOMES

Anecdotal findings and previous studies have attested to the success of the program in terms of positive academic and social outcomes associated with JROTC participation.[16] Detractors of the JROTC program, on the other hand, have always criticized the program on the premise that it goes against the basic tenet of public education by "introducing guns into the schools".[17] Whether JROTC influences outcomes, military recruitment and accession, and values is still a matter of debate.

In terms of academic outcomes, various studies conducted by hosting high schools have found that JROTC cadets, when measured against key indicators of student performance perform just as well as their non-JROTC peers. The indicators include better class attendance rates, lower drop-out rates and higher graduation rates.[18] These studies emphasized the significance of the results due to the higher proportion of "at risk" students relative to national norms amongst the JROTC participants. Anecdotally, principals of schools with JRTOC units indicate that having JROTC reduces disciplinary problems in their schools.

Previous research also suggests positive social outcomes in terms of meeting the objectives of the JROTC program in instilling citizenship and character development. For example, JROTC graduates reported higher levels of self-esteem, personal maturity and personal efficacy than a comparison group of college students. There appears to be a positive correlation between Army JROTC participation and assertiveness, caring, social integration and demographic values scores among students compare with a sample of non-JROTC students, amidst other similar studies.[19]

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16 Ibid, 62-85.

17 America Friends Service Committee Online, *Making Soldiers in the Public Schools: An Analysis of the Army JROTC Curriculum*, April 1995,3 [www.afsc.org/y**out**hmil/jrotc/msitps.pdf] Accessed June 2004.

18 Taylor, W.J, Junior officers' training corps contributing to America's communities: Final report of the CSIS Political-Military studies project on the JROTC, Center for Strategic and International Studies, Washington, DC, (1999).

19 , D.F., & Ritter, D.L, Comparison of democratic maturity and self-fulfillment between high school AFJROTC students and upper division college students, Education , 120(3), 2000: 410-415; Reiger, R.C., & DeMoulin, D.F., Comparing democratic maturity test score between high school ARMY JROTC students and other students, Education, 121(1),2000: 43-45.

Although JROTC is not a recruiting tool, the exposure of JROTC participants to the military life probably has an influence in their future career choice. The NPS study examined JROTC's impact on accession and first-term attrition of JROTC graduates. Relying on cohort accession files from DMDC and general descriptive data, the study found that JROTC graduates had consistently lower first-term attrition than non-JROTC enlistees. The study further examined the first-term attrition patterns along racial groups, AFQT categories and reason for discharge and found that: first-term attrition rate is relatively lower for JROTC graduates who are minorities than for whites; it is lower for JROTC graduates in higher AFQT categories with differences between them and all recruits greatest in lower AFQT categories; it is lower also when recruits are examined by reason for discharge. While the results are suggestive, we must caution that the descriptive statistics do not provide rigorous causal linkages between JROTC and the variables of interest. JROTC participation, for example, may merely signal a pre-existing commitment to join the military. Our thesis, therefore, seeks to examine the purported relationship between JROTC graduates and propensity to enlist, retention and attrition. through various multivariate regression techniques. Until such an analysis is completed, we hesitate to draw any conclusions on the basis of descriptive statistics.

## F. CONCLUSION

The comparison of the four services' JROTC program has one common theme, which is to instill citizenship values in high school students. Yet, as a youth program, JROTC is controversial. Civilian proponents and opponents of the JROTC program differ in their tastes for the military way of life. The former believed in the positive academic and social outcomes of the program while the latter abhorred the concept of guns and violence included in high school education. Within the military, the question of the value-added of JROTC to the military keeps surfacing. There is therefore, definite interest from all stakeholders of the JROTC program to find out the influence of JROTC, if any, on military recruiting, retention and attrition via a more comprehensive program of analysis.

# III. LITERATURE REVIEW

## A. INTRODUCTION

In this chapter, we aim to provide an overview of the relevant studies on enlistment decisions, retention and re-enlistment. The literature search allows us to gather the pertinent factors, in addition to the impact of JROTC participation, that are important in youths' decisions to enlist and military personnel's decision to re-enlist. Since the explanatory variable of interest is JROTC participation, we are also interested to find out if there have been previous studies that included JROTC as one of the independent variables. This chapter presents the literature review in three broad sections - recruitment studies, retention and re-enlistment studies, and JROTC-related studies. The recruitment studies section looks at studies relating to enlistment decisions, propensity to enlist and enlistment incentives. The retention and reenlistment studies section looks at the factors that affect the decision to stay or leave the military. The last section looks at existing literature on JROTC programs and its social and academic outcomes.

## B. RECRUITMENT STUDIES

### 1. Enlistment Decision

McFadden (1983) assumes that individuals choose the activity that yields the highest expected utility. In the context of military enlistment study, the choice is between military employment and non-military employment. Therefore, the individual's decision to enlist in the military is the result of enlistment utility being greater than the utility of the other alternatives. This random utility framework expresses the probability that the individual chooses the activity as a function of the characteristics of the individual and the attributes of the choice.

The probability that an individual enlists is higher when the coefficients on the individual characteristics and choice attributes for enlistment are higher than other alternatives. Individual *i* will be more likely to enlist than another individual *j* if

individual *i* has characteristics that tend to raise the utility of enlisting relative to other alternatives. Similarly, if the military has an attribute that increases the utility of enlisting relative to other alternatives, the probability of enlisting increases. While JROTC was not the focus of the study, McFadden's work suggests that if JROTC positively influences the utility of military service for the $i^{th}$ individual, the probability of the $i^{th}$ individual enlisting will increase.

Hosek and Peterson (1985, 1990) and Kilburn and Klerman (1999) utilized a random utility framework to examine enlistment decisions using individual-level data. Hosek and Peterson (1985, 1990) looked at individuals' choice between military enlistment and non-military employment whereas Kilburn and Klerman (1999) expanded Hosek and Peterson's studies to include individuals' choice amongst military enlistment, college and civilian employment. Both studies included supply and demand factors in their specification models. Hosek and Peterson (1985, 1990) had used the 1980 wave of the National Longitudinal Survey of Youth (NLSY) and the 1979 DoD Survey of Personnel Entering Military Service, while Kilburn and Klerman (1999) had used the 1992 and 1994 wave of the National Educational Longitudinal Study (NELS).

On the supply side, Hosek and Peterson (1985, 1990) hypothesized that an individual who expects higher returns to educational investments would be more likely to acquire more education after high school and thus would be less likely to enlist in the military. Also, if an individual finds that education costs are higher or education is less available, the probability of enlisting is higher as compared to pursuing higher education. Better civilian labor market opportunities also reduce the likelihood to enlist in the military. Black and Hispanic race ethnicity are included in the Hosek and Peterson model to study their impact on the decision to enlist and it was found that black men were more likely to enlist than non-blacks while Hispanics were less likely to enlist as compared to whites.

On the demand side, Hosek and Peterson (1985, 1990) hypothesized that an individual who is in an area with higher recruiter density would be more likely to enlist in the military. They included enlistment standard measures to control for the eligibility of the individual to enlist. Hosek and Peterson (1985) chose demand variables that vary

across states but not across time. The usual factor that lies on the demand side of the enlistment market, like national advertising, enlistment incentives and number of recruiters, which could not be studied with individual-level data as they vary at the national level.

The Hosek and Peterson (1985, 1999) studies found that the high school graduates were more responsive to work-related variables like pay, length of job, labor force experience, employment status, and duration of joblessness that impact their enlistment decisions. The high school seniors, on the other hand, were more responsive to educational-related variables like learning proficiency measures, financial ability for education, expectations of more education; and parental-related variables like parental influence.

The Hosek and Peterson study looked at demographic characteristics of individuals, educational aspirations and influence of parents and recruiters but not the impact of JROTC. One possible reason that JROTC was never a factor in the traditional enlistment models is that JROTC is perceived as a citizenship program rather than a recruiting tool. However, the JROTC program does provide a realistic job preview of the military lifestyle and thus create a possibly positive influence in the participants' military enlistment decisions. Moreover, there is a military incentive in JROTC participation whereby graduates of the program can enlist into the military at an advanced paygrade.

Kilburn and Klerman (1999) replicated Hosek and Peterson's study. They added additional variables to capture factors that were of importance at the time of the study but might have been relatively unimportant in the 1980s. The new variables included average in-state tuition at a four-year institution, whether youths come from an immigrant household, whether the parents' have served in the military and whether the individuals ever used marijuana or were arrested to indicate if they are likely to meet the military's moral standards.

Kilburn and Klerman (1999) deleted some variables based on the reasoning that these variables could be endogenous to the choice decision between enlistment and

alternative activities, like the indicator if the respondent lives at home[20], resulting in correlation with the error term of the logit models, hence, biased estimates. Another reason is that some of the variables, like labor-market variables for graduates who have enlisted[21], are not meaningful in the study. Therefore, the Kilburn and Klerman (1999) study looked at recruiter density and AFQT category IV instead.

Kilburn and Klerman (1999), however, could not replicate Hosek and Peterson (1985, 1990) results in that many of the explanatory variables lacked significance. For the high school seniors, the blacks appear to enlist at a lower rate compared to whites, contrary to Hosek and Peterson's findings but providing further evidence on the recent trend of declining enlistment propensity for blacks in the 1990s (see Orvis et al. (1996)). Also, the study found that a working mother increases the probability of enlistment for high school seniors. On the other hand, if individuals come from an immigrant household (using English as a first language as proxy) negatively influenced enlistment probability.

For the high school graduates segment, Kilburn and Klerman (1999) found that graduates in the higher AFQT categories were more likely to enlist opposite that of the high school seniors. Other differences include having a parent in the military raises the probability of enlistment, not using marijuana reduces the probability of enlistment and having an arrest record increases the likelihood of enlistment.

Again, JROTC was not factored into the Kilburn and Klerman (1999) study, possibly for the same reason put forth earlier. We conclude from our literature search on military enlistment decisions studies that there has never been an empirical study done on

[20] According to Kilburn and Klerman (1999), if the individual is a senior and plans to relocate at the end of his senior year, it is unlikely that the individual will set up a separate household at time of responding to the survey.

[21] Kilburn and Klerman (1999) explained that graduate enlistees are likely to respond negatively to the question of whether they are currently employed when they are in the Delayed Entry Program (DEP).

the impact of JROTC participation on the decision to enlist although there have been anecdotal findings that JROTC participation has a positive impact.[22]

The random utility framework underpins the theoretical model developed for the purpose of this study. As the High School and Beyond (HS&B) data is different from the data used in the above two studies, the literature review of their specification models provides a template for the type of covariates to be taken into consideration but impossible to replicate the exact same type of variables. Both of these studies run two sets of regression, one for the seniors and one for the graduate pool of eligible applicants. This implicitly implies that the decision behaviors for these two groups are different but there was no statistical evidence reported in these studies that the two groups should be estimated separately. We will discuss the estimation methods for our HS&B data in Chapter V.

### 2. Propensity to Enlist

Enlistment propensity is an overall measure of youths' interests and plans pertaining to military service. Military planners are especially interested in the relationship between propensity to enlist and actual enlistment. If it is found that individuals who state positive enlistment intentions are more likely to enlist than those stating negative intentions, military recruiters will then find it more worthwhile to target their recruiting efforts at those individuals with high propensity to enlist.[23] Previous research suggests that there is a relationship between enlistment intentions and propensity.

The Youth Attitude Tracking Study (YATS) was the primary tool used from 1975 to 1998 by the Department of Defense (DoD) to measure the propensity of youth to enlist in the armed forces. Previous research shows that YATS propensity measures are valid measures of enlistment behavior. A RAND study shows that high quality youth providing an unaided mention of plans to enlist are seven times more likely to enlist than

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[22] See Department of the Army FY2004/2005 Biennial Budget Estimates: Operation and Maintenance, February 2003: 335-1. Taylor, W.J, *Junior officers' training corps contributing to America's communities: Final report of the CSIS Political-Military studies project on the JROTC,* Center for Strategic and International Studies, Washington, DC, (1999).

[23] Orvis, Bruce R. & Sastry, N, Military Recruiting Outlook: Recent Trends in Enlistment Propensity and Conversion of Potential Enlisted Supply, RAND Corporation, 1996: 51-53.

those who say they will "probably not" or "definitely not" serve[24]. YATS provided a nationally representative sample of youth from ages 16 to 24. It was the only mechanism in place that measured propensity to enlist, which has been found to have a strong correlate with enlistment behavior. This information is important because the increasing number of high school graduates attending colleges limits the supply of high quality applicants to the services. The empirical predictive validity of YATS propensity, as discussed below, as a measure of enlistment behavior has been shown repeatedly over the past 20 years.

Administered by the Defense Manpower Data Centre (DMDC), the YATS focused on two different types of propensity measures, positive and negative. In 1980, RAND provided the first evidence on the relationship between intentions and enlistment decisions. Combining data from the YATS and the Military Entrance Processing Command (MEPCOM), researchers were able to match survey responses to actual enlistment decisions. The 1980 study showed a strong relationship between stated propensity to serve in the military (intention) and enlistment, at both the individual and aggregated levels.[25]

RAND conducted the intention-propensity study again in 1994 with FY94 survey data and FY95 MEPCOM enlisted records. RAND used survival analysis techniques that include the various enlistment periods and YATS survey periods. The goal was to examine propensity trends during the same time frame. The methodology applied to conduct trend analysis was to build an econometric model, which predicted respondents' aptitude from their self-reported demographic and academic characteristics.[26]

The methodology employed to assess the propensity to enlist was the weighting of the survey data. The Office of the Secretary of Defense, in particular the Office of Accession Policy and the Defense Manpower Data Center in collaboration with DMDC

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[24] Defense Manpower Data Center, Youth Tracking Study, *1998 Propensity and Advertising Report* DMDC Report 2000-02, July 2000.

[25] Orvis Bruce R., Martin Gahart, Alvin K. Ludwig, with Karl F. Schutz , *Validity and Usefulness of Enlistment Intention Information,* Santa Monica, CA: RAND, R-3775FMP, 1992.

[26] Ibid.

developed the procedure. The sample results needed to be weighted to reflect differences between the composition of the sample and that of the population it is supposed to represent.[27]

The results were analogous to those from the 1980 study with the exception of the stated propensity of one race ethnic group. The decline in propensity to enlist in the FY95 study is much steeper for African Americans than any other racial ethnic group. Relative to the FY89 survey, enlistment propensity appeared to decline 10 percent for whites. The same time period also saw a decrease in positive propensity to enlist for blacks.

Bachman et al. examined the correlates of propensity and enlistment in the military[28]. Their goal was to examine factors correlated with plans for military service (military propensity) and actual enlistment in the service. They used bivariate and multivariate regression analysis independently for men and women. They set out to predict what factors lead some young men and women to choose military service, and what factors lead to successful enlisting among those who choose military service. In order to answer those questions they used cross-sectional and longitudinal panel survey data[29]. Survey data from nationwide samples totaled more than 100,000 high school seniors (classes 1984-1991). In addition, data also included a sub sample of 15,000 seniors who were tracked beyond their senior year for one or two years

The findings indicated that those who enlist directly after high school intended to do so by the end of their senior year. In addition, those that actually enlist have no desire to attend college and view the military as a potential career option. It must be stated that although panel data was utilized, the surveys used did not track respondents throughout their decision making process. The surveys only captured their responses at or near the end of the process when various options had been weighed. The MTF surveys used in

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[27] Bruce Orvis, Narayan Sastry and Laurie McDonald, Military Recruiting Outlook, Recent Trends in Enlistment Propensity and Conversion of Potential Enlisted Supply, Santa Monica, CA: RAND, 1996.

[28] Jerald G. Bachman et al., Who Chooses Military Service? Correlates of Propensity and Enlistment in the U.S Armed Forces, Military Psychology, Vol. 12. No. 1, 2000.

[29] Survey derived from the Monitoring the Future (MTF) survey. MTF devised to study changes in the beliefs, attitudes, and behavior of young people. Nationwide sample consisted of 100,000 high school seniors and post graduation data is collected. The MTF gauges propensity and enlistment data as well as a broad range of other measurable characteristics.

this study contain several hundred questions that bear on a broad range of questions dealing with behaviors and attitudes. There were no questions that addressed whether a student participated in JROTC.

### 3. Enlistment Incentives

Enlistment incentives and their corresponding effectiveness are of great interest to academics, policy makers and military personnel alike. In this section, we examine the literature on enlistment incentives and how they possibly impact the enlistment decisions. The consensus appears to be that education and bonus incentives generally tend to have a positive impact on enlistment decisions.

Bachman and Blair (1985) stressed that the typical high school student planning to attend college tends to have an otherwise negative perception of the military and feels as if it is an interruption in their educational plans.[30] The "college in exchange for service" formula is a means of attracting able individuals who can learn quickly, serve quickly, and then leave quickly to make room for other recruits. There are many incentives to joining the military and the most widely used is the Voluntary Education Program (VOLED). In order to analyze the effect of participation in VOLED on retention, they estimated a binomial probit model. The dependent variable was whether the sailor reenlisted or extended at the end of first-term. They tracked the FY92 cohort of obligors through to their first enlistment decision (24,756 observations) to examine the effects of VOLED on retention. Retention was measured by reenlistments and extensions of more than one year. Bachman and Blair found that sailors who decided to participate in VOLED had higher reenlistment rates than those who did not participate in VOLED.

Gilroy (1986) found that pay has a very strong effect on enlistments[31]. However, the effect varies depending upon the occupational specialty code. A one percent increase in relative military pay would cause the enlistment supply to increase by 0.50 to 3.61.[32]

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[30] Jerald G. Bachman and John D. Blair, *Citizen Force or Career Force? Implications of Ideology in the All-Volunteer Army,* Armed Forces and Society, Vol. 2, No. 1, November 1985, pp 81-96.

[31] Curtis Gilroy, *Army Manpower Economics,* West view Press, Boulder and London, 1986

[32] Martin Binkin, *America's Volunteer Military: Progress and Prospects,* The Brookings Institution, Washington, DC 1984.

As for enlistment bonuses, the magnitude of a bonus is much smaller than that of relative pay. This may imply that it is expensive to use bonuses to channel recruits to various occupational specialties.[33]

Warner (1990) determined that, between 1981 and 1986, the average present value of Army educational benefits increased by nearly 70 percent.[34] According to an estimate of the effects of Army educational benefits on enlistments, such an increase would induce high-quality enlistments to rise by about 29 percent. Because actual enlistments nearly doubled over this period, more than one-quarter of the increase in the Army's high quality enlistments apparently can be traced to increases in the Army's educational benefits. During the period of this study, however, the country was experiencing a recession; therefore, the impact of the ACF on enlistments may be a proxy for the economic downturn and not the influence of educational benefits on enlistments.

Gilroy, Phillips and Blair (1990) examined the effects of the Army College Fund (ACF) on recruiting.[35] The ACF is an enlisted incentive option designed to aid in the recruitment of highly qualified soldiers for critical or shortage Military Occupational Specialties (MOS). The ACF supplements the basic Montgomery GI Bill (MGIB) entitlement. They found that a 10 percent increase in the ACF amount results in a 1.4 percent increase in the supply of enlistments. The study also suggested that relative to bonus programs, educational benefits enhance the flow of prior service individuals into the military.

Aasch and Dertouzos (1994) analyzed the relative cost-effectiveness of enlistment bonuses and educational benefits.[36] They found that educational benefits significantly expand enlistment supply and increase incentives for first-term completion.

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[33]Ibid.

[34] John T. Warner, *Military Recruiting Programs During the 1980s: Their Success and Policy Issues,* Contemporary Policy Issues, Vol. VIII, October 1990, pp 47-67.

[35] Curtis Gilroy, Robert L. Phillips, and John Blair, *the All Volunteer Army Fifteen Years Later,* Armed Forces and Society, Vol. 16, No 3, Spring 1990, pp 329-350.

[36] Beth Aasch and James Dertouzos, Educational Benefits Versus Enlistment Bonuses: A Comparison of Recruiting Options, RAND Corp, MR-302-OSD) Santa, Monica, CA 1994.

Garcia et al. (2002) study also looked at VOLED in a project commissioned by the Chief of Naval Personnel which requisitioned the Center of Naval Analysis (CNA) to determine the effectiveness of VOLED and its impact on retention for the Navy sailors. VOLED provides an incentive to sailors to pursue off-duty education to enhance their investment in human capital. VOLED consists of four elements: Tuition assistance (TA), the Program for Afloat College Education (PACE), the Academic Skills Learning Centers (ASLCs) and the education centers. TA accounted for 54 percent or 30.9 million of VOLED expenditures in FY98.[37] About 60,800 active duty enlisted sailors, 18.1 percent of the force, participated in the VOLED in FY97. Currently, over 300,000 servicemen and women are enrolled in post secondary courses leading to associates, bachelors, masters and doctorate degrees. Table 3 outlines the most recent breakdown across services of VOLED participation rates and expenditures.

Table 3. Voluntary Education FY03

| | **Army** | **Navy** | **Marines** | **Air Force** | **DOD total** |
|---|---|---|---|---|---|
| **INDIVIDUAL ENROLLMENTS** | | | | | |
| **High School Completions** | 332 | 93 | 12 | 176 | 613 |
| **Non Credit Courses** | | | | | |
| Language | 0 | 0 | 0 | 632 | 632 |
| Military Specialty | 0 | 5,318 | 0 | 0 | 5,318 |
| Basic Skills | 18,025 | 11,768 | 2,392 | 5,161 | 37,346 |
| **Postsecondary** | | | | | |
| Undergraduate | 283,904 | 163,164 | 76,908 | 254,409 | 778,385 |
| Graduate | 30,162 | 11,859 | 4,688 | 39,305 | 86,014 |
| Navy Undergraduate includes PACE | | | | | |
| **DEGREES COMPLETED** | **Army** | **Navy** | **Marines** | **Air Force** | **DOD Total** |
| High School/GED | 84 | 64 | 22 | 36 | 206 |
| Associate Degrees | 3,374 | 1,371 | 510 | 15,264 | 20,519 |
| Baccalaureate Degrees | 2,282 | 1,459 | 715 | 4,065 | 8,521 |
| Graduate Degrees | 1,526 | 323 | 197 | 2,196 | 4,242 |
| Doctorate Degrees | DNC | 1 | 0 | 38 | 39 |
| **EXPENDITURES (in millions)** | **Army** | **Navy** | **Marines** | **Air Force** | **DOD Total** |
| Personnel Costs | $35.7 | $10.8 | $3.0 | $33.1 | $82.6 |
| Contract Costs (Non Instructional) | $0.0 | $0.0 | $0.5 | $0.0 | $0.5 |
| Contract Costs (Instructional) | $2.0 | $20.3 | $0.5 | $0.1 | $22.8 |
| Tuition Assistance | $157.3 | $58.7 | $35.4 | $120.2 | $371.6 |
| **TOTAL EXPENDITURES** | $195.0 | $89.8 | $39.3 | $153.3 | $477.5 |

[37] Federico E. Garcia, Ernest Joy and David L. Reese, *Effectiveness of the Voluntary Education Program,* CAN, Alexandria, Va (2002)

| DANTES TESTING (FUNDED) | Army | Navy | Marines | Air Force | DOD Total |
|---|---|---|---|---|---|
| CLEP General | 4,039 | 7,458 | 1,716 | 23,303 | 36,516 |
| CLEP Subject | 4,865 | 6,078 | 1,600 | 17,667 | 30,210 |
| DSSTs | 7,118 | 8,564 | 1,498 | 36,224 | 53,404 |
| EXCEL | 2,091 | 2,359 | 233 | 3,080 | 7,763 |
| SAT | 1,134 | 3,530 | 643 | 381 | 5,688 |
| ACT | 2,103 | 3,118 | 502 | 266 | 5,989 |
| GRE | 548 | 195 | 34 | 798 | 1,575 |
| GMAT | 274 | 210 | 34 | 331 | 849 |
| PRAXIS | 663 | 338 | 69 | 253 | 1,323 |
| GED | 582 | 1,751 | 321 | 10 | 2,664 |
| GUIDANCE | 31,943 | 5,324 | 997 | 5,162 | 43,426 |
| ASE | 1,603 | 1,534 | 123 | 351 | 3,611 |
| **Total Testing:** | 56,963 | 40,459 | 7,770 | 87,826 | 193,018 |

Source: Under Secretary of Defense and Personnel Readiness: DOD Voluntary Education. (http://www.voled.doded.mil)

## C. RETENTION AND REENLISTMENT STUDIES

In this section, we review the previous studies of the retention and reenlistment behavior of military personnel. The military is especially concerned on the first-term completion rates and reenlistment rates as they have an impact on the force mix and manpower costs (accession and training). The literature review of these studies helps construct our theoretical model for the study of the impact of JROTC on retention and reenlistment.

Most of the studies investigated the retention effects of two main categories of variables. The first category is the impact of pay-related variables to include relative military pay, retention bonuses, and the returns to the decision to stay in the military compared to alternative civilian employment. The second category examines how individual characteristics (aptitude scores, race or educational qualification) or work environment (incidence of sea duty, length of deployment and time spent underway while not deployed) affect first-term completion reenlistment eligibility.

### 1. Pecuniary Factors on Retention and Reenlistment

Quester and Adedeji (1991) analyzed the impact of bonuses, grade and dependency status on re-enlistment.[38] There have been substantial changes in the characteristics of enlisted Marines and Marine Corps policy, and these changes led to this research on first-term reenlistment decisions. First, the responsiveness of high quality marines to incentives had not been investigated. Secondly, with the increase in marriages and dependency status of marines, the potential retention implications were not observed. Thirdly, the researchers were interested in the impact of the implementation of long-term contracts. Generally, the first term enlistment contract was three to four years, but most recently the first term enlistment contracts are four or six years. Finally, the time in service requirement has increased for promotion to corporal and sergeant, which was directly impacted by high retention. Larger numbers of marines remained in service, therefore, slowing down the promotion norms.

The Quester and Adedeji study restricted the population sample to "recommended and eligible" marines in the first 72 months of service.[39] To obtain valid estimates of the effects of particular variables on the reenlistment decision, a multivariate model was estimated. The goal was to partition out the independent effects of grade, compensation, and marital status on the reenlistment decision. Some characteristics, however, vary together. Fortunately, there is sufficient variation in the data to allow estimation.

The researchers used two basic specifications for the reenlistment equation. The first model specification includes the pay index and civilian unemployment rate variables. The pay index is the simple average of pay index value for the current quarter and is constructed by obtaining the ratio of military pay series to civilian pay series. The second model specification omits pay index and civilian unemployment rate, and adds instead a set of control variables, one for each fiscal year. The results of this study were higher promotion percentages; longer initial enlistments and high SRB's are associated with higher re-enlistment rates. Moreover, minorities, females, and married marines are more

[38] Quester, A and A. Adedeji, "Reenlisting in the Marine Corps: The Impact of Bonuses, Grade, and Dependency Status," C.N.A Corporation, Alexandria, VA, July 1991.

[39] Ibid.

likely to reenlist than other groups. Lastly, a higher military to civilian pay index and high unemployment are associated with re-enlistment probabilities.

Warner and Asch (1995) employed an Annualized Cost of Leaving (ACOL) model[40] to compare the present value of future streams of military earnings and civilian earnings in a specific time horizon. The ACOL model states that an individual chooses to stay in the military if the net returns to staying in the military are greater than the taste for civilian life. The weakness of the ACOL model lies in its inability to incorporate dynamic changes in the environment. Nevertheless, the positive correlation between reenlistments and pay (either through bonuses or regular compensation) has been well established both theoretically and empirically.[41]

Mackin and Darling (1996) looked at the impact of incentive pay on officers' retention behavior. The findings could provide some insights to the utility of introducing incentive pay for the enlisted personnel. Mackin and Darling conducted a comprehensive cost benefit analysis of the feasibility of the Surface Warfare Officer (SWO) Career Incentive Pay (CIP).[42] The costs of introducing SWOCIP was weighed against the benefits of reduction in the number of accessions hence cost savings of accession and training costs.

As there had been no study of pay and retention elasticity estimates for the SWO community, Mackin and Darling used the estimates from the aviation and nuclear officer communities as proxies. A criticism of this study lies in their use of pay and retention elasticity estimates from the aviation and nuclear officer communities that do not share similar traits as that of the SWO community like different contract obligation, training costs, working conditions and demographics. Nevertheless, applying transition analysis and sensitivity analysis, the study found that the SWO community is responsive to pay changes and that the SWOCIP implementation, in particular a CIP quantum of ten

[40]Warner, J., and B. Asch, "The Economics of Military Manpower," Handbook of Defense Economics, Volume 1, Elsevier Science, BV, 1995.

[41] Ibid.

[42] Mackin, C., and K. Darling, "*Economic Analysis of Proposed Surface Warfare Officer Career Incentive Pay*," Bureau of Naval Personnel, Washington, DC, September 1996.

thousand dollars, would bring about significant cost savings while giving the Navy the ammunition to retain high-quality officers.

Hansen and Wagner (2002) estimated the relationship between military compensation and enlisted retention using standard logistic regression[43]. They asserted that to effectively man a volunteer force, the Navy must offer compensation that motivates men and women not only to enlist in the Navy, but also to remain in the Navy past their initial commitments.[44] The baseline model employed encapsulated three general categories of variables: variables that affect military compensation, variables that affect civilian earnings opportunities and those that reflect a relative preference for military service. In this study, in order to identify those who reenlist, the researchers exclude service members who do not extend beyond three years. Women were excluded as well due to their small sample size. Those that are ineligible to reenlist remained in the sample and the justification was inferred that servicemen made bad decisions. The findings suggest that estimates of the pay elasticity of reenlistment are highly sensitive to the choice of empirical specification. The researchers found that pay elasticity's differ significantly between models and thus could not be used as an accurate tool to predict reenlistments. The same data was used to estimate each alternative model and the differences in pay elasticity did not reflect actual changes in the responsiveness to pay of Navy enlisted personnel, but rather shifts in the magnitude of responsiveness that these models attribute to pay.[45]

The covariates used in this study provide ideas on the factors that have to be controlled in our theoretical models for retention and reenlistment. We note that using the ACOL model to reflect relative preference for military service in this study could result in selection bias. This is because the researchers obtained civilian pay data from veterans and not a random sample of civilians. This created a self-selection bias because those who left the service had made the decision to leave already.

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[43]Hansen, M. J. Wagner, "Why Do Pay Elasticity Differ?" C.N.A Corporation, Alexandria, VA, March 2002.

[44] Ibid.

[45] Ibid.

### 2. Individual Characteristics on Retention and Reenlistment

Ward and Tan (1985), in one of the first empirical studies, examined the retention behavior of "quality" enlisted personnel using the 1974 cohort in all services.[46] They constructed a single measure of quality by combining performance-based measures with entry-level and background characteristics. Performance-based measures include the length of time for promotion to E-4 and E-5, while the entry-level characteristics include education levels and AFQT scores. Quality was estimated for eight different occupation groups. They argued that background characteristics were useful in predicting subsequent performance as measured by promotion rates.

Cooke and Quester (1992) examined the background characteristics of Navy enlisted personnel that are likely to increase the likelihood of contract completion. The researchers define a successful enlistee as one who completed his or her enlistment, was eligible to reenlist, and either reenlisted or extended. Using logistic models to estimate the relationship between recruit background characteristics and successful outcomes in the Navy[47], the study found that recruits who were high school graduates, with high AFQT scores, and entered through the Delayed Entry Program (DEP) were more likely to be complete their first-term enlistment contract. In addition, black and Hispanic recruits were more likely than other to complete their first enlistment and be promoted. The study also concluded that characteristics associated with contract completion are also good predictors of retention and promotion.

From our literature review on retention and reenlistment studies, we conclude that retention and reenlistment models have often included variables other than pay. The non-pecuniary aspects include personal characteristics, such as marital status, race, education, and mental group. These same factors could also be used to find out the relative tastes for the military life via the ACOL model. If a retention model includes those personal characteristics and the ACOL variable, the question of multicollinearity arises. However, one could argue that those personal characteristics should be included as the ACOL

[46]Ward, M. and H. Tan, "The Retention of High Quality Personnel in the U.S Armed Forces, " The Rand Corporation, Santa Monica, CA 1985.

[47]Cooke, W., and A. Quester, "What Characterizes Successful Enlistees in the All-Volunteer Force: A Study of Male Recruits in the U.S Navy," Social Science Quarterly, volume 73, Number 2, June 1992.

variable might not be able to capture all these effects on retention or reenlistment behaviors. Personal characteristics should certainly be included if there is an independent interest in their effects on retention and reenlistment. [48]

Various studies have been conducted on officer and enlisted personnel retention and reenlistment but none had included JROTC participant as one of the explanatory variables. As our primary interest in this study is the impact of the personal characteristic of JROTC participation on retention and reenlistment, the personal characteristic of JROTC participation will be included in our analysis.

## D. STUDIES ON JROTC

To date there is a consensus on literature pertaining to the positive impact JROTC participation has on participant's performance. Some researchers claim heightened performance in high school and on college entrance exams for JROTC participants. In this section, we discuss some studies on performance of JROTC participants.

### 1. Benefits of Navy JROTC

Balley et al. (1992) study was perhaps the only one study that had attempted to evaluate the benefits of JROTC to the military. This study, in particular, looked at the benefits of Navy JROTC (NJROTC) to the Navy.[49] Balley et al. administered a survey to NJROTC cadets in 38 NJROTC units (out of 300 units) and they received 5,521 responses. Overall, the NJROTC host school administrators, instructors, community leaders, and cadets shared positive perceptions of the value of the program. The positive impact of NJROTC program on youths' education was evident when almost two-thirds of the NJROTC cadets agreed that NJROTC participation was a major factor in their decisions to remain in school.[50]

On the impact of the NJROTC program on the cadets' propensity to enlist, the study found that approximately 20 percent of the respondents indicated military

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[48] Ibid.

[49] Balley, Hodak, Sheppard and Hassen, Technical Report 92-015, *Benefits Analysis of the Naval Junior Reserve Officers Training Corps,* Naval Training Systems Center, Orlando, FL, June 1992.

[50] Ibid.

enlistment as their career plans after high school while the majority at 60 percent planned to attend college. Of the 762 cadets who indicated they were planning to enlist in the service, 20 percent had been in the NJROTC program for at least three years; and 32 percent of the youth had held after school jobs. A total of 592 cadets had elected to take the Naval Science course voluntarily.[51] Of those possibly interested in enlistment, the majority reported satisfaction with their overall experience in the NJROTC program. When compared to the overall sample population, a higher percentage of cadets (66.6%) expressed an interest in enlisting after high school. Cadets agreed that participation in the program was a major factor in their decision to remain in school.

One-third of the NJROTC cadets expressed interest in enlisting in the Navy. For the total sample population, more cadets expressed an interest in enlisting in the Navy (30.8%).[52] For the remaining branches of service, 12 percent are interested in the Marine Corps; 11 percent in the Air Force; and 9 percent in the Army. Nine percent of the cadets expressed an interest in the Coast Guard and six percent in the Merchant Marine.

Bally et al. (1992) merely reported the survey results and did not attempt an empirical analysis of the data obtained that could shed some insights to the enlistment propensity behavior of the NJROTC cadets. Furthermore, Bally et al. only surveyed NJROTC cadets in the identified NJROTC units when a comparison of NJROTC cadets and non-NJROTC cadets in those units would have given more robust qualitative findings.

### 2. Benefits of JROTC

The Center for Strategic and International Studies (CSIS) conducted a study in 1999 to objectively evaluate if JROTC benefits the participants and communities and to provide possible recommendations for policy makers. The researchers employed field research methodology and randomly selected high schools that host JROTC programs from three urban cities, Chicago, Washington D.C and El Paso. The field research studied high school students from School Year (SY) 1993 to 1998 and included JROTC

[51] Ibid.

[52] Ibid.

participants from 28 JROTC units. This research involved personal interviews and written surveys with more than 150 school officials, including principals, assistant principals, academic counselors, security personnel, teachers and JROTC instructors. [53] In addition, several students completed written questionnaires or were directly involved in focus groups sharing their perceptions of JROTC and how the program has impacted their educational experience.

In Chicago, there are 75 public schools in which there are 40 JROTC units (33 Army units, four Navy units, one Air Force unit and two Marine Corp units). [54] With the help of the Directorate of Army Instruction (DAI) located in the Chicago Public School District (CPS) central administration, the researchers obtained useful information on JROTC and non-JROTC participants in 16 of the 18 schools visited by the research team. Data provided to the research team included grade point averages (GPA), suspension rates, absentee information, graduation rates and college entrance examination scores.

The CSIS study followed a single cohort of JROTC and non-JROTC participants in Chicago from SY 93 (freshmen) to SY 97 (seniors) and tabulated their findings based on the information provided by DAI. Specifically on educational outcomes, the researchers used the average GPA scores of the students as proxy for the impact of JROTC program on the students' academic performance. The CSIS study found that in SY 1993-1994, the JROTC students' GPA scores were lower than that of the non-participants. However, in the subsequent school years, the GPA scores of JROTC participants improved and even surpassed that of the non-JROTC participants. This seems to suggest that JROTC program has a positive influence on the educational outcomes of the participants. The field research for high schools located in the Washington DC and El Paso cities yield similar results.

Again, the CSIS study was of a descriptive nature and there was no attempt to carry out any empirical analysis. The conclusion from the CSIS study was that JROTC program benefits a significant segment of our nation's youth and their communities based

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[53] Center for Strategic and International Studies, *Junior Reserve Officers' Training Corps: Contributions to America's Communities.* Final Report. Washington, DC, May 1999.

[54] Ibid.

on their study of high schools located in three urban cities.[55] The chosen urban cities, however, might not be a representative sample of the population of high schools that host JROTC units. The positive impact of the JROTC program could have been overstated as the three urban cities chosen typically have students that come from the lower socioeconomic stratum; therefore, the JROTC program has a higher positive intervention impact for these students as compared to other school districts.

Typically, many research studies on the benefits of JROTC tend to espouse the program's benefits to "at risk" youths. The "at risk" label was originally created to identify students at risk of dropping out of school. However, the "at risk" label has over time, shifted to tag youths with potential capacity for violence, drug use, or crime. Furthermore, educators have been pressured to identify "at risk" students at earlier ages; beginning in elementary school before any evidence of substance abuse or criminal activity exists. The perception of the JROTC as a program designed specifically for "at risk" youth requires empirical evidence as the demographic shifts over the years could make this label irrelevant today.

### 3. Benefits of JROTC Career Academy

The Director of Special Projects and Research, in the Office of the Under Secretary of Defense for Personnel and Readiness commissioned Elliot et al. (2000) to conduct a study to determine the effects of the JROTC Career Academy programs on student outcomes.[56] Career academies are schools within schools and the students receive academic and vocational instruction with a specific career theme. The JROTC Career Academy is therefore, a career academy model with the JROTC program of instruction. Similar to high schools with JROTC programs, JROTC career academies aim to foster academic and vocational skills, while giving students a sense of civic and personal responsibility. As of year 2000, there were 36 JROTC Career Academies operating in 33 cities in 23 states, with a total of approximately 3,800 students.

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[55] Ibid.

[56] Marc Elliot, Lawrence Hanser and Curtis Gilroy, *Evidence of Positive Student Outcomes in JROTC Career Academies,* RAND, Santa Monica, CA, 2000.

Elliot et al. (2000) collected data on almost 7,000 students in schools on the West Coast and in the Midwest, including students in JROTC Career Academies, other career academies, magnet schools and other programs. The study is a quasi-experimental design with non-randomly chosen multiple comparison groups. The almost 7000 students included students in JROTC Career Academies, and students in three comparison groups; (1) students in other academy or magnet programs in the target and other schools; (2) students in regular JROTC programs; and (3) students not enrolled in any special programs. A multiple regression model was used to test whether students in the JROTC academies performed better than students in other programs. A series of variables were used such as absenteeism, GPA, dropout rates and credits earned.

Of the whole sample, more than half of the students were Hispanic, nearly one quarter were African American, 16 percent were white, and 49 percent were females. Of the students who attended the JROTC academies, 77 percent were Hispanic, 11 percent were African American, ten percent were white, and 48 percent were female. The percentage of Hispanic participants is noticeably high and attributed to the influx of Hispanics migrating to the west coast.

Elliot et al. (2000) was cautious to speculate on why students prefer the JROTC Career Academies to other programs. They suggest that some students were attracted due to the combination of the JROTC military-style instruction with the vocational components associated with career academies. Some students may have enrolled because they did not meet the performance levels required for other career academy and magnet programs. In addition, many teachers and counselors focused on the military discipline aspect of the JROTC Career Academies and assumed that the programs were appropriate for student who needed extra discipline. Teachers and counselors thus referred students with poor discipline, attendance and academic performance, including low grades and few earned credits to academies.

The study did not find evidence that the JROTC Career Academy's regimented teaching style played a role in the programs' success. However, they could not rule out this influence from the finding that JROTC Career Academy students performed better than students in the regular JROTC programs. In focus groups, students mentioned that

the major factor in their success was the nurturing environment provided by the academy. The findings show that JROTC Career Academy students had a mean GPA 40 percent higher than students in regular schools; lower rates of absenteeism, lower drop out rates, and earned more credits than students at other career academies and magnet schools.[57]

Selection bias poses the question of validity for this study. The students who participated in the career academies self selected into the programs or were chosen by counselors for a variety of reasons. Selection effects make it difficult to discern whether observed differences in performance are the result of pre-intervention differences in the groups being compared or whether they are attributable to the effect of the treatment.[58] Experimental designs, that include random assignment to conditions, eliminate this problem by ensuring that groups are not systematically different prior to treatment. To minimize potential bias from selection effects, Elliot et al. used propensity weighting. This is a technique that attempts to weight the samples from each of several groups in such a way that they resemble the sample in a particular group of interest.[59]

## E. CONCLUSION

We have reviewed the pertinent studies on enlistment decisions, retention and reenlistment and related JROTC studies. We found that JROTC participation, as an explanatory variable in any empirical framework has not been carried out before. Major studies on the benefits of the JROTC program to the military or the communities were purely qualitative. The literature review points to an interesting aspect of this study - the empirical examination of the impact of JROTC on the military is first of its kind. The findings from our thesis will be of great interest to policy makers in DOD and JROTC administrators in all branches of services.

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[57] Ibid.

[58] Ibid.

[59] Ibid.

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# IV. DATA DESCRIPTION

## A. INTRODUCTION

This chapter describes the two data sets – High School & Beyond (HSB) 1980 senior and sophomore cohort survey data and Defense Manpower Data Center (DMDC) enlisted personnel cohort data – that will be used to determine the impact of JROTC participation on military enlistment decision, retention and re-enlistment. The first section will describe the HSB data set, followed by the DMDC data set.

## B. HIGH SCHOOL & BEYOND DATA

The High School & Beyond (HS&B) study follows a representative sample of high school sophomores and high school seniors in 1980, collecting information on high school programs, family background, goals, values, post-high school plans and post-high employment. The students in the 1980 sample were selected using a two-stage probability strategy, with 1,122 schools selected in the first-stage and within each stratum schools, 36 seniors and 36 sophomores were randomly selected.

In this stratified national sample, there were 14,825 sophomores and 11,995 seniors selected from the 1,122 high schools sample. Certain groups of students and schools were selected with probabilities higher than their occurrence in the population to allow for meaningful study of the educational experience and impact on the students. These special strata included the Hispanic strata that ensure sufficient numbers of Cuban, Puerto Rican and Mexican students for separate analyses; Catholic schools stratum with high proportions of black students; public alternative schools stratum; and private schools stratum with high-achieving students.

Both senior and sophomore cohorts had follow-up surveys conducted in years 1982, 1984 and 1986. A fourth follow-up survey was conducted in 1992 for the sophomore cohort. The base year 1980 sample and the first follow-up 1982 sample for the sophomore cohort provide useful information on the sophomores' intentions to enlist

and their subsequent decision to enlist. The 1984 and beyond sample sets shed more light on the enlistment decisions and other post-high school plans of these high school sophomores.

Similarly, the base year 1980 sample provides useful information on the high school seniors' intention to enlist as well as the decision to enlist. The follow-up surveys in 1982, 1984 and 1986 for the senior cohorts, however, have a different emphasis compared to the sophomore cohort. The surveys for the senior cohort are geared toward finding out the values, opinions and voting behavior of the seniors after high school whereas the surveys for the sophomore cohort tend to focus more on the employment and schooling opportunities of the sophomores after high school.

The following paragraphs provide a description of the sophomore and senior cohort data in the following order: overview of the data, JROTC participant data and enlisted personnel data.

**1. Overall Descriptive Statistics**

Table 4 provides the summary of the statistics of the 1980 HSB Sophomore and Senior Cohort that are useful in the empirical analysis of the impact of the JROTC participants on military enlistment. The main variables of interest are JROTC participation of the high school students, military enlistments of the high school sophomores and seniors after high school, their demographic profiles, family background, educational aspirations, attitudes, military intentions and family income. The region and urbanity of the high schools are also included in the data description to serve as control for the external economic environment.

Table 4. Summary Statistics of the HSB 1980 Sophomore and Senior Cohort

| | Sophomore | | | | | Senior | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max |
| | | | | | | | | | | |
| JROTC | 74125 | 0.02 | 0.13 | 0 | 1 | 47980 | 0.04 | 0.19 | 0 | 1 |
| Enlisted | 74125 | 0.02 | 0.14 | 0 | 1 | 47980 | 0.04 | 0.19 | 0 | 1 |
| | | | | | | | | | | |
| *Demographics* | | | | | | | | | | |
| Black | 74125 | 0.15 | 0.36 | 0 | 1 | 47980 | 0.27 | 0.44 | 0 | 1 |
| White | 74125 | 0.62 | 0.49 | 0 | 1 | 47980 | 0.48 | 0.50 | 0 | 1 |
| Native | 74125 | 0.02 | 0.15 | 0 | 1 | 47980 | 0.02 | 0.14 | 0 | 1 |
| Asian | 74125 | 0.03 | 0.18 | 0 | 1 | 47980 | 0.04 | 0.18 | 0 | 1 |
| Hispanic | 74125 | 0.16 | 0.37 | 0 | 1 | 47980 | 0.19 | 0.39 | 0 | 1 |
| | | | | | | | | | | |
| Male | 74125 | 0.50 | 0.50 | 0 | 1 | 47980 | 0.35 | 0.48 | 0 | 1 |
| Female | 74125 | 0.50 | 0.50 | 0 | 1 | 47980 | 0.40 | 0.49 | 0 | 1 |
| | | | | | | | | | | |
| Single | 74125 | 0.69 | 0.46 | 0 | 1 | 47980 | 0.73 | 0.44 | 0 | 1 |
| Married | 74125 | 0.14 | 0.35 | 0 | 1 | 47980 | 0.15 | 0.36 | 0 | 1 |
| | | | | | | | | | | |
| *Family Background* | | | | | | | | | | |
| Father in military | 74125 | 0.02 | 0.13 | 0 | 1 | 47980 | 0.02 | 0.13 | 0 | 1 |
| Mother in military | 74125 | 0.00 | 0.03 | 0 | 1 | 47980 | 0.00 | 0.04 | 0 | 1 |
| | | | | | | | | | | |
| Father is HS grad* | 74125 | 0.24 | 0.43 | 0 | 1 | 47980 | 0.03 | 0.16 | 0 | 1 |
| Father is College grad* | 74125 | 0.18 | 0.38 | 0 | 1 | 47980 | 0.06 | 0.24 | 0 | 1 |
| Mother is HS grad | 74125 | 0.33 | 0.47 | 0 | 1 | | | | | |
| Mother is College grad | 74125 | 0.12 | 0.32 | 0 | 1 | | | | | |
| | | | | | | | | | | |
| *Individuals' Education Expectations* | | | | | | | | | | |
| Amostly | 74125 | 0.10 | 0.30 | 0 | 1 | 47980 | 0.03 | 0.16 | 0 | 1 |
| Bmostly | 74125 | 0.17 | 0.38 | 0 | 1 | 47980 | 0.05 | 0.21 | 0 | 1 |
| Cmostly | 74125 | 0.11 | 0.31 | 0 | 1 | 47980 | 0.03 | 0.18 | 0 | 1 |
| Highest educ expected - HS | 74125 | 0.14 | 0.35 | 0 | 1 | 47980 | 0.10 | 0.30 | 0 | 1 |
| Highest educ expected - Col | 74125 | 0.16 | 0.37 | 0 | 1 | 47980 | 0.25 | 0.44 | 0 | 1 |
| College plans in HS | 74125 | 0.26 | 0.44 | 0 | 1 | 47980 | 0.32 | 0.47 | 0 | 1 |
| | | | | | | | | | | |
| *Individuals' Attitudes* | | | | | | | | | | |
| Positive attitude | 74125 | 0.78 | 0.41 | 0 | 1 | 47980 | 0.82 | 0.39 | 0 | 1 |
| Self-worth | 74125 | 0.80 | 0.40 | 0 | 1 | 47980 | 0.83 | 0.38 | 0 | 1 |
| Discipline | 74125 | 0.11 | 0.32 | 0 | 1 | 47980 | 0.14 | 0.34 | 0 | 1 |
| Suspension | 74125 | 0.09 | 0.29 | 0 | 1 | 47980 | 0.11 | 0.32 | 0 | 1 |
| Absenteeism | 74125 | 0.28 | 0.45 | 0 | 1 | 47980 | 0.38 | 0.49 | 0 | 1 |
| | | | | | | | | | | |
| *Individuals Military Intentions* | | | | | | | | | | |
| Military aspiration | 74125 | 0.02 | 0.14 | 0 | 1 | 47980 | 0.01 | 0.10 | 0 | 1 |
| Military interest in 1980 | 74125 | 0.04 | 0.19 | 0 | 1 | 47980 | 0.04 | 0.18 | 0 | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Military plans in HS | 74125 | 0.04 | 0.20 | 0 | 1 | 47980 | 0.05 | 0.22 | 0 | 1 |
| Military interest in 1982 | 74125 | 0.46 | 0.50 | 0 | 1 | | | | | |
| Military incentives in 1982 | 74125 | 0.25 | 0.43 | 0 | 1 | | | | | |
| Military interest in 1984 | 74125 | 0.20 | 0.40 | 0 | 1 | 47980 | 0.14 | 0.35 | 0 | 1 |
| | | | | | | | | | | |
| *Family Income* | | | | | | | | | | |
| Family income less than 19k | 74125 | 0.50 | 0.50 | 0 | 1 | 47980 | 0.68 | 0.47 | 0 | 1 |
| Family income greater than 25k | 74125 | 0.21 | 0.41 | 0 | 1 | 47980 | 0.10 | 0.31 | 0 | 1 |
| Family income between 20K-24K | 74125 | 0.09 | 0.28 | 0 | 1 | 47980 | 0.07 | 0.25 | 0 | 1 |
| | | | | | | | | | | |
| *High School Location* | | | | | | | | | | |
| New England | 74125 | 0.05 | 0.22 | 0 | 1 | 47980 | 0.05 | 0.21 | 0 | 1 |
| Mid Atlantic | 74125 | 0.18 | 0.39 | 0 | 1 | 47980 | 0.15 | 0.36 | 0 | 1 |
| South Atlantic | 74125 | 0.16 | 0.36 | 0 | 1 | 47980 | 0.18 | 0.39 | 0 | 1 |
| West-south central | 74125 | 0.11 | 0.31 | 0 | 1 | 47980 | 0.13 | 0.34 | 0 | 1 |
| East-north central | 74125 | 0.19 | 0.40 | 0 | 1 | 47980 | 0.17 | 0.38 | 0 | 1 |
| West-north central | 74125 | 0.07 | 0.26 | 0 | 1 | 47980 | 0.06 | 0.24 | 0 | 1 |
| Mountain | 74125 | 0.05 | 0.21 | 0 | 1 | 47980 | 0.06 | 0.23 | 0 | 1 |
| Pacific | 74125 | 0.14 | 0.35 | 0 | 1 | 47980 | 0.15 | 0.35 | 0 | 1 |
| | | | | | | | | | | |
| Suburban | 74125 | 0.50 | 0.50 | 0 | 1 | 47980 | 0.45 | 0.50 | 0 | 1 |
| Rural | 74125 | 0.25 | 0.43 | 0 | 1 | 47980 | 0.27 | 0.44 | 0 | 1 |
| Urban | 74125 | 0.24 | 0.43001 | 0 | 1 | 47980 | 0.28 | 0.45 | 0 | 1 |

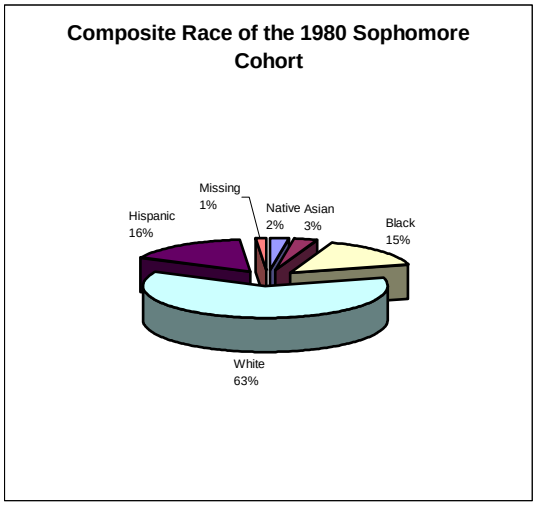
Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

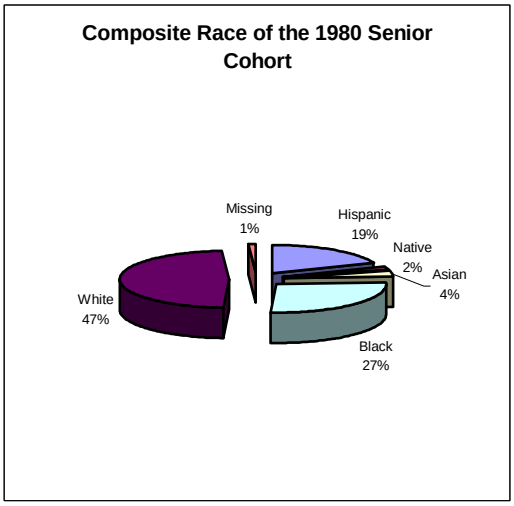
* The educational levels of the respondents' parents are tracked separately for the sophomore cohort but not for the senior cohort.

Pooling the follow-up surveys and the base year survey provide 74,125 observations for the 1980 Sophomore Cohort and 47,980 observations for the 1980 Senior Cohort. All variables of interest are converted to dummy variables that take on value of either "0" or "1". There are similarities and differences between the 1980 sophomore and senior cohort, which are discussed, in the ensuing paragraphs.

From these pooled sample data sets, the number of JROTC participants and the number who enlisted in the military are relatively small. The senior population set has a relatively higher proportion of students who are black as compared to the sophomore cohort. On the other hand, there are a high proportion of students who are of Hispanic origin in the sophomore cohort as compared to the senior cohort. The charts below depict

the relative percentages of the composite race breakdown of the 1980 sophomore and senior cohort.




In the sophomore cohort, a higher proportion of the educational attainment of the students' parents is high school graduates whereas in the senior cohort, there are a higher proportion of parents who are college graduates. It is to be noted that while the sophomore cohort survey tracks the education level of the students' father and mother, the senior cohort survey only has composite data on the educational level of the students' parents. This might explain the disparity between the two data sets. Both the sophomore and senior cohort data sets have approximately the same proportion of parents who are in the military.

The participation rate in all waves for the survey for both the sophomore and senior cohort is relatively high at above 90 percent for all years except for the last wave that garnered approximately 85 percent response rate as described in Table 5 below.

Table 5. Participation Rate of the 1980 Sophomore and Senior Cohort

| | Sophomore | | | | Senior | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Participate | Did not participate | Total | Participation Rate (%) | Participate | Did not participate | Total | Participation Rate (%) |
| 1980 | 13,749 | 1,076 | 14,825 | 92.74% | 11,500 | 495 | 11,995 | 95.87% |
| 1982 | 14,102 | 723 | 14,825 | 95.12% | 11,227 | 768 | 11,995 | 93.60% |
| 1984 | 13,682 | 1,143 | 14,825 | 92.29% | 10,925 | 1,070 | 11,995 | 91.08% |
| 1986 | 13,425 | 1,400 | 14,825 | 90.56% | 10,536 | 1,459 | 11,995 | 87.84% |
| 1992 | 12,640 | 2,185 | 14,825 | 85.26% | | | | |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

### 2. JROTC Participants Data Description

From the HSB data, the number of sophomores who participated in the JROTC Program was 333 and 251 in year 1980 and 1982 respectively. For the seniors, the number of participants was 435 in 1980.

Table 6. JROTC Participation Rate of Survey Respondents

| | Sophomore | | | | Senior | | | |
|---|---|---|---|---|---|---|---|---|
| | JROTC | Non-JROTC | Total | Participation Rate (%) | JROTC | Non-JROTC | Total | Participation Rate (%) |
| 1980 | 333 | 13,416 | 13,749 | 2.42% | 435 | 11,065 | 11,500 | 3.78% |
| 1982 | 251 | 13,851 | 14,102 | 1.78% | - | - | - | - |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

Table 7 below provides the summary of the statistics, which consists of the same variables collected in Table 4, for the JROTC participants in year 1980 and 1982 for the sophomore cohort and only year 1980 for the senior cohort. The average percentage of all survey participants for each variable is also shown for purpose of comparison.

Table 7. Summary Statistics of JROTC Participants in the HSB 1980 Sophomore and Senior Cohort

| | Sophomore | | | | | | Senior | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1980 | | 1982 | | All Survey Participants Average | | 1980 | | All Survey Participants Average |
| | | | | | 1980 | 1982 | | | 1980 |
| | No | (%) | No | (%) | (%) | (%) | No | (%) | (%) |
| Black | 122 | 36.64 | 106 | 42.23 | 15.22 | 15.16 | 236 | 54.25 | 27.76 |
| White | 127 | 38.14 | 86 | 34.26 | 62.27 | 62.74 | 87 | 20.00 | 50.11 |
| Hispanics | 67 | 20.12 | 40 | 15.94 | 17.17 | 17.39 | 94 | 21.61 | 19.70 |
| Native | 9 | 2.70 | 13 | 5.18 | 2.35 | 2.34 | 11 | 2.53 | 1.99 |
| Asian | 5 | 1.50 | 6 | 2.39 | 3.30 | 3.21 | 6 | 1.38 | 3.65 |
| | | | | | | | | | |
| Male | 210 | 63.06 | 152 | 60.56 | 49.34 | 49.29 | 256 | 58.85 | 49.35 |
| Female | 123 | 36.94 | 99 | 39.44 | 50.66 | 50.71 | 179 | 41.15 | 54.96 |
| | | | | | | | | | |
| Father in military | 15 | 4.50 | 12 | 4.78 | 1.81 | 1.88 | 16 | 6.90 | 1.86 |
| Mother in military | 4 | 1.20 | 0 | 0.00 | 0.09 | 0.16 | 5 | 8.05 | 0.14 |
| | | | | | | | | | |
| Father is HS grad | 80 | 24.02 | 61 | 24.30 | 25.08 | 24.58 | 30 | 6.90 | 5.37 |
| Father is College grad | 28 | 8.41 | 30 | 11.95 | 18.42 | 18.07 | 35 | 8.05 | 12.85 |
| | | | | | | | | | |
| Mother is HS grad | 98 | 29.43 | 66 | 26.29 | 34.46 | 33.85 | - | - | - |
| Mother is College grad | 19 | 5.71 | 24 | 9.56 | 12.59 | 12.33 | - | - | - |
| | | | | | | | | | |
| Amostly | 17 | 5.11 | 12 | 4.78 | 10.25 | 10.22 | 35 | 8.05 | 11.08 |
| Bmostly | 36 | 10.81 | 43 | 17.13 | 18.37 | 18.18 | 75 | 17.24 | 19.92 |
| Cmostly | 55 | 16.52 | 40 | 15.94 | 10.96 | 12.38 | 79 | 18.16 | 13.71 |
| | | | | | | | | | |
| Highest educ expected – HS | 108 | 32.43 | 42 | 16.73 | 14.44 | 18.28 | 91 | 20.92 | 15.79 |
| Highest educ expected – Col | 55 | 16.52 | 34 | 13.55 | 20.60 | 21.50 | 91 | 20.92 | 25.20 |
| College plans in HS | 85 | 25.53 | 50 | 19.92 | 26.41 | 29.14 | 127 | 29.20 | 33.10 |
| | | | | | | | | | |
| Positive | 231 | 69.37 | 182 | 72.51 | 82.08 | 80.21 | 352 | 80.92 | 84.66 |
| Self_worth | 240 | 72.07 | 187 | 74.50 | 84.02 | 82.42 | 347 | 79.77 | 85.97 |
| Discipline | 99 | 29.73 | 51 | 20.32 | 10.47 | 14.55 | 90 | 20.69 | 14.20 |
| Suspension | 55 | 16.52 | 38 | 15.14 | 9.15 | 10.63 | 77 | 17.70 | 11.70 |
| Absenteeism | 106 | 31.83 | 95 | 37.85 | 29.80 | 27.95 | 169 | 38.85 | 39.52 |
| | | | | | | | | | |
| Military aspiration | 51 | 15.32 | 26 | 10.36 | 2.40 | 2.76 | 42 | 9.66 | 2.17 |
| Military interest in 1980 | 44 | 13.21 | - | - | 3.52 | - | 58 | 13.33 | 3.70 |
| Military plans in HS | 54 | 16.22 | 39 | 15.54 | 3.99 | 5.11 | 68 | 15.63 | 5.17 |

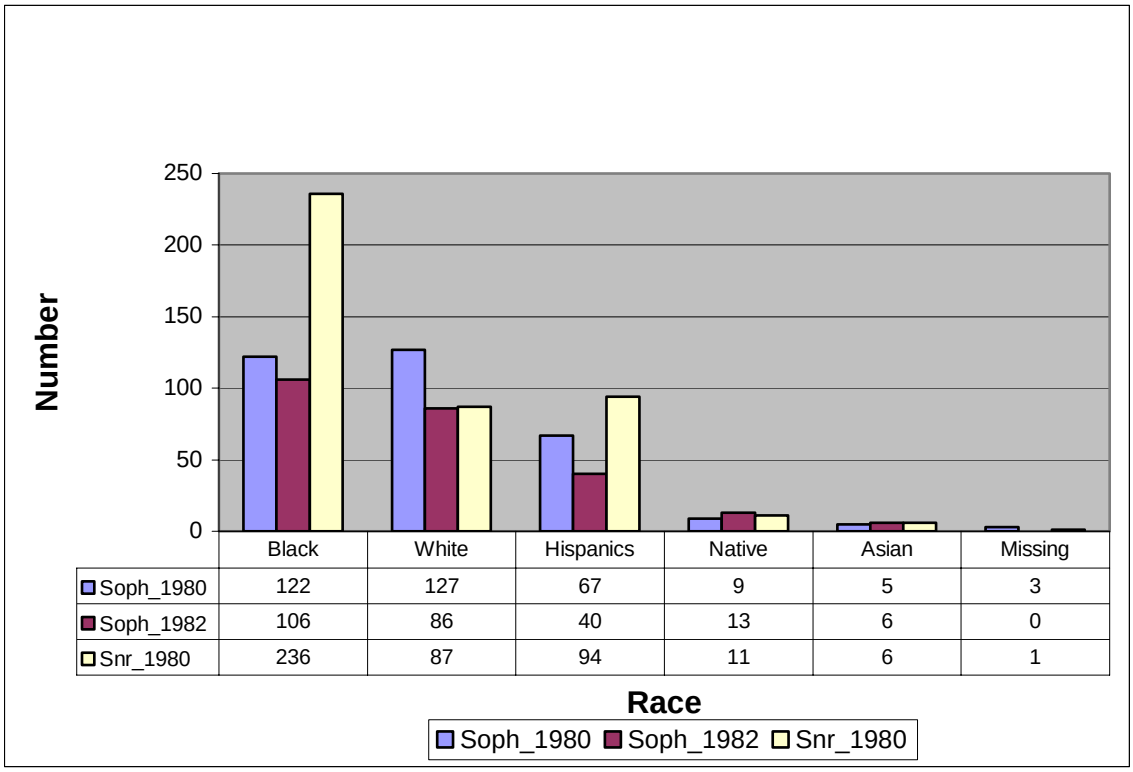
| | Sophomore | | | | | | Senior | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1980 | | 1982 | | All Survey Participants Average | | 1980 | | All Survey Participants Average |
| | | | | | 1980 | 1982 | | | 1980 |
| | No | (%) | No | (%) | (%) | (%) | No | (%) | (%) |
| Military interest in 1982 | - | - | 183 | 72.91 | - | 47.25 | - | - | - |
| Military incentives in 1982 | - | - | 135 | 53.78 | - | 25.87 | - | - | - |
| | | | | | | | | | |
| Family income less than 19k | 195 | 58.56 | 115 | 45.82 | 28.05 | 38.17 | 271 | 62.30 | 52.91 |
| Family income greater than 25k | 42 | 12.61 | 81 | 32.27 | 37.14 | 28.43 | 51 | 11.72 | 20.52 |
| Family income between 20K-24K | 25 | 7.51 | 30 | 11.95 | 10.54 | 12.29 | 54 | 12.41 | 13.95 |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

* The educational level of the respondents' parents are tracked separately for the sophomore cohort but not for the senior cohort.

We observe that the JROTC participants were predominantly males for the two sophomore and senior cohorts although the national sample were evenly split between the males and females. There were more seniors who were black that participated in the JROTC program at 54.25 percent compared to the proportion of blacks amongst the sophomore JROTC participants at 36.64 percent and 42.23 percent in the years 1980 and 1982 respectively. Nevertheless, compared to the national sample of race representation, the number of blacks who participated in the JROTC program was on average, higher than the national percentage. The Hispanic group was the next largest minority group after the blacks. If we compare the racial demographic across the two waves of the survey for the sophomore cohort, we notice that the number of black participation increased by approximately six percentage points while the number of white participation decreased by approximately four percentage points. The figure below provides the racial group composition of the JROTC participants.

Figure 1. Race Composition of JROTC Participants from the Sophomore and Senior Cohorts




| | Black | White | Hispanics | Native | Asian | Missing |
|---|---|---|---|---|---|---|
| Soph_1980 | 122 | 127 | 67 | 9 | 5 | 3 |
| Soph_1982 | 106 | 86 | 40 | 13 | 6 | 0 |
| Snr_1980 | 236 | 87 | 94 | 11 | 6 | 1 |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

On the family background of the JROTC participants, we find that on average, JROTC participants had higher number of parents who were active duty service members compared to the general population. Majority of the JROTC participants' parents had high school education.

In terms of educational achievements, the number of JROTC participants who had scored mostly As and Bs were lower than the national average, almost half of that of the national average for the sophomore cohort, while the senior cohort was not too far behind at less than three percentage points. The number of JROTC participants who had scored mostly Cs was higher than the national average and the difference range between three to six percentage points.

On the JROTC participants' educational aspirations, we find that the sophomore cohort was more contented with high school education compared to a college degree

compared to the senior cohort, which was split evenly. Nevertheless, approximately 20 to 30 percent of the JROTC participants in both cohorts had thought about college while they were in high school.

The JROTC participants for both sophomores and seniors were not any less positive about themselves compared to the average population. The average population who felt positive about themselves or had self-worth ranged from 82 percent to 85 percent. The JROTC participants who thought so about themselves ranged from 69 percent to 80 percent.

On disciplinary situations in schools like discipline problems, suspension and absenteeism from school, there appear to be a higher incidence amongst JROTC participants compared to the population average. While approximately one fifth of the population had ever had disciplinary problems, about one quarter of the JROTC participants had the same problem. For suspension, average ten percent of the population admitted to being suspended, while the average response rate for the JROTC participants' was16 percent. Absenteeism occurs at a much higher rate with approximately one-third of the population admitting to cutting class. The response rate of the JROTC participants admitting to cutting class was on average similar to the population percentage.

The expressed interest of the JROTC participants with regard to military lifestyle and intention to enlist was higher than the population average. Nine to 15 percent of the JROTC participants amongst the sophomores and seniors had listed military enlistment as their career goals compared to the population, which was approximately two percent. As the 1980 sophomore cohort became seniors in 1982, the interest in military increased tremendously from 13 percent to 72 percent. This behavior was not exhibited amongst the 1980 senior cohort, where only 13 percent of them indicated interest in the military.

The last variable of interest is the economic background of the JROTC participants. The 1980 survey separated the family income question by one-sevenths while the 1982 survey used one-fifths. This thesis decided to have the cut-off for the lower income group at 19 thousand or less per annum, the middle income group that had annual family income that range from 20 to 24 thousand, and the high income group with an annual family income of 25 thousand and above. Almost half of the JROTC

participants fall into the lower income group while slightly less than a third of the sophomore population falls into this category. For the senior cohort, almost half of the population as well as the JROTC participants fall into this category. As expected, the high-income group is the minority group here with an average of 12 percent of the population found in this category while for the JROTC participants; it ranges from seven percent to 12 percent.

This section provides interesting insights to the demographics, educational expectations, family background and socio-economic background of the JROTC participants. We have read articles that had commented that the JROTC program is designed for "at-risk" youths. This seems to conjecture that JROTC participants as being from the lower socio-economic strata, or did not excel academically and were problem kids in school. From the information gathered from the 1980 HSB sophomore and senior cohorts, we did not observe JROTC participants as predominantly composed of any particular minority groups. We also did not observe that the JROTC participants performed any less satisfactorily compared to the average population and the family income distribution of the JROTC participants was not overly skewed toward the lower income group when compared to the population sample. However, our sample size for JROTC is small in the first place. We want to see if similar observations are made with the DMDC data.

### 3. Military Enlistment Intentions and Decisions Data Description

This section looks at the enlistment decisions made by the sophomores and seniors in the 1980 HSB survey. Table 8 looks at the overall enlistment rate for the population in both sophomore and senior cohort. We note that the average enlistment rate was less than five percent and tapers off at the last wave of the survey. Table 9 and Table 10 compared the enlistment rates of the sophomores and seniors who had participated in the JROTC program during high school to those who had not. The enlistment rate of the non-JROTC participants was similar to the population. On the other hand, the enlistment rate of the JROTC participants was almost twice that of the population. This seems to suggest that JROTC participants were more positively inclined to the military compared to the non-JROTC participants.

Table 8. Enlistment Rate of 1980 HSB Sophomore and Senior Cohort

| | Sophomore | | | | Senior | | | |
|---|---|---|---|---|---|---|---|---|
| | Enlisted | Did not enlist | Total | % Enlisted | Enlisted | Did not enlist | Total | % Enlisted |
| 1980 | - | - | - | - | 395 | 11,105 | 11,500 | 3.43% |
| 1982 | 369 | 13,733 | 14,102 | 2.62% | 447 | 10,780 | 11,227 | 3.98% |
| 1984 | 527 | 13,155 | 13,682 | 3.85% | 495 | 10,430 | 10,925 | 4.53% |
| 1986 | 555 | 12,870 | 13,425 | 4.13% | 392 | 10,144 | 10,536 | 3.72% |
| 1992 | 98 | 12,542 | 12,640 | 0.78% | - | - | - | - |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

Table 9. Enlistment Rate of 1980 HSB Sophomore Cohort who were JROTC Participants

| | Non-JROTC Participants | | | | JROTC Participants | | | |
|---|---|---|---|---|---|---|---|---|
| | Enlisted | Did not enlist | Total | % Enlisted | Enlisted | Did not enlist | Total | % Enlisted |
| 1982 | 342 | 13,509 | 13,851 | 2.47% | 27 | 224 | 251 | 10.76% |
| 1984 | 505 | 12,941 | 13,446 | 3.76% | 22 | 214 | 236 | 9.32% |
| 1986 | 535 | 12,666 | 13,201 | 4.05% | 20 | 204 | 224 | 8.93% |
| 1992 | 93 | 12,344 | 12,437 | 0.75% | 5 | 198 | 203 | 2.46% |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

Table 10. Enlistment Rate of 1980 Senior Cohort who were JROTC Participants

| | Non-JROTC Participants | | | | JROTC Participants | | | |
|---|---|---|---|---|---|---|---|---|
| | Enlisted | Did not enlist | Total | % Enlisted | Enlisted | Did not enlist | Total | % Enlisted |
| 1980 | 343 | 10,722 | 11,065 | 3.10% | 52 | 383 | 435 | 11.95% |
| 1982 | 405 | 10,424 | 10,829 | 3.74% | 42 | 356 | 398 | 10.55% |
| 1984 | 454 | 10,099 | 10,553 | 4.30% | 41 | 331 | 372 | 11.02% |
| 1986 | 367 | 9,811 | 10,178 | 3.61% | 25 | 333 | 358 | 6.98% |

Source: Derived from HSB 1980 Sophomore and Senior Cohort Data

## C. DMDC COHORT DATA

The Defense Manpower Data Center (DMDC) located in Monterey, California, is an excellent source of information for the purpose of our thesis. We obtained the enlisted cohort files from DMDC and they included all branches of service - Army, Navy, Air Force, and Marine Corp.

The definition of a cohort means all personnel who entered the military in a given fiscal year (FY), which in this case runs from October through September. The cohorts

obtained were for enlisted personnel who entered service from FY1980 to FY2000. These cohort files were matched with corresponding active duty inventory files at 3-year intervals for the tracking of changes in pay grade and rank.

The main identifier of enlistees who were JROTC graduates in the cohort files lies in the variable "Youth Program". This field in the data set provides information on the youth programs that the enlistees had undertaken prior to enlistment, including JROTC participation in all services for three or four years. Participation in JROTC for two years or less was not captured. One possible reason for tracking only those who had participated for three or more years was that they are eligible for accelerated advancement upon enlisting in the service solely based on their participation in the JROTC program.

The 19 cohort files obtained from DMDC each contain sixty-five variables and the ensuing paragraphs provide the description of the pertinent variables that will be useful for the purpose of this thesis. In our data description, we excluded the Navy reserve and Coast Guard records that had been provided to us by DMDC. The number of Navy Reserve records is small and inconsequential. The Coast Guard records on active duty inventory and loss data only began from December 1988 and moreover, there was no Coast Guard JROTC program. Therefore, the Coast Guard recruits are excluded. We were unable to read the information from the FY1987 cohort file as it was corrupted and hence, FY1987 was also excluded from the data description. Lastly, those enlisted personnel who were not qualified for reenlistment were also excluded from the sample population.

### 1. Military Enlistment by JROTC participants from FY80- FY00.

This section will characterize the DMDC data using frequency distributions and descriptive analysis. We will examine the number of accessions, recruiting trends and the number of personnel who participated in JROTC over a nineteen- year period. The numbers of accessions in FY80-FY00 are 4,992,962. Cohorts are tracked longitudinally and included in the accession files is the Inter-Service Separation Codes (ISCs), which describes why a recruit was discharged from the military.

Table 11 indicates the total number of recruits for each fiscal year that enlisted in all services and the total number of JROTC participants.

Table 11. Recruits With/Without JROTC

| FY Entry | All Recruits | JROTC Participants | Percentage of cohort |
|---|---|---|---|
| 1980 | 380,403 | 5542 | 1.45 |
| 1981 | 352,816 | 5043 | 1.42 |
| 1982 | 323,823 | 4849 | 1.49 |
| 1983 | 320,499 | 5208 | 1.62 |
| 1984 | 325,371 | 7010 | 2.15 |
| 1985 | 311,992 | 6611 | 2.11 |
| 1986 | 324,516 | 6570 | 2.02 |
| 1988 | 272,976 | 6919 | 2.53 |
| 1989 | 285,762 | 7002 | 2.45 |
| 1990 | 230,313 | 6485 | 2.81 |
| 1991 | 195,361 | 5849 | 2.99 |
| 1992 | 192,538 | 6802 | 3.53 |
| 1993 | 198,336 | 6620 | 3.33 |
| 1994 | 169,041 | 6049 | 3.57 |
| 1995 | 164,812 | 6503 | 3.94 |
| 1996 | 179,200 | 7258 | 4.05 |
| 1997 | 196,211 | 8237 | 4.19 |
| 1998 | 185,940 | 8504 | 4.57 |
| 1999 | 191,257 | 7750 | 4.05 |
| 2000 | 191,795 | 7274 | 3.79 |
| TOTAL | 4,992,962 | 132,085 | 2.64 |

Source: Derived from Defense Manpower Data Center Cohort Files

It is interesting to note that as the number of recruits continues to decline each fiscal year, the number of JROTC participants' increases on average. This can be attributed to the military drawdown; hence, the proportion of recruits that are JROTC participants appears to increase. In the early eighties, the average percentage of JROTC participants that enlisted in the services was two percent. In the early nineties, approximately three percent of new recruits were JROTC participants. This small proportion is one measure that indicates the number of JROTC participants within the military is increasing at a relatively constant rate. In addition, increasing further are the appropriations from the Office of the Under Secretary of Defense and President's Budget for JROTC. As noted earlier in Table 2.1, a steady increase in funding by each service has been approved to augment potential growth and expansion of the JROTC program.

The American Friends Service Committee (AFSC), which is an organization that promotes social justice and peace programs throughout the world are strong proponents against JROTC. AFSC reports in a 1994 study that 45 percent of all cadets who complete JROTC enter some branch of service[60]. The data encompassing the past nineteen years does not support that claim. Similar claims have been made by other organizations; hence, the importance of empirical analysis on the effects of JROTC on recruitment, retention and attrition.

### 2. Distribution of Recruits with JROTC Participation by Service

We would like to further explore the distribution of recruits by service. Table 12 details the number of JROTC participants that enlisted by service. The Army has traditionally had higher participation rates than the other services respectively. In addition, the Army JROTC program is allocated the largest percentage of funding from the Department of Defense (DoD) Operation and Maintenance (O&M) appropriation.

[60] American Friends Service Committee, " *Making Soldiers in the Public Schools*", 1994.

The AFSC is founded by Quakers to provide conscientious objectors with an opportunity to aid civilian war victims. AFSC's work is based on the Quaker belief in the worth of every person and faith in the power of peace to overcome violence and injustice. AFSC received over $250k in government grants in FY02.

Table 12. Distributions of Recruits by Service with JROTC

| FY | Recruits | Army JROTC | % | Recruits | Navy JROTC | % | Recruits | AirForce JROTC | % | Recruits | Marine JROTC | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 173,647 | 3396 | 2.0 | 84,944 | 690 | 0.8 | 77,596 | 1256 | 1.6 | 44,215 | 200 | 0.5 |
| 1981 | 137,247 | 2992 | 2.2 | 89,324 | 683 | 0.8 | 82,374 | 1160 | 1.4 | 43,271 | 208 | 0.5 |
| 1982 | 130,153 | 1760 | 1.4 | 76,788 | 718 | 0.9 | 75,636 | 1185 | 1.6 | 41,246 | 186 | 0.5 |
| 1983 | 145,349 | 2886 | 2.0 | 70,999 | 805 | 1.1 | 65,379 | 1314 | 2.0 | 38,772 | 203 | 0.5 |
| 1984 | 142,470 | 3908 | 2.7 | 77,935 | 1065 | 1.4 | 62,911 | 1722 | 2.7 | 42,055 | 315 | 0.7 |
| 1985 | 125,747 | 3604 | 2.9 | 80,183 | 1069 | 1.3 | 69,639 | 1637 | 2.4 | 36,423 | 301 | 0.8 |
| 1986 | 135,639 | 3695 | 2.7 | 84,501 | 1009 | 1.2 | 67,769 | 1588 | 2.3 | 36,607 | 298 | 0.8 |
| 1988 | 115,054 | 4009 | 3.5 | 80,464 | 1042 | 1.3 | 41,715 | 1518 | 3.6 | 35,743 | 350 | 1.0 |
| 1989 | 120,463 | 3936 | 3.3 | 85,826 | 1034 | 1.2 | 43,838 | 1601 | 3.7 | 33,852 | 331 | 1.0 |
| 1990 | 89,508 | 3708 | 4.1 | 67,954 | 871 | 1.3 | 36,145 | 1552 | 4.3 | 33,426 | 354 | 1.1 |
| 1991 | 78,664 | 3370 | 4.3 | 52,044 | 839 | 1.6 | 29,826 | 1353 | 4.5 | 29,764 | 287 | 1.0 |
| 1992 | 77,253 | 3835 | 5.0 | 44,568 | 1002 | 2.2 | 34,871 | 1637 | 4.7 | 31,805 | 328 | 1.0 |
| 1993 | 77,376 | 3618 | 4.7 | 51,848 | 1012 | 2.0 | 31,425 | 1594 | 5.1 | 34,742 | 396 | 1.1 |
| 1994 | 67,416 | 3328 | 4.9 | 37,393 | 880 | 2.4 | 30,142 | 1491 | 4.9 | 31,778 | 350 | 1.1 |
| 1995 | 62,259 | 3633 | 5.8 | 36,129 | 1023 | 2.8 | 31,225 | 1,458 | 4.7 | 32,115 | 389 | 1.2 |
| 1996 | 72,815 | 4181 | 5.7 | 39,324 | 1121 | 2.9 | 30,970 | 1534 | 5.0 | 32,784 | 422 | 1.3 |
| 1997 | 82,239 | 4638 | 5.6 | 45,025 | 1298 | 2.9 | 30,697 | 1805 | 5.9 | 34,572 | 496 | 1.4 |
| 1998 | 72,620 | 4782 | 6.6 | 44,043 | 1403 | 3.2 | 31,852 | 1798 | 5.6 | 33,634 | 521 | 1.5 |
| 1999 | 70,960 | 4469 | 6.3 | 50,205 | 1229 | 2.4 | 33,015 | 1544 | 4.7 | 33,097 | 508 | 1.5 |
| 2000 | 72,203 | 4106 | 5.7 | 50,528 | 1212 | 2.4 | 34,159 | 1438 | 4.2 | 30,522 | 519 | 1.7 |
| Total | 2,049,082 | 73,854 | 3.6 | 1,205,025 | 20,005 | 1.6 | 941,184 | 30,185 | 3.2 | 710,423 | 6,962 | 1.0 |

Source: Derived from Defense Manpower Data Center Cohort files.

Table 12 indicates that the largest percentages of recruits with JROTC participation are Army. On average 3.6 percent of new recruits who enlisted in the Army in the past nineteen years had participated in JROTC. The service with the second largest number of new recruits with JROTC experience is the Air Force. On average 3.2 percent of its new recruits have JROTC experience. This is not surprising since AFJROTC accounts for over 609 units statewide and is slowly increasing. The percentage of recruits with JROTC experience that enlisted in the Navy and Marine Corp remains relatively constant at 1.6 percent and 1.0 percent respectively.

### 3. Distribution of Recruits with JROTC by Gender

To further examine the characteristics of recruits with JROTC experience we developed Table 13 to outline the distribution of JROTC participants from FY80-FY00 by gender.

Table 13. Recruit Distributions with JROTC by Gender

| | Male | | | Female | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| FY | All Recruits | JROTC | % | All Recruits | JROTC | % | All Recruits | JROTC | % |
| 1980 | 328,781 | 4900 | 1.49 | 51,560 | 641 | 1.24 | 380,403 | 5542 | 1.46 |
| 1981 | 308,919 | 4531 | 1.47 | 43,875 | 511 | 1.16 | 352,816 | 5043 | 1.43 |
| 1982 | 287,818 | 4423 | 1.54 | 35,995 | 426 | 1.18 | 323,823 | 4849 | 1.50 |
| 1983 | 283,291 | 4737 | 1.67 | 37,208 | 471 | 1.27 | 320,499 | 5208 | 1.62 |
| 1984 | 287,673 | 6354 | 2.21 | 37,698 | 656 | 1.74 | 325,371 | 7010 | 2.15 |
| 1985 | 271,068 | 5913 | 2.18 | 40,923 | 698 | 1.71 | 311,992 | 6611 | 2.12 |
| 1986 | 283,160 | 5885 | 2.08 | 41,355 | 685 | 1.66 | 324,516 | 6570 | 2.02 |
| 1988 | 236,819 | 6029 | 2.55 | 36,157 | 890 | 2.46 | 272,976 | 6919 | 2.53 |
| 1989 | 245,574 | 6066 | 2.47 | 40,188 | 936 | 2.33 | 285,762 | 7002 | 2.45 |
| 1990 | 199,439 | 5651 | 2.83 | 30,874 | 834 | 2.70 | 230,313 | 6485 | 2.82 |
| 1991 | 169,783 | 5093 | 3.00 | 25,578 | 756 | 2.96 | 195,361 | 5849 | 2.99 |
| 1992 | 163,594 | 5809 | 3.55 | 28,944 | 993 | 3.43 | 192,538 | 6802 | 3.53 |
| 1993 | 169,801 | 5642 | 3.32 | 28,535 | 978 | 3.43 | 198,336 | 6620 | 3.34 |
| 1994 | 141,588 | 5096 | 3.60 | 27,453 | 953 | 3.47 | 169,041 | 6049 | 3.58 |
| 1995 | 137,206 | 5483 | 4.00 | 27,606 | 1020 | 3.69 | 164,812 | 6503 | 3.95 |
| 1996 | 148,336 | 5964 | 4.02 | 30,848 | 1294 | 4.19 | 179,200 | 7258 | 4.05 |
| 1997 | 161,895 | 6664 | 4.12 | 34,314 | 1572 | 4.58 | 196,211 | 8237 | 4.20 |
| 1998 | 153,034 | 6857 | 4.48 | 32,906 | 1647 | 5.01 | 185,940 | 8504 | 4.57 |
| 1999 | 157,126 | 6168 | 3.93 | 34,131 | 1582 | 4.64 | 191,257 | 7750 | 4.05 |
| 2000 | 156,644 | 5699 | 3.64 | 35,150 | 1575 | 4.48 | 191,795 | 7274 | 3.79 |
| Total | 4,291,549 | 112964 | 2.63 | 701,298 | 19118 | 2.73 | 4,992,962 | 132085 | 2.65 |

Source: Derived from Defense Manpower Data Center Cohort Data Files

The above table indicates that 2.65 percent of all recruits that enlisted in the service between FY80-FY00 were JROTC participants. In addition, the percentage of female JROTC participants is slightly higher than the proportion of male participants by approximately .10 percent. The number of male recruits has constantly declined over the past nineteen years, while the number of JROTC participants has remained relatively constant. The number of female recruits has fluctuated over the past nineteen years and there has been a steady increase in the number of JROTC participants. These trends in enlistment lend possible implications for recruiters. It appears that JROTC has a minimal affect on a male's enlistment decision; however, females that participate in JROTC have a greater propensity to enlist.

The Navy has experienced a rapid growth in its JROTC program. Since FY1994 over two hundred and sixty new units have been established. The number of female

cadets has increased significantly as well as the number of minorities enrolled. Table 14 is provided to further explore the distribution of cadets by gender enrolled in NJROTC from School Year (SY) 94 – SY95.

Table 14. NJROTC Enrollment History SY94- SY04

| SY | 94-95 | 95-96 | 96-97 | 97-98 | 98-99 | 99-00 | 00-01 | 01-02 | 02-03 | 03-04 |
|---|---|---|---|---|---|---|---|---|---|---|
| **No. of Units** | 359 | 397 | 435 | 435 | 434 | 434 | 490 | 553 | 584 | 623 |
| **Enrollment** | | | | | | | | | | |
| Males | 26,414 | 30,333 | 33,966 | 35,533 | 36,421 | 36,827 | 40,687 | 44,149 | 46,906 | 49,059 |
| Females | 18,353 | 22,441 | 25,791 | 27,191 | 26,974 | 27,421 | 26,826 | 29,034 | 33,024 | 37,010 |
| **Total Cadets** | **44,767** | **52,774** | **59,757** | **62,724** | **63,395** | **64,248** | **67,513** | **73,183** | **79,930** | **86,069** |
| | | | | | | | | | | |
| Black | 14,080 | 16,118 | 17,585 | 17,276 | 17,751 | 20,605 | 23,418 | 24,882 | 27,176 | 27,147 |
| Indian | 305 | 432 | 320 | 365 | 633 | 537 | 672 | 732 | 799 | 889 |
| Oriental | 1,280 | 1,582 | 1,958 | 2,268 | 2,536 | 2519 | 2,732 | 2,927 | 3,197 | 4,238 |
| Hispanic | 5,884 | 7,268 | 8,805 | 9,613 | 9,509 | 9772 | 11,136 | 16,100 | 17,584 | 19,656 |
| Other | | | | | | 4409 | 2,354 | 2,195 | 2,397 | 1,822 |
| **Minorities** | **21,549** | **25,400** | **28,668** | **29,522** | **30,429** | **37,842** | **40,312** | **46,836** | **51,153** | **53,752** |
| | | | | | | | | | | |
| NS-1 | 26,549 | 30,928 | 34,803 | 34,303 | 34,864 | 35,392 | 41,695 | 46,364 | 48,366 | 48,336 |
| NS-2 | 11,536 | 12,311 | 14,820 | 16,222 | 16,909 | 17,611 | 16,328 | 18,033 | 20,619 | 22,619 |
| NS-3 | 4,356 | 6,742 | 6,915 | 8,646 | 9,375 | 9,676 | 9,814 | 9,853 | 10,241 | 10,241 |
| NS-4 | 2,523 | 2,849 | 3,396 | 4,038 | 4,848 | 5,432 | 5,355 | 5,399 | 5,456 | 5,456 |
| **Total NS Enroll** | **44,964** | **52,830** | **59,934** | **63,209** | **65,996** | **68,111** | **73,192** | **79,649** | **84,682** | **86,652** |

Source: Navy Education and Training Center (NETC), NJROTC Ops, Citizen Development

As indicated by Table 14 the number of females enrolled in NJROTC increased proportionally from SY94 – SY04. Another interesting trend is the number of minorities that participated in the program. From SY 99 – SY 04 half of the cadets enrolled in NJROTC are minorities, the majority were blacks. This is an interesting parallel since data indicates that on average the majority of recruits with JROTC are minorities. The expansion of JROTC has left many larger cities underrepresented; hence, a change in the composition of the units. To further explore the distribution of JROTC participants by race see Table 15.

### 4. Distribution of Recruits with JROTC by Race

To further explore the minority representation of JROTC we have compiled from the DMDC data a table that represents the minority representation for all services from

FY80 – FY00. Table 15, which details the distribution of recruits by race, indicates that the majority of JROTC participants for the past nineteen years have been minorities, more specifically blacks. This can partially be attributed to the locations of JROTC units and the expansion of these units in urban areas. This also amplifies the under representation of whites in the JROTC program. It is clearly evident that blacks who participate in JROTC are more likely to enlist in the military then whites. It is not possible from the data to ascertain the reasons why blacks are so highly represented in the JROTC program. Previous research has not investigated the possible correlations between JROTC participation and propensity to enlist. We would like to further explore this phenomenon through empirical analysis.

Table 15. Distribution of JROTC Participants by Race.

| | White | | | Black | | | Hispanic | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY | All Recruits | JROTC | % | All Recruits | JROTC | % | All Recruits | JROTC | % | All Recruits | JROTC | % |
| 1980 | 278,849 | 3261 | 1.17 | 84,016 | 2077 | 2.47 | 17,428 | 203 | 1.16 | 110 | 1 | 0.91 |
| 1981 | 269,586 | 2990 | 1.11 | 68,018 | 1867 | 2.74 | 15,154 | 182 | 1.20 | 58 | 4 | 6.90 |
| 1982 | 249,416 | 2961 | 1.19 | 60,931 | 1753 | 2.88 | 13,385 | 134 | 1.00 | 91 | 1 | 1.10 |
| 1983 | 249,895 | 3189 | 1.28 | 57,299 | 1850 | 3.23 | 13,190 | 168 | 1.27 | 115 | 1 | 0.87 |
| 1984 | 251,141 | 3933 | 1.57 | 59,071 | 2828 | 4.79 | 15,139 | 248 | 1.64 | 20 | 1 | 5.00 |
| 1985 | 238,931 | 3785 | 1.58 | 57,499 | 2540 | 4.42 | 15,542 | 285 | 1.83 | 20 | 1 | 5.00 |
| 1986 | 246,191 | 3694 | 1.50 | 61,488 | 2587 | 4.21 | 16,814 | 289 | 1.72 | 23 | 0 | 0.00 |
| 1988 | 202,714 | 3740 | 1.84 | 55,974 | 2848 | 5.09 | 14,211 | 331 | 2.33 | 77 | 0 | 0.00 |
| 1989 | 209,483 | 3795 | 1.81 | 60,431 | 2881 | 4.77 | 15,792 | 325 | 2.06 | 56 | 1 | 1.79 |
| 1990 | 169,967 | 3564 | 2.10 | 46,996 | 2620 | 5.57 | 13,288 | 301 | 2.27 | 62 | 0 | 0.00 |
| 1991 | 152,033 | 3540 | 2.33 | 31,611 | 2002 | 6.33 | 11,649 | 307 | 2.64 | 68 | 0 | 0.00 |
| 1992 | 149,309 | 4086 | 2.74 | 31,497 | 2426 | 7.70 | 11,656 | 289 | 2.48 | 76 | 1 | 1.32 |
| 1993 | 153,755 | 3975 | 2.59 | 32,864 | 2336 | 7.11 | 11,585 | 300 | 2.59 | 132 | 9 | 6.82 |
| 1994 | 128,686 | 3708 | 2.88 | 29,542 | 1979 | 6.70 | 10,742 | 358 | 3.33 | 71 | 4 | 5.63 |
| 1995 | 122,568 | 3991 | 3.26 | 29,623 | 2101 | 7.09 | 12,541 | 406 | 3.24 | 80 | 5 | 6.25 |
| 1996 | 129,403 | 4247 | 3.28 | 33,811 | 2522 | 7.46 | 15,882 | 482 | 3.03 | 104 | 7 | 6.73 |
| 1997 | 137,294 | 4701 | 3.42 | 38,718 | 2897 | 7.48 | 19,925 | 628 | 3.15 | 274 | 11 | 4.01 |
| 1998 | 129,032 | 4857 | 3.76 | 36,148 | 2883 | 7.98 | 20,510 | 754 | 3.68 | 250 | 10 | 4.00 |
| 1999 | 131,793 | 4483 | 3.40 | 37,806 | 2589 | 6.85 | 21,561 | 674 | 3.13 | 97 | 4 | 4.12 |
| 2000 | 133,868 | 4272 | 3.19 | 38,356 | 2414 | 6.29 | 19,496 | 585 | 3.00 | 75 | 3 | 4.00 |
| Total | 3,733,914 | 76772 | 2.06 | 951,699 | 48000 | 5.04 | 305,490 | 7249 | 2.37 | 1859 | 64 | 3.44 |

Source: Derived from Defense Manpower Data Center Cohort Files

Although one-third of the new recruits belong to a minority group in each cohort, they proportionally make up a larger percentage of JROTC participants. In the early eighties less than 2 percent of new recruits were white and on average 4 percent were black. The percentage of black JROTC participants continues to increase. In FY98 7.98 percent of new recruits were black JROTC participants. The percentage of Hispanic JROTC participants is steadily increasing, as are the numbers of Hispanic recruits.

### 5. Distribution of Recruits with JROTC by AFQT

Armed Forces Qualification Test (AFQT) Percentile is defined as an aptitude composite that combines the work knowledge, paragraph comprehension, arithmetic reasoning, and numerical operation subtests from the ASVAB. The traditional AFQT categories and their corresponding percentile scores are displayed in Table 16. AFQT scores associate closely with years of schooling, types of classes taken (e.g., mathematics), motivation to learn, quality of school's academic environment, performance on standardized tests, and relationships with teachers. They also have shown that these associations occur regardless of the students' innate cognitive abilities (Fischer et al. 1996; Grassmmer, Flanagan, and Williamson 1998). These authors, along with Phillips et al. (1998), have documented that social structural and interpersonal factors such as family background, peers, and community context also affect AFQT scores. Interestingly enough, researchers rally around the idea that JROTC cadets score higher on standardized tests than do non-participants.

Table 16. AFQT Categories

| **Armed Forces Qualification Test (AFQT Categories by** | | |
|---|---|---|
| Corresponding Percentile Scores and Level of "Trainability" | | |
| AFQT Category | AFQT Percentile Score | Level Of Trainability |
| I | 93-99 | Well above average |
| II | 65-92 | *(i) Above Average* |
| IIIA | 50-64 | Average |
| IIIB | 31-49 | Average |
| IV | 10 to 30 | Below average |
| V | 1 to 9 | Well below average |

Table 17 indicates there was a steady increase in the number of recruits that were classified in category I-IIIA. In the eighties on average 1.4 percent of the force recruited with JROTC experience fell into AFQT category I-IIIA and a proportionally large number (2.2 percent) fell in category IV. By 1990, the number of recruits with JROTC doubled; however, the percentage of recruits that fell in category I-IIIA remained relatively constant. We observe a larger percentage of recruits fell into category III-B. Most surprising is the number of recruits with JROTC that enlisted in the service from FY95 – FY00 that fell in category IV. An assumption would be that recruits with JROTC experience would score higher on the ASVAB due to the critical skills and cognitive abilities derived from the JROTC program. The data indicates that from FY80 – FY00 3,085,967 category I-IIIA recruits enlisted, and of those 77,666 or 2.52 percent had JROTC experience.

Table 17. Recruit Distribution With JROTC by AFQT Category

| | I-IIIA | | | III-B | | | IV | | |
|---|---|---|---|---|---|---|---|---|---|
| FY | All Recruits | JROTC | % | All Recruits | JROTC | % | All Recruits | JROTC | % |
| 1980 | 143,524 | 1946 | 1.36 | 99,225 | 1392 | 1.40 | 125,134 | 2125 | 1.70 |
| 1981 | 163,181 | 1983 | 1.22 | 104,355 | 1447 | 1.39 | 70,007 | 1527 | 2.18 |
| 1982 | 164,624 | 3738 | 2.27 | 98,758 | 1654 | 1.67 | 45,167 | 1023 | 2.26 |
| 1983 | 181,127 | 2499 | 1.38 | 97,744 | 1951 | 2.00 | 31,317 | 695 | 2.22 |
| 1984 | 187,111 | 3199 | 1.71 | 102,480 | 2817 | 2.75 | 29,176 | 942 | 3.23 |
| 1985 | 193,008 | 3431 | 1.78 | 92,348 | 2517 | 2.73 | 19,313 | 615 | 3.18 |
| 1986 | 209,358 | 3532 | 1.69 | 96,650 | 2673 | 2.77 | 11,420 | 335 | 2.93 |
| 1988 | 184,238 | 4010 | 2.18 | 73,970 | 2524 | 3.41 | 10,001 | 351 | 3.51 |
| 1989 | 186,508 | 4060 | 2.18 | 77,593 | 2434 | 3.14 | 14,620 | 470 | 3.21 |
| 1990 | 158,637 | 4053 | 2.55 | 62,728 | 2227 | 3.55 | 5,673 | 165 | 2.91 |
| 1991 | 145,070 | 4126 | 2.84 | 47,338 | 1658 | 3.50 | 1,034 | 48 | 4.64 |
| 1992 | 147,380 | 4893 | 3.32 | 43,800 | 1871 | 4.27 | 376 | 14 | 3.72 |
| 1993 | 142,671 | 4396 | 3.08 | 52,936 | 2131 | 4.03 | 1,637 | 68 | 4.15 |
| 1994 | 123,411 | 4180 | 3.39 | 43,242 | 1795 | 4.15 | 1,208 | 54 | 4.47 |
| 1995 | 118,316 | 4327 | 3.66 | 43,389 | 2099 | 4.84 | 1,138 | 51 | 4.48 |
| 1996 | 125,057 | 4481 | 3.58 | 50,108 | 2664 | 5.32 | 1,343 | 76 | 5.66 |
| 1997 | 135,704 | 5056 | 3.73 | 57,185 | 3036 | 5.31 | 1,915 | 118 | 6.16 |
| 1998 | 126,699 | 5124 | 4.04 | 56,071 | 3241 | 5.78 | 1,986 | 127 | 6.39 |
| 1999 | 124,753 | 4468 | 3.58 | 61,827 | 3099 | 5.01 | 2,732 | 174 | 6.37 |
| 2000 | 125,590 | 4164 | 3.32 | 62,053 | 3019 | 4.87 | 1,529 | 71 | 4.64 |
| Total | 3,085,967 | 77,666 | 2.52 | 1,423,800 | 46249 | 3.25 | 376,726 | 9049 | 2.40 |

Source: Derived from Defense Manpower Data Center Cohort Files

## D. CONCLUSION

The mining of the data sets from the HSB surveys and DMDC cohort files provide useful information that enables us to conduct an empirical analysis of the impact of JROTC on military enlistment, reenlistment and attrition. The next chapter presents our regression models and findings, which will then allow us to evaluate the efficacy of the JROTC program with respect to the military.

# V. THEORETICAL FRAMEWORK

## A. INTRODUCTION

In this chapter, we explore several econometric models that best fit our theoretical specification models for our study on the impact of JROTC participation on military enlistment decisions, reenlistment decisions and attrition decisions. As our response variables are binary in nature, we examine the feasibility of using binary response models to include the linear probability LOGIT and PROBIT models. We also examine whether survival analysis methods can be employed to estimate the attrition patterns of JROTC graduates and non-JROTC graduates. We discuss the set of covariates that goes into the respective specification models in each section. We choose the covariates in our specification models based on our literature review in Chapter III.

## B. BINARY RESPONSE MODELS

In our study of whether JROTC provides a discernable benefit for the Armed Forces, our response variables include the decision to enlist and the decision to reenlist. These are binary response variables, also known as limited dependent variables, whose probability value lies between zero and one. The econometric models for limited dependent variable include the simple linear probability model (LPM) and more advanced binary response models like logit or probit.[61]

### 1. Linear Probability Model (LPM)

The normal multiple least squares regression model is specified as :

$$y = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k + \mu$$

An assumption of the classical linear regression model is that $E(\mu|x_1,\ldots,x_k)=0$, such that $E(y \mid x) = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k$. When the dependent variable is limited to zero one values, the expected value of $y$ given a set of $x$ variables is the same as the probability that $y$=1, or $E(y / x) = p(y = 1 / x) = \beta_0 + \beta_1 X_{1+} \beta_2 X_2 + ... + \beta_k X_k$

[61] See Woolridge(2003) for more detailed explanation of the econometric models specified in this chapter.

The coefficients in the LPM therefore, measure the change in the probability of $y$ in response to changes in $x_k$ ceteris paribus. If the underlying assumptions held, we can estimate the impact of various explanatory variables on qualitative events like youths' decisions to enlist or military personnel's decisions to reenlist using the Ordinary Least Squares (OLS) estimator. The inadequacies of the LPM for a binary response variable; however, lie in the results of the fitted probabilities and the partial effects of the explanatory variables. The fitted probabilities are not constrained to the zero one interval, which may lead to estimated probabilities that are negative or greater than one. The LPM also gives constant change effect of the explanatory variables on $y$ where in some cases, different marginal effects are desired.

## 2. LOGIT and PROBIT Models

The LOGIT and PROBIT models, another form of binary response models, avoid the limitations of the LPM. From Woolridge (2003), the general form of the binary response model is as follows:

$$P(y=1 \mid x) = G(\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k) = G(\beta_0 + x\beta)$$
$$0 < G(z) < 1$$

G is a function with values strictly between zero and one for all real numbers $z$ such that the binary response model also lies between zero and one. Depending on the assumption of the function G, the binary response model can be a logit or probit model. In a logit model, the function G is the logistic function with cumulative distribution function for a standard logistic random variable:

$$G(z) = \exp(z)/[1+\exp(z)] = \Lambda(z)$$
$$0 < G(z) < 1$$

In a probit model, the function G is the standard normal cumulative distribution function, with $\phi(z)$ as the standard normal density, expressed as an integral:

$$G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(v)dv$$
$$\phi(z) = (2\pi)^{-1/2} \exp(-z^2/2)$$
$$0 < G(z) < 1$$

Both logit and probit functions are increasing functions. As $z \to -\infty$, $G(z) \to 0$, and as $z \to \infty$, $G(z) \to 1$. The choice of logit or probit as the fitting binary response model depends on the preference on the assumption for the error term, *e*. We assume that *e* is not correlated with *x* and that *e* has either the standard logistic distribution or the standard normal distribution. If the normality assumption of *e* is preferred, probit model is chosen over logit model. In reality, it is difficult to justify the selection of one model over another.

As in the LPM, we want to find out the effect of *x* on the probability that *y*=1. It is straightforward for the LPM but not so for the probit and logit models. The partial effects of *x* for nonlinear G(.) depend on the nature of the *x* variables. If *x* is a continuous variable, the partial effect of *x* on P(*y*=1|*x*) is obtained from the partial derivative:

$$\frac{\partial p(x)}{\partial x_j} = g(\beta_0 + x\beta)\beta_j, \text{where } g(z) \equiv \frac{dG}{dz}(z)$$

If *x* is a binary explanatory variable, the partial effect from changing for example, $x_1$ from zero to one, ceteris paribus, is

$$G(\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k) - G(\beta_0 + \beta_2 x_2 + \ldots + \beta_k x_k)$$

### 3. Maximum Likelihood Estimation (MLE)

Typically, we use the Maximum Likelihood Estimation (MLE) for nonlinear binary response models instead of OLS. MLE is an estimation method where the parameter estimates are chosen to maximize the log-likelihood function and it is based on the distribution of *y* given *x*. From Woolridge (2003), if we have the density function $y_i$ given a set of vectors $x_i$ as

$$f(y \mid x_i : \beta) = [G(x_i\beta)]^y [1 - G(x_i\beta)]^{1-y}, y = 0,1$$

When $y = 1$, we have $G(x_i\beta)$ and when $y$=0, we obtain $1 - G(x_i\beta)$. The log-likelihood function is therefore, a function of the parameters and the data ($\mathbf{x_i}$,$y_i$) and given as follows

$$\ell_i(\beta) = y_i \log[G(x_i\beta)] + (1 - y_i)\log[1 - G(x_i\beta)]$$
$$0 < G(.) < 1$$

Since G(.) lies strictly between the values zero and one, the log-likelihood function is well defined for all values of β. In the most condensed form of explanation, the MLE method sums up $\ell_i(\beta)$ across all observations for a random sample size *n* and chooses the estimated value $\hat{\beta}$, that maximizes this log-likelihood. The application of MLE to LOGIT and PROBIT models comes from the general principal that the MLE is consistent, asymptotically normal, and asymptotically efficient.

## C. SPECIFICATION MODEL FOR ENLISTMENT DECISIONS

In the study of youths' enlistment decisions, we treat success as the response variable for high school graduates that indicated that they had enlisted in the military at time of survey. The probability of success, in this case, military enlistment, takes on a value of one and zero, if otherwise. The latent variable model for enlistment decision is

$$Y_i^* = X_i\beta + JROTC_i\delta + \varepsilon_i$$

where $Y_i^*$ is the net benefit a respondent receives from enlisting in the military, $X_i$ is a vector of individual characteristics, and $JROTC_i$ is the JROTC participation dummy variable. The vector of individual characteristics include the respondents' demographics, ability to afford college, educational expectations, military interest, family background, peer influence, and the civilian labor market. The respondents of the HS&B survey will enlist in the military if the expected net benefits of enlisting are positive. Therefore, the probability that a student enlists in the military is

$$P(Yi = 1) = P(X_i\beta + JROTC_i\delta + \varepsilon_i > 0) = \Phi[X_i\beta + JROTC_i\delta]$$

*or*

$$P(Yi = 1) = P(X_i\beta + JROTC_i\delta + \varepsilon_i > 0) = \Lambda[X_i\beta + JROTC_i\delta]$$

where $\Phi[X_i\beta + JROTC_i\delta]$ is the evaluation of the standard normal cdf and $\Lambda[X_i\beta + JROTC_i\delta]$ is the evaluation of the logistic cdf. Depending on one's assumption of the error variable distribution, we can adopt either a PROBIT or LOGIT model.

### 1. Enlistment

The dependent variable is a dummy variable that takes on a value of "1" if the respondents replied "yes" to question asked on their employment by the military. For the 1982 wave and 1980 wave of the HSB survey for the sophomore and senior cohort respectively, the questions on military employment included the branch of service that they had been accepted in while the later years asked if the respondents were on active duty service at time of survey.

### 2. JROTC

The most important explanatory variable in this study is the indicator of JROTC participation. The JROTC participation variable is set up as a dummy variable where it takes on the value of one for respondents who had participated in the JROTC program. We hypothesized that participation in the JROTC program increases the probability to enlist in the military. We are, however, cautious about the magnitude of the impact given the relatively small number of JROTC participants in the HS&B sample.

### 3. Demographics

We include in our specification the following demographic characteristics of the survey respondents: race/ethnicity, gender, marital status, number of children and age. For the race variable, we create dummy variables for the various racial groups provided in the survey but we are primarily interested in the dummy variables of whether the respondents were white, black or Hispanics. Previous studies had shown that blacks are more likely to enlist while the Hispanics effect is at best inconclusive.

For the gender variable, we have dummy variables if the respondents were male or female. Similarly, we create dummy variables for whether the respondents were never married or married. We expect that an unmarried male is more likely to enlist in the military than a married male and also an unmarried female is also more likely to enlist in the military than a married female.

In the HS&B survey results, the number of children is recorded categorically for some years and others, discrete inputs by the respondents. We choose to create dummy variables for different number of children to control for ease of interpretation. Similarly, we treat age in the same manner. We expect that high school graduates with more

children or who are older are less likely to enlist partly due to the resistance from the military in accepting potential enlistees that have large number of dependents or who are older.

**4. Ability to Afford College**

The likelihood of enlisting in the military decreases if the individual finds higher education more affordable. The 1980 and 1982 waves of the HS&B data contained information on the ability of the respondents to finance their college education. Dummy values of one and zero are created for the responses where the respondents were definitely able to afford college and not able to afford college respectively. Other indicators of the respondents' ability to afford college include the number of siblings of the respondents and the family income. We expect that the more number of siblings in the household, the less resources the respondents' parents have available to send them for higher education, thus increasing the likelihood of enlisting in the military. We also expect that the more affluent the family background of the respondents, the more likely they are to pursue higher education and less inclined toward enlisting in the military after high school.

**5. Educational Expectations**

We hypothesize that the higher educational expectations an individual has, the less likelihood of enlisting in the military. The proxies for this factor include the respondents' college expectations, their school grades, the highest level of education they had expected to receive, their college plans after high school and their level of disappointment if they were not able to attend college. We expect that if the respondents have college expectations and performing well academically, they are more likely to pursue college and less likely to enlist in the military. On the other hand, if they have only the desire to complete high school, their motivation to join the military is likely to be higher. We therefore, create dummy variables for college expectations, academic grades and high school education only expectations.

**6. Military Interest**

We expect that respondents who actively seek out military information or express desire to join the military are more likely to enlist in the military. Indicators of military interest include the individuals' expressed aspiration to join the military after high school,

where they had taken the ASVAB test, spoken to a military recruiter or obtained military information. The dummy variable of military interest takes on a value of one if the individuals exhibit any of the abovementioned behaviors.

**7. Family Background**

In this category, we extract information on the respondents' family including family structure (staying with either parent, both parents, others or alone), parents' educational qualifications, parents' occupations and parents' influence on their children's academic progress and post high school plans. We expect that respondents staying with both parents and whose parents take an active interest in their schoolwork and post high school activities are more likely to pursue higher education and therefore, less likely to seek enlistment in the military after high school. Similarly, we expect that the higher level of education attained by their parents, the higher the expectations placed on their children to pursue higher education and hence, they are less receptive to their children joining the military after high school. On the other hand, if the respondents' parents are in the military, the military background of the parents could have a positive effect on their children's propensity to enlist in the military. Again, the qualitative nature of these variables is captured by creating dummy variables for each of the events mentioned.

**8. Peer Influence**

We attempt to capture the influence of friends in the individuals' decisions to either pursue college education or to enlist in the military. We expect that if the peers of the respondents prefer to enlist in the military, the peer influence would have a positive effect on the respondents' decision to enlist in the military. Conversely, if the peers influence the college plans of the respondents, they will be less likely to enlist in the military.

**9. Civilian Labor Market**

As the HS&B data did not capture sufficient data on the civilian labor employment opportunities for the subsequent follow-up years' surveys after the base year 1980, we proxy the civilian economy using the census region of the high schools and the urbanity of the high schools. We will be interested to find out if the census region and the urbanity have any impact on the respondents' decision to enlist in the military.

## D. SPECIFICATION MODEL FOR REENLISTMENT DECISIONS

In the study of the reenlistment decisions of the military personnel, we treat success in the response variable for the enlisted personnel as those who reenlisted after first-term. The probability of success, military reenlistment, takes on a value of one and zero otherwise. The latent variable model for the reenlistment decision is

$$Y_i^* = X_i\beta + JROTC_i\delta + \varepsilon_i$$

where $Y_i^*$ is the net benefit the enlisted personnel receives from reenlisting in the military, $X_i$ is a vector of individual characteristics, $JROTC_i$ is the JROTC graduate dummy variable. The vector of individual characteristics included are assumed to be dependent on a set of covariates, namely JROTC graduate status, demographics, educational qualification at time of recruitment, entry pay grade, term of enlistment, branch of service, AFQT category and civilian labor economy. The enlisted personnel will reenlist in the military if the expected net benefits of reenlisting are positive. Therefore, the probability that the enlisted personnel reenlist after the first-term is

$$P(Yi = 1) = P(X_i\beta + JROTC_i\delta + \varepsilon_i > 0) = \Phi[X_i\beta + JROTC_i\delta]$$

*or*

$$P(Yi = 1) = P(X_i\beta + JROTC_i\delta + \varepsilon_i > 0) = \Lambda[X_i\beta + JROTC_i\delta]$$

where $\Phi[X_i\beta + JROTC_i\delta]$ is the evaluation of the standard normal cdf and $\Lambda[X_i\beta + JROTC_i\delta]$ is the evaluation of the logistic cdf. Depending on one's assumption of the error variable distribution, we can adopt either a PROBIT or LOGIT model. The theoretical specification model is as follows:

$$\begin{aligned}\Pr(Reenlistment = 1) = {} & \beta_0 + \beta_1 JROTC + \beta_2 Demographics + \\ & \beta_3 Education + \beta_4 EntryPayGrade + \beta_5 EnlistmentTerm + \\ & \beta_6 BranchofService + \beta_7 AFQTCategory + \varepsilon_i\end{aligned}$$

### 1. Reenlistment

The dependent variable is a dummy variable that takes on a value of "1" if the enlisted personnel reenlist at the expiration of term of service and "0" if they separate from the military.

### 2. JROTC Graduate

The DMDC data captures the youth program that the enlisted personnel had participated in prior to enlistment as a means to determine their entry grades. This is because certain youth programs, like for example JROTC, entitle enlisted personnel who enter the military an advanced pay grade. However, not all enlistees have participated in youth programs. We are primarily interested in the JROTC youth program amidst other programs like the Civil Air Patrol or Sea Cadets. As the JROTC program is akin to a realistic job preview of the military lifestyle, we expect that enlistees who were JROTC graduates are more likely to reenlist.

### 3. Demographic Variables

We include in our specification the following demographic characteristics of the enlisted personnel: race/ethnicity, marital status and enlistment age. For the race variable, we create dummy variables for non-white, white, black and Hispanic based on the categories specified in the DMDC cohort files. Previous literature reports that blacks are more likely to complete their terms of service and reenlist.

The marital status from the DMDC dataset is interacted with the number of children and we have four dummy variables: single with no children, married with no children, single with children and married with children. We expect that given the benefits associated with enlistees with dependents, military members with more dependents are less likely to seek changes to their current career status and thus are more likely to stay with the military and reenlist.

The gender of the enlisted personnel could also affect the reenlistment decision. We hypothesize that males are more likely to reenlist compared to females, as the latter tend to drop out of their careers once they have families.

We include the enlisted personnel's age at enlistment because typically the military targets youths in the age group of 17 to 25 and we like to find out if the age at time of enlistment has an impact on subsequent reenlistment decisions. Presumably, members who join later reach reenlistment at an older age and the responsibilities of families could motivate their decision to reenlist and stay with the military.

### 4. Educational Qualification

We expect that the higher educational qualification that enlistees have at time of enlistment, the less likely they are to reenlist. This is because we expect that enlisted personnel with higher levels of education are likely to leave the military for better civilian opportunities, therefore, decreases the likelihood of reenlistment. Dummy variables were constructed for all levels of education, including non-high school diploma graduate, high school diploma graduate, some college, college graduate and those who obtained General Education Diploma (GED).

### 5. Entry Pay Grade

This variable seeks to identify the impact entry pay grade has on the reenlistment decision. We create dummy variables for each enlisted rank from E1 to E9. We acknowledge that there will be some collinearity between the dummy variable JROTC and entry pay grades from E3 to E4 as individuals who participate in JROTC for three of four years enter the service with an advanced pay grade. However, since our interest lies estimating the effect of JROTC on reenlistment decisions, we include the entry pay grade to control for non-JROTC graduates who enter at various entry pay grades.

### 6. Term of Enlistment

The term of enlistment refers to the length of service in which the enlistees are contracted for. The contract length typically ranges from one to six years. We expect that the contract length impacts reenlistment decisions as the time spend in the military could possibly affect the individuals' psychological perceptions of their fit with the military organization. As such, we hypothesize that a longer contractual length increases the probability of reenlistment with the military

### 7. Branch of Service

As we have the population-wide data from DMDC, we include the branch of service (Army, Navy, Marine Corp and the Air Force) to control for unintended effects due to the unequal distribution of JROTC graduates amongst the four services. The Army, being the largest force, naturally has the largest number of JROTC units and therefore, the largest number of JROTC graduates. The inclusion of this variable also

allows us to find out whether the accession service of the JROTC graduates has any impact on their reenlistment decisions.

### 8. AFQT Mental Category

The AFQT score measures both the individuals' cognitive ability to absorb military training and their potential performance or aptitude for service. We use the AFQT mental category as proxy for the "quality" of the enlisted personnel. The DMDC data has nine categories for this variable - Category I,II,IIIA,IIIB, IVA, IVB, IVC, V and unknown[62] – in which we combine Category I, II and IIIA to represent the dummy variable for "high quality" and the rest as "low quality". We expect that the "high quality" enlisted personnel are more likely to stay till completion of service but reenlist at a lower rate as they face higher opportunity costs associated with remaining in the military.

### 9. Highest Paygrade

The variable highest paygrade is used as a proxy for a performance indicator. Enlisted personnel who acquire the higher paygrades do so because of sustained military performance and training. We create dummy variables for each paygrade rank E1 to E9. The inclusion of this variable will account for those non-JROTC participants who remain in the service some prescribed amount of time.

## E. SURVIVAL ANALYSIS

We conduct survival analysis when we have survival data. Survival data refers to any data that deals with time until an event occurs. We see survival data typically in the medical field where an event includes death or onset of disease or relapse of a disease. Another common application of survival analysis lies in the industrial sector where survival times are typically tied to failure of a unit or some component in a unit. If we have a random variable, T, that represents survival time, the cumulative distribution function is $P(t) = \Pr(T \le t)$ and probability density function is $p(t) = dP(t)/dt$. The survival function is then

[62] The nine categories represent AFQT percentile scores from the highest to the lowest correspondingly, except for the unknown category. The percentile scores are 93-99, 65-92, 50-64,31-49,21-30, 16-20, 10-15, 1-9.

$$S(t) = \Pr(T > t) = 1 - P(t)$$

This leads us to the hazard function, which looks at the probability of failure (like death) at time *t*, conditional on survival to that time.

$$\text{h(t)} = \lim_{\Delta t \to 0} \frac{\Pr[(t \le T < t + \Delta t) \mid T \ge t)]}{\Delta t}$$
$$= \frac{f(t)}{S(t)}$$

One common feature of survival data is the censoring of data. A common form of censoring is right-censoring where the subjects of a study survived to a future time beyond which the success or failure status is not known as the observation period has expired or the study ends before the end-point is reached. Left-censoring occurs when the initial time at risk is not known. Interval censoring occurs when both right censoring and left censoring appear for the same observation.

The statistical methods under the umbrella of survival analysis include parametric, semi-parametric and non-parametric statistical methods. For parametric survival analysis methods, we assume the knowledge of the distributions of the survival times like log-logistic, exponential, Weibull or Gompertz. For non-parametric models, there are no assumptions of the survival times like the Kaplan and Meier estimators. The semi-parametric models lie in between by assuming a parametric form for the effects of the explanatory variables but make no assumptions on the distributions of the survival times.

The covariates in any survival analysis whose values do not change over time are called time independent and conversely, those covariates whose values vary with time, are known as time-dependent covariates. The common estimation method is the Cox proportional hazard (PH) model which we elaborate further in the following paragraphs.

**1. Cox Proportional-Hazards Model**

The Cox proportional-hazards (PH) model, which is a semi-parametric model, is a popular model in survival analysis which can be used in analyzing time independent variables. Let $X_{ij}$ *(t)* be the *jth* covariate of the *ith* person where *i = 1*,…,*n* and *j = 1*,…,*p*. It is natural to think of the set of covariates as forming an *n x p* matrix, and we use $X_i$ to

denote the covariate vector for subject *i*, that is, the $i^{th}$ row of the matrix. When all covariates are fixed over time $X_i$ , it is just a vector of covariate values which looks like multiple linear regressions. When the data set has a combination of time independent and time-dependent covariates, we can use *Xi* for both time-fixed and time-varying covariate processes, employing $X_i(t)$ when we wish to emphasize the time varying structure.

A parametric model that examines the relationship between survival distribution and the covariates, takes on the following form,

$$\log h_i(t) = \alpha_0 + \beta_j X_{ij}$$

The anti-log of the log-linear regression equation above gives

$$h_i(t) = e^{(\alpha_0 + \beta_j X_{ij})}$$

where $\alpha_0$ is a constant and represents the log-baseline function as $\log h_i(t) = \alpha_0$ when all the covariates are zero. The Cox PH model by not making any assumption of the baseline hazard function gives us the semi-parametric form as follows.

$$h_i(t) = h_0(t)e^{(\alpha_0 + \beta_j X_{ij})}$$

When we have two observations, $X_i$ and $X_{i'}$,

$$\eta_i = \beta_j X_{ij}$$
$$\eta_{i'} = \beta_j X_{i'j}$$

the hazard ratio for these two observations gives us the proportional hazards model that is independent of time.

$$\frac{h_i(t)}{h_{i'}(t)} = \frac{h_0(t)e^{\eta_i}}{h_0(t)e^{\eta_{i'}}} = \frac{e^{\eta_i}}{e^{\eta_{i'}}}$$

The Cox proportional regression model assumes that the effects of the predictor variables are constant over time. Furthermore, there should be a linear relationship between the endpoint and predictor variables. Predictor variables that have a highly skewed distribution may require logarithmic transformation to reduce the effect of

extreme values. Logarithmic transformation of a variable *var* can be obtained by entering LOG (*var*) as predictor variable.

A key reason for the popularity of the Cox model is that, even though the baseline hazard is not specified, reasonably good estimates of regression coefficients, hazard ratios of interest, and adjusted survival curves can be obtained for a wide variety of data situations. Another appealing property of the Cox model is that even though the baseline hazard part of the model is unspecified, it is still possible to estimate the betas in the exponential part of the model. The Cox model is also applicable when survival time information is available and the data is censored. In sum, the Cox model uses more information, the survival times, than the logistic model, which considers a (0, 1) outcome and ignores survival times and censoring.

## F. SPECIFICATION MODEL FOR ATTRITION PATTERN

To further explore the possible effects of JROTC, we examine the attrition patterns of first term enlistees. First term enlistees are characterized as service members who depart the service after completion of their initial contract. Contract times range from two to six years. The data was converted to survival time data as to analyze the attrition patterns. Survival analysis is a collection of statistical procedures for data analysis for which the outcome variable of interest is time until separation from the service. The theoretical specification model is as follows:

$$H(t) = h_0(t) * \exp(\beta_1 JROTC + \beta_2 Demographics + \beta_3 Education + \beta_4 EntryPayGrade + \beta_5 EnlistmentTerm + \beta_6 BranchofService + \beta_7 AFQTCategory + \varepsilon_i$$

### 1. Survival Time

The survival time is the dependent variable which is defined as the time to reach the event of interest is attrition. It is taken as the difference between the date of separation and date of entry of each enlisted personnel. The probability of separating from the military at the end of obligated service is characterized as attrition. The hazard

is defined as attrition, which is a natural reduction in workforce. The baseline hazard at time *t* represents the hazard for a person with the value 0 for all the predictor variables.

### 2. Right-censored Data

The enlisted personnel cohort files data was cut-off in year 2003. For those who are still in service as at the censored point, the date of separation is coded as zero. As such, we identify those who are still in service as of year 2003 using a dummy variable.

### 3. Variables of Interest

The variables of interest in the survival model are similar to that of the reenlistment model. Specifically, we have JROTC, demographics, education, entry pay grade, enlistment-term, branch of service, AFQT category as our right-hand side variables. The hypothesized effects for the survival model are similar to that of the reenlistment model. All the variables are categorical with the exception of age.

## G. CONCLUSION

The chapter explains the econometric models available in our empirical study of the impact of JROTC on the military. Binary response models like the LPM, LOGIT and PROBIT are suitable for our study on the impact of JROTC on enlistment and reenlistment decisions. Survival analysis method like the semi-parametric Cox PH model in suitable for our study on the attrition patterns of JROTC graduates and non-JROTC graduates. We present the results of this empirical study in the next chapter.

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# VI. RESULTS FROM HIGH SCHOOL & BEYOND DATA

## A. INTRODUCTION

We present the results of our empirical findings on the impact of JROTC participation on military enlistment, attrition and reenlistment in this chapter. We utilize the 1980 High School & Beyond (HS&B) data that surveyed a stratified sample of high school sophomores and students where information on JROTC participation and military enlistment were recorded. We extract the HS&B data using cross-sectional sample and then compare each cohort using four econometric methods: single equation logit, single equation probit, two-stage least squares (2SLS) with instrumental variable (IV) and bivariate probit equation. The last two regression methods treat JROTC participation as endogenous, in that high school students self-select into the JROTC program for reasons that have no impact on the enlistment decision but would have otherwise cause the estimation results of the JROTC variable to be biased.

## B. ENLISTMENT DECISION EMPIRICAL FINDINGS

The 1980 HS&B Sophomore Cohort and Senior Cohort datasets provide rich information on the high school students' educational attainment, values, aspirations, employment after high school and their family background. From this vast amount of qualitative information, we select pertinent information that allows us to study the impact of JROTC participation on military enlistment decision. We present the summary of the definitions of the variables selected in our model specifications in Appendix A.

In this study, we treat the data as one cross-sectional data across all years using the latest information for the chosen variables. For both cohorts, we first treat JROTC as an exogenous variable that is not correlated with any unobserved effects. We use single equation probit and logit models for this.

However, as the impact of JROTC on enlistment decision could be overstated if selectivity bias exists, we employ bivariate probit model that uses Maximum Likelihood Estimators (MLE) and the two-stage least squares (2SLS) with instrumental variables (IV) method that treat JROTC variable as endogenous. As it is often touted that the

JROTC program targets "at risk" youths, there is a possibility that students who are "at risk" self-select into the JROTC program. As a consequence of their participation in the JROTC program, these students could have a more favorable inclination toward enlisting in the military.

In the 2SLS with IV model, we select the following instruments from the respondent's days in high school[63]: remedial lessons taken, views on the value of citizenship, disciplinary problems in school, family structure and family income, to explain JROTC participation and not the enlistment decision. In the bivariate probit model, the same instruments form the right-hand side variables of the second probit equation with JROTC as the dependent variable. Demographics variables are added in the two models to control for self-selection due to race, ethnic group or age. The following paragraphs present our results using the methods described above.

The cross-sectional dataset has 14,825 and 11,995 observations for the sophomore and senior cohort population respectively. After accounting for missing observations, we have 11,805 and 9,360 observations in the sophomore and senior final sample respectively.

### 1. Single Equation LOGIT and PROBIT Models with Exogenous JROTC Variable

Table 18 presents the more significant results from the single equation LOGIT and PROBIT models of the 1980 sophomore and senior cohort cross-sectional data. We find that most of the logit odds ratios and probit partial effects exhibit similar behavior and statistical significance in the two cohorts. From the reported "pseudo R-squared" values for both logit and probit models, the covariates explain approximately 23 percent and 36 percent of the variance in the sophomore and senior model respectively.

63 For the cross-sectional datasets, we obtain IVs from variables that occur in either year 1980 or 1982 for the sophomore cohort and year 1980 for the senior cohort.

Table 18. Coefficients, Standard Errors & Partial Effects of the 1980 Sophomore and Senior Cohort Single Equation LOGIT and PROBIT Models

| | Sophomore | | | Senior | | |
|---|---|---|---|---|---|---|
| Variables | Single Equation LOGIT | Single Equation PROBIT | PROBIT Partial Effects | Single Equation LOGIT | Single Equation PROBIT | PROBIT Partial Effects |
| JROTC | 0.609 | 0.320 | 0.028 | 0.446 | 0.271 | 0.018 |
| | (0.182)*** | (0.098)*** | (0.011)** | (0.178)** | (0.100)*** | (0.008)** |
| Black | -0.054 | 0.008 | 0.001 | -0.544 | -0.290 | -0.003 |
| | (0.246) | (0.125) | (0.008) | (0.243)** | (0.131)** | (0.003) |
| White | -0.107 | -0.049 | -0.003 | -0.688 | -0.402 | -0.013 |
| | (0.226) | (0.115) | (0.008) | (0.238)*** | (0.128)*** | (0.005)** |
| Native | 0.128 | 0.071 | 0.005 | -0.273 | -0.109 | -0.021 |
| | (0.322) | (0.167) | (0.012) | (0.347) | (0.188) | (0.007)*** |
| Hispanic | 0.051 | 0.042 | 0.003 | -0.775 | -0.428 | -0.005 |
| | (0.239) | (0.122) | (0.008) | (0.250)*** | (0.135)*** | (0.008) |
| Male | 1.802 | 0.852 | 0.063 | 1.354 | 0.701 | -0.017 |
| | (0.114)*** | (0.051)*** | (0.004)*** | (0.106)*** | (0.055)*** | (0.004)*** |
| Not Married | -0.440 | -0.207 | -0.013 | -0.488 | -0.253 | 0.040 |
| | (0.098)*** | (0.050)*** | (0.003)*** | (0.111)*** | (0.060)*** | (0.004)*** |
| Number of Children | 0.137 | 0.073 | 0.005 | 0.046 | 0.025 | -0.014 |
| | (0.040)*** | (0.021)*** | (0.001)*** | (0.061) | (0.033) | (0.004)*** |
| Age | -0.061 | -0.031 | -0.002 | 0.100 | 0.075 | 0.001 |
| | (0.071) | (0.036) | (0.002) | (0.076) | (0.042)* | (0.002) |
| Total income | -0.000 | -0.000 | -0.000 | -0.000 | -0.000 | 0.004 |
| | (0.000) | (0.000)* | (0.000)* | (0.000)** | (0.000)* | (0.002)* |
| Completed HS | 0.351 | 0.181 | 0.011 | 0.354 | 0.153 | -0.000 |
| | (0.148)** | (0.073)** | (0.004)*** | (0.369) | (0.198) | (0.000)* |
| Ability to Afford College | -0.110 | -0.060 | -0.004 | 0.197 | 0.088 | 0.007 |
| | (0.094) | (0.048) | (0.003) | (0.110)* | (0.060) | (0.007) |
| Parents Support | -0.505 | -0.251 | -0.021 | -0.131 | -0.065 | 0.004 |
| | (0.200)** | (0.106)** | (0.011)* | (0.143) | (0.079) | (0.003) |
| Poor Academic | -0.139 | -0.069 | -0.005 | -0.092 | -0.050 | -0.003 |
| | (0.094) | (0.047) | (0.003) | (0.099) | (0.054) | (0.004) |
| College Expectations | -0.212 | -0.096 | -0.006 | 0.473 | 0.255 | 0.015 |
| | (0.188) | (0.093) | (0.005) | (0.092)*** | (0.050)*** | (0.003)*** |
| Military Interest | 1.927 | 0.830 | 0.048 | 3.264 | 1.538 | 0.159 |
| | (0.175)*** | (0.070)*** | (0.003)*** | (0.149)*** | (0.061)*** | (0.008)*** |
| Parents Influence Military | 1.519 | 0.854 | 0.114 | 1.346 | 0.789 | 0.082 |
| | (0.123)*** | (0.071)*** | (0.016)*** | (0.135)*** | (0.078)*** | (0.014)*** |
| Parent in the Military | 1.013 | 0.553 | 0.059 | 0.584 | 0.356 | 0.026 |
| | (0.172)*** | (0.094)*** | (0.015)*** | (0.251)** | (0.140)** | (0.014)* |
| Parents with less than High School | 0.205 | 0.106 | 0.007 | 0.037 | 0.016 | 0.001 |
| | (0.089)** | (0.046)** | (0.003)** | (0.098) | (0.054) | (0.003) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Parents with High School | -0.178 | -0.068 | -0.004 | 0.395 | 0.211 | 0.013 |
| | (0.213) | (0.105) | (0.006) | (0.178)** | (0.098)** | (0.007)* |
| Number of Siblings | 0.016 | 0.008 | 0.001 | 0.023 | 0.012 | 0.001 |
| | (0.013) | (0.007) | (0.000) | (0.012)* | (0.007)* | (0.000)* |
| Friends Influence Military | 1.209 | 0.695 | 0.084 | 0.614 | 0.372 | 0.027 |
| | (0.173)*** | (0.101)*** | (0.019)*** | (0.190)*** | (0.109)*** | (0.011)** |
| Friends Influence College | -0.238 | -0.132 | -0.009 | -0.246 | -0.135 | -0.007 |
| | (0.097)** | (0.050)*** | (0.004)** | (0.103)** | (0.057)** | (0.003)** |
| Census Region Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| | | | | | | |
| Constant | -3.345 | -1.678 | | -7.622 | -4.403 | |
| | (2.067) | (1.054) | | (1.921)*** | (1.052)*** | |
| Observations | 11,805 | 11,805 | 11,805 | 9,360 | 9,360 | 9,360 |
| Log Likelihood | -2210.929 | -2213.490 | -2213.490 | -1738.994 | -1740.419 | -1740.419 |
| Chi2 | 1339.806 | 1334.684 | 1334.684 | 1967.959 | 1965.109 | 1965.109 |
| Pseudo R squared adjusted | 0.233 | 0.232 | 0.232 | 0.361 | 0.361 | 0.361 |

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

We find that the JROTC variable is statistically significant at the five percent significance level for both cohorts across the logit and probit econometric models. The results show that the JROTC participation increases the probability of enlisting in the military. The odds ratio of JROTC enlisting the military is 0.609 and 0.446 for the sophomore and senior cohort respectively, ceteris paribus. The probit partial effects are of smaller magnitude with the JROTC participation increasing the probability of enlistment by 0.028 and 0.018 the sophomore and senior cohort respectively, ceteris paribus.

For the rest of the variables, we find that the race/ethnic demographic variables for the sophomore cohort have no impact on the enlistment decision while blacks or whites or Hispanics in the senior cohort reduce the probability of enlisting in the military for both the econometric models, ceteris paribus. Males in both cohorts increase the likelihood of enlisting in the military compared to females, ceteris paribus. For marital status, we find that sophomores and seniors who are not married reduce the likelihood of

enlisting in the military, ceteris paribus. On the other hand, as the number of children increases by one, the likelihood of enlisting in the military increases, ceteris paribus, with the exception of the seniors using probit model. An increase of one child reduces the probability of a senior enlisting in the military by 0.014, ceteris paribus. The age variable in both cohorts does not display any statistical significance.

The total income variable is significant for the sophomore cohort at the ten percent level but both logit and probit models reported the coefficients as approximately zero such that the impact of this variable on the enlistment decision is negligible.

Being a high school graduate positively impacts the enlistment decision for the sophomores but not the seniors. For example, a sophomore who is a high school graduate increases the probability of enlisting in the military by 0.011 or display odds ratio of 0.351, ceteris paribus.

We find that the ability to afford college in the logit and probit models for both cohorts is not statistically significant but parental support for those in the senior cohort reduces the probability of enlisting in the military, ceteris paribus. As for college expectations, it is statistically significant in the senior cohort and both logit and probit reported positive coefficient estimates, which means that having college expectations increase the likelihood of enlisting in the military. As for those with poor academic performance during high school, there is no significant impact on the decision to enlist.

We find that for those who expressed interest in the military increases the probability of military enlistment compared to those who did not, ceteris paribus. For those whose parents influence their post-high school plans toward the military and whose fathers or mothers are in the military, the sophomores and seniors are also more likely to enlist in the military, ceteris paribus. In addition, sophomores whose parents have less than high school education are more likely to enlist in the military, ceteris paribus. The picture is reversed for the seniors. The number of siblings for sophomores has no impact on the enlistment decision whereas it is positively significant at the ten percent level for the seniors.

The influence of friends with regard to post high school plans have a significant impact on the respondents' decision to enlist in the military. both logit and probit models show positive relationship between the influence of friends to join the military and the military enlistment decision. The opposite relationship is reported between friends influence to go to college and the military enlistment decision for the senior cohort.

**2. Two-stage Least Squares Model with Endogenous JROTC Variable**

We posit that JROTC is endogenous in the enlistment model and we address the endogeneity problem by choosing a number of instrumental variables. The unobserved factors in the enlistment equation would include ability and taste for military life. For example, someone with a strong preference for military life would join JROTC and also enlist in the military with a higher probability than others. On the other hand, those with low ability will not qualify for enlistment. The JROTC program targets "at-risk" youths who may display lower ability. Therefore, the JROTC variable would be correlated with unobservables left in the error term and as a result, our estimates of fixed impacts on enlistment will be biased.

With the 2SLS model, we first determine the IVs that characterize "at-risk" youths. Typically, "at-risk" youths are those whose academic performance needs help, come from broken families, have low self-esteem, or from the lower socio-economic status. From the HS&B data, we derive IVs that capture the abovementioned factors, but do not belong in the enlistment model. The IVs include whether the high school students have taken remedial lessons, have discipline problems in school, live with single parent, and have low self-esteem. Their socio-economic background is captured by the family income reported in the HS&B data. We also include one aspect of JROTC participation, that is, the inclination toward being a community leader or in general, being able to contribute to society. JROTC, being a youth program that inculcates citizenship values, could possibly attract like-minded students to participate.

After the IVs are selected, we run a general test of joint significance of the IVs by first regressing the JROTC variable against all exogenous variables. With the regression results, we conduct a joint significance test of the IVs with the null hypothesis that the IVs are not jointly significant. We obtain a p-value of 0.0046 for which we reject the null

and conclude that the IVs selected are jointly significant. Therefore, we conclude that all these IVs satisfy the rank condition which ensures that they are sufficiently correlated with the JROTC variable.

Next, we test for over-identification of the IVs by obtaining the predicted residuals from the 2SLS model and regress the residuals against all exogenous variables. The null hypothesis is that the IVs are not correlated with the error term of the structural equation. We obtain the p-value of 0.125 that allows us not to reject the null hypothesis, at the usual levels of test. Hence, we conclude that our IVs are reasonably uncorrelated with the error term and suitable for use in the 2SLS model.

We present the first-stage results in Table 19 while Table 20 presents the results of the 2SLS model for the 1980 sophomore and senior cohort in the second and third column respectively.

Table 19. First Stage Regression Of 1980 Sophomore And Senior Cohort

| Variables | Sophomore | Senior |
|---|---|---|
| Black | 0.044 | 0.034 |
| | (0.009)*** | (0.011)*** |
| White | 0.013 | 0.006 |
| | (0.008) | (0.010) |
| Native | 0.033 | 0.017 |
| | (0.013)** | (0.016) |
| Hispanic | 0.013 | 0.010 |
| | (0.009) | (0.010) |
| Male | 0.008 | 0.015 |
| | (0.003)** | (0.004)*** |
| Not Married | 0.004 | 0.002 |
| | (0.004) | (0.005) |
| Number of children | 0.005 | 0.005 |
| | (0.002)*** | (0.003)* |
| Age | 0.003 | 0.001 |
| | (0.003) | (0.003) |
| Total income | -0.000 | 0.000 |
| | (0.000) | (0.000) |
| Completed HS | -0.018 | -0.006 |
| | (0.005)*** | (0.017) |
| Ability to Afford College | -0.005 | 0.001 |
| | (0.004) | (0.005) |
| Parents Support | -0.009 | -0.001 |
| | (0.009) | (0.006) |
| Poor Academic | 0.009 | 0.009 |
| | (0.004)** | (0.004)** |
| College Expectations | 0.001 | -0.002 |
| | (0.006) | (0.004) |

| | | |
|---|---|---|
| Military Interest | 0.014 | 0.018 |
| | (0.003)*** | (0.004)*** |
| Parents Influence Military | 0.011 | 0.044 |
| | (0.008) | (0.010)*** |
| Parent in the Military | 0.035 | 0.022 |
| | (0.009)*** | (0.014) |
| Parents with less than High School | 0.000 | -0.003 |
| | (0.003) | (0.004) |
| Parents with High School | 0.001 | 0.017 |
| | (0.007) | (0.008)** |
| Number of Siblings | 0.000 | 0.001 |
| | (0.001) | (0.001) |
| Friends Influence Military | 0.073 | 0.043 |
| | (0.012)*** | (0.013)*** |
| Friends Influence College | 0.003 | 0.002 |
| | (0.004) | (0.005) |
| Census Region Dummies | Yes | Yes |
| | | |
| Live with Single Parent | 0.009 | 0.008 |
| | (0.008) | (0.007) |
| Remedial Lessons | 0.005 | 0.005 |
| | (0.003) | (0.004) |
| Values community service | 0.011 | 0.010 |
| | (0.003)*** | (0.005)** |
| Low Esteem | 0.000 | 0.006 |
| | (0.004) | (0.004) |
| Discipline Problems in School | 0.005 | -0.002 |
| | (0.003) | (0.004) |
| Family Income | -0.000 | -0.000 |
| | (0.000) | (0.000)** |
| Constant | -0.062 | -0.017 |
| | (0.079) | (0.085) |
| Observations | 11,805 | 9,360 |
| R-squared | 0.04 | 0.04 |

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 20. Coefficients, Standard Errors & Partial Effects For The 1980 Sophomore And Senior Cohort Two-Stage Least Squares Models

| | Sophomore | Senior |
|---|---|---|
| JROTC | 0.702 | -0.232 |
| | (0.378)* | (0.378) |
| Black | -0.031 | -0.020 |
| | (0.023) | (0.020) |
| White | -0.011 | -0.033 |
| | (0.014) | (0.014)** |
| Native | -0.015 | 0.002 |
| | (0.027) | (0.028) |
| Hispanic | -0.005 | -0.035 |
| | (0.015) | (0.015)** |
| Male | 0.076 | 0.075 |
| | (0.006)*** | (0.007)*** |
| Not Married | -0.026 | -0.031 |
| | (0.006)*** | (0.007)*** |
| Number of children | 0.005 | 0.004 |
| | (0.003) | (0.005) |
| Age | -0.005 | 0.007 |
| | (0.005) | (0.005) |
| Total income | -0.000 | -0.000 |
| | (0.000)* | (0.000)** |
| Completed HS | 0.035 | 0.023 |
| | (0.011)*** | (0.029) |
| Ability to Afford College | -0.002 | 0.013 |
| | (0.006) | (0.008)* |
| Parents Support | -0.025 | -0.012 |
| | (0.016) | (0.009) |
| Poor Academic | -0.016 | -0.003 |
| | (0.007)** | (0.008) |
| College Expectations | -0.013 | 0.031 |
| | (0.010) | (0.006)*** |
| Military Interest | 0.039 | 0.199 |
| | (0.007)*** | (0.011)*** |
| Parents Influence Military | 0.227 | 0.244 |
| | (0.025)*** | (0.030)*** |
| Parent in the Military | 0.072 | 0.055 |
| | (0.026)*** | (0.030)* |
| Parents with less than High School | 0.011 | -0.000 |
| | (0.006)* | (0.006) |
| Parents with High School | -0.006 | 0.028 |
| | (0.011) | (0.015)* |
| Number of Siblings | 0.001 | 0.002 |
| | (0.001) | (0.001)* |
| Friends Influence Military | 0.187 | 0.137 |
| | (0.046)*** | (0.038)*** |
| Friends Influence College | -0.017 | -0.016 |
| | (0.007)** | (0.008)** |
| Census Region Dummies | Yes | Yes |
| | | |

| | | |
|---|---|---|
| Constant | 0.140 | -0.161 |
| | (0.138) | (0.129) |
| Observations | 11,805 | 9,360 |
| F statistics | 23.405 | 34.417 |
| R squared | - | 0.197 |
| R squared adjusted | - | 0.194 |

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

For the JROTC variable, we find that after accounting for self-selection in to the JROTC program, sophomores who participate in JROTC program increases the probability of enlistment by 0.044 compared to the non-JROTC participants at the one percent significance level, ceteris paribus. On the other hand, we find that JROTC participation does not have any impact on youths' enlistment decisions for the seniors.

For other variables, we find that the race demographic variable in this specification model does not have any impact on the enlistment decision either, except for high school seniors who are white, which in this case, is negatively correlated with the enlistment decision. Male high school students, on the other hand, have positive influence on the youths' decision to enlist in the military. Male sophomores and seniors are 0.076 and 0.075 more likely than females respectively to enlist in the military, ceteris paribus. We find that the number of children and age have no significant impact on the enlistment decision.

The variable of the total income earned by the respondents after high school turns out to be significant for both samples at the ten percent significant level but the magnitude is miniscule. Being a high school graduate positively impacts the enlistment decision for the sophomores but not the seniors, which is similar to our single equation model findings. For example, a sophomore who is a high school graduate increases the probability of enlisting in the military by 0.035 compared to a non-high school graduate, ceteris paribus.

We find that the ability to afford college is statistically significant at the ten percent level for the seniors only while parental support has no impact on the enlistment decision. In this model, we find that poor academic performance of the sophomores reduces the probability of enlisting by 0.016 compared to those with good academic

performance, ceteris paribus. This is as expected given that those who perform badly in school are unlikely desirable candidates for the military. As for college expectations, it is statistically significant for the seniors but not sophomores.

Our results also showed that respondents who expressed interest in the military display a higher propensity to enlist in the military than those who did not. Sophomores who expressed military interest are 0.032 more likely to enlist compared to those who did not, ceteris paribus. Sophomores who indicated military interest is 0.039 more likely to enlist compared to those who did not while seniors who indicated military interest is 0.199 more likely to enlist than those who did, ceteris paribus. Both coefficients are statistically significant at the one percent significance level.

We find that respondents whose parents influence their post-high school plans toward the military or whose parents are in the military are more likely to enlist in the military than whose parents did not exhibit the same characteristics. The educational background of the respondents' parents does not impact the enlistment decision much in this model. Sophomores whose parents have less than high school education are 0.011 more likely to enlist in the military compared to those whose parents have high school or more education at the ten percent significance level, ceteris paribus. The number of siblings the respondents have in both samples did not seem to impact the enlistment decision in any way, except for the senior population but the impact is small. An increase in the number of sibling increases the probability of enlisting by 0.002, ceteris paribus.

The influence of friends with regard to post high school plans have a significant impact on the respondents' decision to enlist in the military. Sophomores and seniors influenced by friends to join the military are 0.187 and 0.137 more likely to enlist in the military compared to those without such peer influence, ceteris paribus. Therefore, we find that the coefficients are negative for peer influence to go to college after high school although it is significant for the senior population and not the sophomore population.

### 3. Bivariate PROBIT Models with Endogenous JROTC Variable

Table 21 presents the results of the bivariate PROBIT model, including the partial effects for the sophomores in the first three columns and seniors in the last three columns.

Table 21. Coefficients, Standard Errors & Partial Effects for the 1980 Sophomore and Senior Cohort Bivariate PROBIT Models

| | Sophomores | | | Seniors | | |
|---|---|---|---|---|---|---|
| Variables | (1) | (2) | Partial effects | (1) | (2) | Partial effects |
| JROTC | 0.842 | | 0.0011423 | 0.117 | | 0.0002694 |
| | (0.603) | | | (0.480) | | |
| Black | 0.006 | | 0.0000030 | -0.289 | | -0.0005315 |
| | (0.125) | | | (0.131)** | | |
| White | -0.048 | | -0.0000241 | -0.402 | | -0.0008563 |
| | (0.115) | | | (0.128)*** | | |
| Native | 0.070 | | 0.0000374 | -0.108 | | -0.0002044 |
| | (0.166) | | | (0.188) | | |
| Hispanic | 0.042 | | 0.0000213 | -0.428 | | -0.0007015 |
| | (0.122) | | | (0.135)*** | | |
| Male | 0.849 | | 0.0005124 | 0.701 | | 0.001613 |
| | (0.051)*** | | | (0.055)*** | | |
| Not Married | -0.206 | | -0.0000970 | -0.253 | | -0.0005523 |
| | (0.049)*** | | | (0.060)*** | | |
| Number of children | 0.072 | | 0.0000355 | 0.025 | | 0.0000517 |
| | (0.021)*** | | | (0.033) | | |
| Age | -0.032 | | -0.0000158 | 0.075 | | 0.0001562 |
| | (0.036) | | | (0.042)* | | |
| Total income | -0.000 | | 0.0000000 | -0.000 | | 0.0000000 |
| | (0.000)* | | | (0.000)* | | |
| Completed HS | 0.184 | | 0.0000775 | 0.153 | | 0.0002767 |
| | (0.073)** | | | (0.198) | | |
| Poor Academic | -0.071 | | -0.0000348 | -0.049 | | -0.0001006 |
| | (0.047) | | | (0.054) | | |
| Ability to Afford College | -0.059 | | -0.0000288 | 0.089 | | 0.000177 |
| | (0.048) | | | (0.060) | | |
| Parents Support | -0.249 | | -0.0001656 | -0.065 | | -0.0001417 |
| | (0.106)** | | | (0.079) | | |
| College Expectations | -0.096 | | -0.0000425 | 0.255 | | 0.0005884 |
| | (0.093) | | | (0.050)*** | | |
| Military Interest | 0.827 | | 0.0003672 | 1.538 | | 0.0059645 |
| | (0.070)*** | | | (0.062)*** | | |
| Parents Influence Military | 0.849 | | 0.0011442 | 0.789 | | 0.0031407 |
| | (0.071)*** | | | (0.078)*** | | |
| Parent in the Military | 0.550 | | 0.0005298 | 0.355 | | 0.0010159 |
| | (0.094)*** | | | (0.140)** | | |
| Parents with less than High School | 0.105 | | 0.0000550 | 0.016 | | 0.0000333 |
| | (0.046)** | | | (0.054) | | |
| Parents with High School | -0.070 | | -0.0000320 | 0.211 | | 0.0005259 |
| | (0.105) | | | (0.098)** | | |
| Number of Siblings | 0.008 | | 0.0000038 | 0.012 | | 0.0000252 |
| | (0.007) | | | (0.007)* | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Friends Influence Military | 0.689 | | 0.0007954 | 0.372 | | 0.0010798 |
| | (0.101)*** | | | (0.109)*** | | |
| Friends Influence College | -0.131 | | -0.0000687 | -0.135 | | -0.0003012 |
| | (0.050)*** | | | (0.057)** | | |
| Census Region Dummies | Yes | | | Yes | | |
| | | | | | | |
| Live with Single Parent | | -0.108 | -0.0000621 | | 0.148 | 0.0002628 |
| | | (0.107) | | | (0.092) | |
| Remedial Lessons | | 0.162 | 0.0000823 | | 0.153 | 0.0003131 |
| | | (0.049)*** | | | (0.052)*** | |
| Values community service | | 0.259 | 0.0001514 | | 0.268 | 0.0005997 |
| | | (0.050)*** | | | (0.057)*** | |
| Low Esteem | | 0.004 | 0.0000022 | | 0.097 | 0.000187 |
| | | (0.060) | | | (0.054)* | |
| Discipline Problems in School | | 0.202 | 0.0001006 | | 0.064 | 0.0001264 |
| | | (0.050)*** | | | (0.052) | |
| Family Income | | -0.000 | 0.0000000 | | -0.000 | 0.0000000 |
| | | (0.000)*** | | | (0.000)*** | |
| Constant | -1.664 | -1.966 | | -4.405 | -2.010 | |
| | (1.051) | (0.120)*** | | (1.052)*** | (0.096)*** | |
| Observations | 11,805 | 11,805 | | 9,360 | 9,360 | |
| Log pseudo-likelihood | -3677.204 | | | -3065.004 | | |
| Wald Chi2 | 1031.551 | | | 1164.730 | | |
| Prob Wald > Chi2 | 0.000 | | | 0.000 | | |

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The first probit equation regresses enlistment variable against all exogeneous variable and JROTC. The second probit equation estimates JROTC with all the IVs identified in the 2SLS model.

We do not find any statistical significance of the JROTC variable in the bivariate probit model. The partial effects, if any, are very small. Other variables like the demographics, affordability of college, college expectations, parental support, military interest, family and peer influence to join the military display similar results as that of the 2SLS model.

## C. SUMMARY OF RESULTS

Our empirical findings show that JROTC participation increase youths' probability of enlisting in the military when we treat the JROTC variable as exogenous for both the sophomore and senior cohort. From our single equation probit and logit models, we find that JROTC participation increase youths' probability of enlisting in the military. When we factor in self-selection into the JROTC program, we find that both 2SLS and bivariate probit model both present negligible impact of JROTC on enlistment decisions. Table 22 presents a summary of the coefficients of the JROTC variable using the four econometric methods.

Table 22. Summary of Coefficients of JROTC

| | Single Equation LOGIT Odds Ratio | Single Equation PROBIT | PROBIT Partial Effects | 2SLS/OLS | Bivariate PROBIT | Bivariate PROBIT Partial Effects |
|---|---|---|---|---|---|---|
| Sophomore | 0.609 | 0.320 | 0.028 | 0.702 | 0.842 | 0.0011423 |
| | (0.182)*** | (0.098)*** | (0.011)** | (0.378)* | (0.603) | |
| Senior | 0.446 | 0.271 | 0.018 | -0.232 | 0.117 | 0.0002694 |
| | (0.178)** | (0.100)*** | (0.008)** | (0.378) | (0.480) | |

# VII. RESULTS FROM DMDC DATA

## A. INTRODUCTION

In this chapter we intend to further contribute to the empirical evidence on the determinants of JROTC's impact on reenlistment and attrition. We worked on a sample drawn from the Defense Manpower Data Center, which consists of the entire population of recruits that enlisted in the Army, Navy, Air Force and Marine Corps from FY80 to FY00, excluding FY87. Its longitudinal nature makes it possible to look at whether a recruit participated in JROTC prior to entering the military, and the way information is displayed allows simultaneous estimations of the whole population. The theoretical framework allows us to estimate jointly the decision to reenlist and the impact JROTC has on attrition. The empirical strategy applied uses a logit and probit model to extend the principles of generalized linear models to better treat the case of a dichotomous dependent variable (reenlist). Further, we analyzed survival-time data by the method of Proportional Hazards Regression (Cox) to determine whether survival rates for JROTC participants are higher then that of non-JROTC participants

## B. REENLISTMENT DECISION EMPIRICAL FINDINGS

The DMDC Cohort files are fiscal year files that track the careers of active duty enlisted service members, including prior service people, who entered active duty through the U.S Military Entrance Processing Command (USMEPCOM). Using the USMECOM files and the active duty master and loss files, an individual is tracked quarterly for the first four and a half years and then every six months until the career has been followed. Among the explanatory variables used for both models we have gathered variables indicating JROTC participation, demographics, and military experience. Youth program designates JROTC participation. Demographics predictors include age at entry, highest year of education, sex, race ethnicity, and marital status/dependents. Military experience variables are Armed Service Vocational Aptitude Battery (ASVAB) raw scores, prior service, paygrade, highest paygrade and reenlistment eligibility. The variable groupings are not all inclusive and contain an array of other variables that could

be used for future research. We have selected from the data elements those variables that combined with JROTC participation have an impact on retention and attrition. The summary of the variables and their definitions is provided in Appendix B.

Two methods were employed to analyze the data. First, because the percentage of JROTC participants in each cohort was relatively small, we appended the data sets to create one massive data set, which contains cohorts FY80 through FY00, excluding FY87. We were able to append the data because each file contained the same variables but different observations. Secondly, we had to create a second data set by which to manipulate it in ways to facilitate summary and analysis of survival time data. The data preparation and organization we do in order to subsequently apply easy estimation methods for discrete time models are closely related to the tasks which one has to do if incorporating time-varying covariates of a continuous time model. Because we focus on time-to-absorbing-event data there are no complications arising from left censoring, gaps, left truncation, or multiple events. There are no missing values and the data do not need to be weighted. Lastly, there are no time varying covariates. In this model, all the explanatory variables in our regressions have a fixed value for each subject. For both analysis methods JROTC is the covariate of interest and is used to determine the impact JROTC has on reenlistment and attrition.

The survival time data used for this analysis has a very simply structure. There is one row in the data set for each 'subject'. Columns in the data set (variables) contain at least two types of information for each subject. The length of time in the state (the survival time = the length of time the subject was exposed to the risk of experiencing a 'failure'; and censoring status (a variable equal to 1 if the person experienced a 'failure', and equal to 0 otherwise). Other columns in the data set include variables used as regressors in estimation of multivariate hazard models.

## C. LOGIT AND PROBIT MODEL RESULTS

The logit and probit model results for the reenlistment model are summarized in Table 23**.** As indicated by the table both logit and probit led to the same conclusions for the same data. The probit model differs from the logistic model in that the dependent

variable is no longer the odds of one outcome versus another, rather, we are now seeking to predict, or cumulative normal probability of one outcome versus another. However, since the probits are formed in the same fashion (cumulatively, using the highest category as the baseline or denominator) as the logits, the general approach to interpretation is identical to that of the logit model.

Table 23. Coefficients, Standard Errors & Partial Effects Of The Single Equation Reenlistment LOGIT And PROBIT Models

| Variables | Logit Model | Probit Model | Partial Effects from Probit [a] |
|---|---|---|---|
| JROTC | 0.168 | 0.089 | 0.035 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| Highest Paygrade E1 | -5.405 | -3.011 | -0.585 |
| | (0.014)*** | (0.007)*** | (0.001)*** |
| Highest Paygrade E2 | -5.327 | -2.989 | -0.502 |
| | (0.015)*** | (0.008)*** | (0.001)*** |
| Highest Paygrade E3 | -4.464 | -2.566 | -0.533 |
| | (0.014)*** | (0.007)*** | (0.001)*** |
| Highest Paygrade E4 | -3.216 | -1.863 | -0.589 |
| | (0.013)*** | (0.007)*** | (0.002)*** |
| Highest Paygrade E5 | -0.944 | -0.497 | -0.182 |
| | (0.014)*** | (0.007)*** | (0.002)*** |
| Highest Paygrade E6 | 2.237 | 1.085 | 0.401 |
| | (0.021)*** | (0.010)*** | (0.003)*** |
| Highest Paygrade E7 | 4.590 | 1.968 | 0.565 |
| | (0.069)*** | (0.024)*** | (0.002)*** |
| Highest Paygrade E8 | 5.669 | 2.404 | 0.581 |
| | (0.214)*** | (0.067)*** | (0.003)*** |
| Highest Paygrade E9 | 6.296 | 2.726 | 0.585 |
| | (0.579)*** | (0.171)*** | (0.003)*** |
| Age | -0.019 | -0.012 | -0.005 |
| | (0.001)*** | (0.000)*** | (0.000)*** |
| Navy | 0.420 | 0.229 | 0.090 |
| | (0.004)*** | (0.002)*** | (0.001)*** |
| Air force | 0.648 | 0.374 | 0.148 |
| | (0.004)*** | (0.003)*** | (0.001)*** |
| Entry paygrade E2 | -0.101 | -0.050 | -0.019 |
| | (0.004)*** | (0.002)*** | (0.001)*** |
| Entry paygrade E3 | 0.026 | 0.034 | 0.013 |
| | (0.005)*** | (0.003)*** | (0.001)*** |
| Entry paygrade E4 | -0.667 | -0.347 | -0.128 |
| | (0.010)*** | (0.006)*** | (0.002)*** |
| Entry Paygrade E5 | -3.030 | -1.630 | -0.383 |
| | (0.017)*** | (0.009)*** | (0.001)*** |
| Marine Corps | -0.344 | -0.179 | -0.069 |
| | (0.005)*** | (0.003)*** | (0.001)*** |
| Female | 0.024 | 0.002 | 0.001 |
| | (0.004)*** | (0.002) | (0.001) |
| Term of Enlistment two years | 0.935 | 0.529 | 0.209 |
| | (0.007)*** | (0.004)*** | (0.002)*** |
| Term of Enlistment three years | 0.343 | 0.195 | 0.077 |

| | | | |
|---|---|---|---|
| | (0.004)*** | (0.002)*** | (0.001)*** |
| Term of Enlistment five years | -0.050 | -0.041 | -0.016 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Black | 0.645 | 0.372 | 0.147 |
| | (0.004)*** | (0.002)*** | (0.001)*** |
| Hispanic | 0.235 | 0.140 | 0.055 |
| | (0.005)*** | (0.003)*** | (0.001)*** |
| AFQT Category CAT IV and V | 0.169 | 0.091 | 0.036 |
| | (0.006)*** | (0.003)*** | (0.001)*** |
| AFQT Category CAT IIIB | 0.130 | 0.075 | 0.029 |
| | (0.004)*** | (0.002)*** | (0.001)*** |
| AFQT Category CAT II | -0.072 | -0.036 | -0.014 |
| | (0.004)*** | (0.002)*** | (0.001)*** |
| AFQT Category CAT I | -0.246 | -0.132 | -0.051 |
| | (0.007)*** | (0.004)*** | (0.001)*** |
| Marital Status - Single with Children | 0.005 | 0.003 | 0.001 |
| | (0.010) | (0.006) | (0.002) |
| Marital Status - Married no Children | 0.173 | 0.094 | 0.037 |
| | (0.014)*** | (0.008)*** | (0.003)*** |
| Marital Status -Married with Children | 0.161 | 0.086 | 0.034 |
| | (0.005)*** | (0.003)*** | (0.001)*** |
| No high school diploma | 0.153 | 0.083 | 0.032 |
| | (0.007)*** | (0.004)*** | (0.002)*** |
| Some college | -0.402 | -0.235 | -0.088 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| College | -1.009 | -0.598 | -0.207 |
| | (0.011)*** | (0.006)*** | (0.002)*** |
| GED | 0.133 | 0.071 | 0.028 |
| | (0.007)*** | (0.004)*** | (0.001)*** |
| Prior Service | 0.169 | 0.086 | 0.034 |
| | (0.007)*** | (0.004)*** | (0.002)*** |
| Cohort FY00 | 2.624 | 1.478 | 0.497 |
| | (0.008)*** | (0.005)*** | (0.001)*** |
| Cohort FY81 | 0.063 | 0.028 | 0.011 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY82 | 0.139 | 0.066 | 0.026 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY83 | 0.112 | 0.049 | 0.019 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY84 | 0.174 | 0.082 | 0.032 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY85 | 0.248 | 0.120 | 0.047 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY86 | 0.262 | 0.125 | 0.049 |
| | (0.008)*** | (0.004)*** | (0.002)*** |
| Cohort FY88 | 0.251 | 0.115 | 0.045 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| Cohort FY89 | 0.280 | 0.131 | 0.051 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| Cohort FY90 | 0.396 | 0.196 | 0.077 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| Cohort FY91 | 0.433 | 0.217 | 0.086 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY92 | 0.391 | 0.193 | 0.076 |

| | | | |
|---|---|---|---|
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY93 | 0.313 | 0.150 | 0.059 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY94 | 0.348 | 0.171 | 0.068 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY95 | 0.307 | 0.149 | 0.058 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY96 | 0.291 | 0.140 | 0.055 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY97 | 0.582 | 0.305 | 0.121 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY98 | 0.850 | 0.446 | 0.177 |
| | (0.009)*** | (0.005)*** | (0.002)*** |
| Cohort FY99 | 1.385 | 0.742 | 0.288 |
| | (0.008)*** | (0.005)*** | (0.002)*** |
| Constant | 2.021 | 1.205 | |
| | (0.019)*** | (0.010)*** | |
| Observations | 4598234 | 4598234 | 4598234 |
| Pseudo- R Squared | .411 | .409 | |

Standard errors are in parentheses

* significant at 10%, ** significant at 5%, *** significant at 1%

Probit [a] Marginal effects are calculated for a white male, single with no children, enlisted in the Army, non-JROTC participant, high school diploma grad, non-prior service, AFQT CAT IIIA who is in Cohort FY80.

### 1. Hypothesized Effects of Variables on Reenlistment

We estimated a binary logit model for reenlistment by creating a dichotomous response variable called reenlist. This model is to predict reenlistment using the aforementioned covariates. The signs for the coefficients for the all the covariates were as expected except Marital Status- single with children, married no children, and married with children. All of the covariates to include those with unexpected signs were found to be statistically significant at the .01 level with the exception of Cohort FY 82 and 88 which were significant at the .05 .GED was found to be insignificant.

#### *a. JROTC Graduate*

The covariate JROTC, which is the basis of this thesis, is found to have a positive effect one ones decision to reenlist. This can be explained by the nature of the program. JROTC introduces youth to military theory, customs and fundamental skills. The JROTC program is an institution that promotes good citizenship and responsibility by teaching values and by training youth to organize and achieve worthwhile objectives together. It was our assumption that some of that training would spill over and increase the desire of youth who join the military to stay.

### *b. Military Experience*

We hypothesized that the covariate, term of enlistment (1-3 year contract), would have a negative impact on ones decision to reenlist. In other words the shorter the initial term, the less commitment the individual is willing to make to the military. Results indicated that all of the defined terms of enlistment had a positive impact on ones decision to reenlist with the exception of three years. We further hypothesized that military personnel with higher AFQT scores would be more likely to depart the military and pursue other options; hence, the results indicated that personnel that fell into the two highest AFQT categories were less likely to reenlist. This is most likely due to the desire of higher scoring individuals to seek out employment opportunities in the civilian sector. Military personnel with high AFQT scores qualify for the more technical jobs, which provide skills and training that are transferable to the civilian sector. This would inevitably lead to a desire to continue advanced education; therefore, departing the service after their initial term.

### *c. Demographics*

An explanation for the unexpected signs on Marital Status SNC, MNC, and MWC would be, it is difficult for single parents to maintain a military career with lengthy duty periods and possible deployments. Single parents find it difficult to meet all the demanding requirements with the given time constraints when they have children to care for, thus, they do not reenlist. Married personnel without children have more options available and are not necessarily tied to the military because of the need for medical care and family support services. Married personnel with no children have more flexibility and if not satisfied would be more likely to depart the service if they felt better opportunities were available in the civilian sector.

The service of accession clearly has an impact on ones decision to reenlist and is promulgated by their taste and liking of that service. We hypothesized that service of accession would have a positive impact on reenlistment. Results indicate that the Marine Corp has a negative impact on ones decision to reenlist. That can be explained by the robust training and demanding nature of the Marine Corps.

### 2. Interpretation of Coefficients

The coefficients are the results of the logit and probit regressions. These coefficients indicate the amount of change expected in the log odds when there is a one unit change in the predictor variable with all of the other variables in the model held constant. Coefficients close to 0 suggest that there is no change due to the predictor variable. The base case is characterized as a high quality recruit. White male, single no children, entry paygrade E1, entered the Army, non-JROTC participant, eligible for reenlistment, high school diploma grad, contracted for 4 years, and AFQT Mental Category IIIA. This service member would be the most likely candidate to reenlist.

#### *a. JROTC Graduate*

The coefficient for JROTC in the logit model is 0.168. Thus, I would predict that the log odds for reenlistment would increase by .168 for every additional military member who participated in JROTC when all other predictor variables are held constant. The predictability of reenlist based on the explanatory variable JROTC is minimal at best. It must be noted that estimated logit coefficients do not provide a direct interpretation because of the non-linear nature of the model. A change in Y from a one unit change in X1 does not just depend on $\beta$ but also on the values of the other predictor variables. The interpretation of the probit model is if people participate in JROTC, on average, the probit (probability of reenlistment) will increase by 0.089. We will further explore the predictor variables that indicate a negative impact on the log odds of reenlisting.

#### *b. Military Experience*

The coefficient for age in the logit model is -0.019; therefore, the log odds for reenlistment would decrease by .019 for each additional year of age, ceteris paribus. Interpreting the probit model indicates that for each additional year of age, on average, the probit (probability of reenlistment) will not change. For each remaining covariate with a negative coefficient the probabilities of reenlistment decrease proportionally. The coefficient for Marine Corps is -0.344; therefore, the log odds for reenlistment would decrease by .344 for each member that enlists in the Marine Corps. It was no surprise that, personnel with high AFQT scores were less likely to reenlist. For AFQT Mental

Category II the coefficient is -0.072; therefore, the log odds for reenlistment would decrease by .072 for every additional recruit in AFQT Mental Category II and .246 for AFQT Mental Category I respectively.

### *c. Demographics*

Other predictors that proportionally decreased the log odds for reenlistment were personnel with some college or a college degree, personnel who entered in the service in paygrades E2, E4 and E5, personnel who's highest paygrade was E1 – E5 and contract lengths for greater than 5 years. The coefficient for the variable some college is -0.402; hence, the log odds for reenlistment would decrease for each additional recruit with some college. We would assume that depending on the economic conditions that member may feel as though they can achieve more in the civilian sector. In addition, they may have joined the service simply for the educational benefits and the desire to serve only one term. In that instance it would hold true that enlisted personnel with some college would be less likely to reenlist.

Personnel with college degrees are also less likely to reenlist as well. This is not to say that these personnel leave the service. Programs such as Officer Candidate School are offered to high quality enlisted personnel who posses a bachelors degree in a sought after specialty. Personnel whose highest paygrade was E1 –E5 were found to be less likely to reenlist. This can be attributed to many factors; however, lack of steady progression in the ranks may lead to atrophy. One of the biggest accomplishments for an enlisted person is to advance in paygrade, which leads to greater responsibility, higher pay and overall job satisfaction. If a service member in unable to promote he/she is less likely to reenlist.

The coefficient for enlisted personnel who are single with children is -0.005. This translates into, the log odds for reenlistment will decrease by 0.005 for each recruit that is single and has children. Single enlisted personnel with children typically have a difficult time in the military due to child care constraints. The pay is not substantial enough to pay child care and living expenses on the civilian economy. For single Navy and Army personnel this is extremely taxing. The service member is required to have a guardian available in the event of a deployment. Also, some find it

extremely difficult to leave young children behind while they deploy; hence, a lower reenlistment rate for enlisted persons that are single and have children.

The coefficient for the variable term of enlistment – 5 years is -0.050. This translates into a decrease in the log odds of reenlistment by .050. This result was surprising. A longer contract length is a sign of commitment and typically longer contract lengths are associated with reenlistment bonuses. Unfortunately, some enlisted personnel only have the opportunity to experience one command and from that one experience they draw their overall conclusions about the military. If the initial tour of a new recruit is not a positive experience than they would be less inclined to reenlist. One variable that produced a positive effect on reenlistment was female. The coefficient for the variable female is .024; therefore, the log odds for reenlistment would increase for each female recruit. Females have historically been under represented in the armed forces as noted in chapter four. Traditionally, the armed services did not employ many females because there were several jobs that were combat related and not open to females. Surprisingly, the number of female new recruits has increased; in addition, the number of females that participate in JROTC has increased significantly in the past decade.

Obviously, if a member is not qualified to re-enlist than they would definitively have a negative impact or cause a decrease in the log odds of reenlisting; therefore, those enlisted personnel that were not eligible for reenlistment were excluded from the sample population.

All of the cohorts were statistically significant at the 0.10 level and they all had a positive impact on the log odds to reenlist. This could be directly related to the end of the drawdown and depressed economic conditions; furthermore, the past four years have seen an increase in the unemployment rate. Jobs growth is lagging and the military is a source of stability and steady income

### 3. Interpretation of Partial Effects – Probit

As previously stated all of the covariates in the reenlistment model were found to be statistically significant at the 0.10 level. Estimating the partial (or ceteris paribus) effect of an explanatory variable on a response variable is fundamental in the empirical

social sciences. If we assume that all explanatory variables are exogenous, and that the response variable has a conditional expectation linear in functions of the explanatory variables, then partial effects are easily estimated by ordinary least squares.

The results of the partial effects probit model were similar to that of the logit model. The covariates which had a negative impact on reenlistment were the same as those in the logit model. The coefficient for the covariate highest paygrade is -0.585; which translates to a decrease in reenlistment by .585. All of the remaining covariates of highest paygrade had a negative impact on reenlistment respectively. The coefficient for the covariate age is -0.005. This result indicates that age decreases reenlistment by 0.005. Entry paygrade was also found to have a negative impact on reenlistment at -0.019, -0.128, and -0.383 respectively. The service of accession that had a negative impact on reenlistment was Marine Corps at -0.069. The higher term of enlistment, 5 years, had a negative impact on reenlistment at -0.016. Lastly, personnel found to have some college or a college degree tend to be less likely to reenlist at -0.088 and -0.207 respectively.

All of the remaining covariates were found to positively impact reenlistment. The variable of interest, JROTC, is statistically significant and positively influences reenlist by 0.035 or 3.5%. As a result of longevity in the service those personnel that acquired the higher paygrades E6 – E9 were more likely to reenlist. A service-member who acquired the rank of E6 would impact reenlistment by .401 or 40%. Enlisted personnel in the Air Force were found to reenlist 0.148 or 14% more often than Navy personnel at 0.090 or 9%. Although statistically significant females impact on reenlistment was marginal at .001 or less than .1%. Military personnel who enlisted for two or three year contracts were more likely to reenlist at .209 or 20% and .077 or 7.7% respectively. Black military personnel were found to be more likely to reenlist than their Hispanic counterparts at 0.147 or 14% vice 0.055 or 5.5%. Those personnel who scored in the lower AFQT categories are more likely to reenlist. The covariates for AFQT Category IIIB and IV are 0.001which translates to lower AFQT category effects reenlistment by less than one percent. The same holds true for personnel who do not have a high school diploma or recipients of the GED. The impact on reenlistment for non-high school grads and GED recipients is less than 1%. Although statistically significant, marital status was

found to have a minimal effect on reenlistment. Personnel who are single with no children, or married with children impact reenlistment by .001 and .003 respectively. Lastly, the cohort personnel belong to have a marginal effect on reenlistment at less than 1%.

### 4. Model Goodness of Fit

When employing a multivariate model, there is always the concern of the statistical significance of each of the predictor variables as well as the overall goodness of fit of the model. For both the probit and logit models the same predictor variables were used to predict reenlistment for approximately 4, 598,234 observations. This data spanned the course of 19 years and the size of the population surely impacted the significance of each covariate. All of the covariates used to estimate these models were found to be significant at the .1 with the exception of the three previously mentioned.

Goodness-of-fit is essential in determining whether a model is sound. For a logit model, one must look at the likelihood ratio chi-square with 55 degrees of freedom. One degree of freedom is used for each predictor variable in the logistic regression model. The likelihood-ratio chi-square is defined as $2(L_1 - L_0)$, where $L_0$ represents the log likelihood for the "constant only" model and $L_1$ is the log likelihood for the full model with the constant and predictors. The likelihood chi square test is calculated manually as 2*(-3355728.6 – (-3175705.2) = 360046.8. The Prob>chi2 is the probability of obtaining the chi square statistic given that the null hypothesis is true. In other words, this is the probability of obtaining this chi-square statistic (360046.8) if there is in fact no effect of the independent variables, taken together, on the dependent variable. In this case, the model is statistically significant because the p-value is less than .000.

Another measure of goodness-of- fit for logit models is observing the correctly predicted observations in the sample, or pseudo- $R^2$. Technically, $R^2$ cannot be computed the same way in logistic regression as it is in OLS regression. The pseudo- $R^2$, in logistic regression, is defined as $(1 - L_1)/L_0$, where $L_0$ represents the log likelihood for the "constant-only" model and $L_1$ is the log likelihood for the full model with constant predictors. The pseudo- $R^2$ for this model is 0.411. This translates into 41.1% correctly

predicted observations. This means that 41.1 percent of the observations in the data set are correctly classified as members who will reenlist and those who will not reenlist.

## D. SURVIVAL ANALYSIS MODEL RESULTS

The results from the Cox Proportional Hazards model are summarized below in Table 24. The Cox regression procedure is used to evaluate the effects of explanatory variables or covariates on the hazard rate using a proportional hazard regression model as discussed in the theoretical chapter. Cox's partial likelihood model allows derivation of estimates of the coefficients $\beta$ from a PH model, but places no restrictions at all on the shape of the baseline hazard.

Using the statistical package STATA, non-parametric estimates of the baseline hazard are provided as opposed to coefficient estimates. The hazard ratio gives the estimated percent change in the hazard for a one-unit increase in the covariate. Cox regression concerns itself with time until failure occurs, and for this thesis failure is defined as attrition. We fit a model in which we account for the effect that as time goes by enlisted personnel leave the military (either at the end of obligated service or for some other reason). Each of the covariates used in this model mirror those applied in the retention model.

Table 24. Regression Results Using the Cox Regression Method

| | Cox Model |
|---|---|
| JROTC | 0.914 |
| | (0.003)*** |
| Age | 1.010 |
| | (0.000)*** |
| Navy | 0.887 |
| | (0.001)*** |
| Air Force | 0.841 |
| | (0.001)*** |
| Marine Corps | 0.802 |
| | (0.001)*** |
| Female | 1.165 |
| | (0.002)*** |
| Term of Enlistment two years | 1.347 |
| | (0.004)*** |
| Term of Enlistment three years | 1.158 |
| | (0.002)*** |
| Term of Enlistment five years | 0.958 |
| | (0.003)*** |
| Term of Enlistment six years | 0.924 |
| | (0.002)*** |

| | |
|---|---|
| Black | 0.786 |
| | (0.001)*** |
| Hispanic | 0.880 |
| | (0.002)*** |
| AFQT Category IV and V | 0.907 |
| | (0.002)*** |
| AFQT Category IIIB | 0.948 |
| | (0.001)*** |
| AFQT Category II | 1.040 |
| | (0.001)*** |
| AFQT Category I | 1.140 |
| | (0.003)*** |
| Marital Status – Single with Children | 1.041 |
| | (0.004)*** |
| Marital Status – Married no Children | 1.027 |
| | (0.005)*** |
| Marital Status – Married with Children | 1.022 |
| | (0.002)*** |
| No High School Diploma | 0.917 |
| | (0.002)*** |
| Some College | 1.080 |
| | (0.003)*** |
| College graduate | 1.471 |
| | (0.006)*** |
| GED | 1.000 |
| | (0.002) |
| Prior service | 0.970 |
| | (0.002)*** |
| Entry Paygrade E2 | 1.045 |
| | (0.002)*** |
| Entry paygrade E3 | 1.114 |
| | (0.002)*** |
| Entry paygrade E4 | 1.289 |
| | (0.005)*** |
| Entry paygrade E5 | 3.003 |
| | (0.016)*** |
| Highest paygrade E2 | 77.223 |
| | (0.803)*** |
| Highest paygrade E3 | 43.832 |
| | (0.454)*** |
| Highest paygrade E4 | 21.170 |
| | (0.219)*** |
| Highest paygrade E5 | 9.031 |
| | (0.093)*** |
| Highest paygrade E6 | 3.066 |
| | (0.032)*** |
| Highest paygrade E7 | 1.617 |
| | (0.018)*** |
| Highest paygrade E8 | 1.069 |
| | (0.015)*** |
| Highest paygrade E9 | 0.622 |
| | (0.018)*** |
| Cohort FY00 | 0.731 |
| | (0.003)*** |
| Cohort FY81 | 0.993 |
| | (0.002)*** |
| Cohort FY82 | 0.994 |
| | (0.003)** |

| | |
|---|---|
| Cohort FY83 | 1.008 |
| | (0.003)*** |
| Cohort FY84 | 0.979 |
| | (0.003)*** |
| Cohort FY85 | 0.981 |
| | (0.003)*** |
| Cohort FY86 | 0.992 |
| | (0.003)*** |
| Cohort FY88 | 1.006 |
| | (0.003)** |
| Cohort FY89 | 1.015 |
| | (0.003)*** |
| Cohort FY90 | 0.978 |
| | (0.003)*** |
| Cohort FY91 | 0.963 |
| | (0.003)*** |
| Cohort FY92 | 0.943 |
| | (0.003)*** |
| Cohort FY93 | 0.961 |
| | (0.003)*** |
| Cohort FY94 | 0.960 |
| | (0.003)*** |
| Cohort FY95 | 0.969 |
| | (0.003)*** |
| Cohort FY96 | 0.960 |
| | (0.003)*** |
| Cohort FY97 | 0.873 |
| | (0.003)*** |
| Cohort FY98 | 0.855 |
| | (0.003)*** |
| Cohort FY99 | 0.779 |
| | (0.003)*** |
| Observations | 4992851 |
| | |
| Number of observations | 4,598,234 |
| | |
| | |
| | |
| Number of personnel who attrite | 4138619.000 |
| Time at Risk | 26624479.000 |
| Standard errors in parentheses | |
| * significant at 10%; ** significant at 5%; *significant at 1% | |

### 1. Hypothesized Effects of Variables on Attrition

All of the covariates given in the specified model displayed the appropriate effects. Also, all of the covariates in the Cox regression model were statistically significant at the (.10, .05 or .1) levels with the exception of GED. The base case is a non-prior service white male, single with no children, high school diploma graduate, enlisted in the Army at paygrade E1 in FY80.

We hypothesized that the shorter the term of enlistment the more likely an enlisted person would attrite. A term of enlistment of one year is naturally not significant because you cannot enlist for a one year term; therefore, that variable would have no impact on attrition. We did however hypothesize that enlisted personnel with some college would probably depart the service after initial tour to continue college education with educational benefits received in the military. The fact that some college and college graduates were both statistically significant may be indicative of the number of enlisted personnel that actually join the military with some college background.

The only variable that was found to be insignificant in determining attrition is GED. This could be explained by the requirements for personnel to enlist. In the early eighties the services enlisted many recruits who did not have a high school diploma or equivalency certificate. With the advent of newer technologies and the requirements for military personnel to be better equipped and capable of learning a high school diploma is now required for entrance in the armed services. Each branch of service has specific quotas for the number of personnel that can enter with a GED. The Army only allows 10 percent of their total enlistments each year to have a GED. To even be considered, a high school dropout (GED) must score at least a 50 on the AFQT. Even with a GED, the chances are not good if enlisting in the Air Force. Only about ½ of a percent of all Air Force enlistments each year are GED-Holders. To even be considered for one of these few slots, a GED-holder must score a minimum of 65 on the AFQT. As with the Army and Air Force, those without a high school education are ineligible. The Marine Corps limits GED enlistments to no more than 5 percent per year. Those with a GED must score a minimum of 50 on the AFQT to even be considered. Lastly, the Navy allows only 5 to 10 percent per year, but they must score a minimum of 50 on the AFQT. Additionally, high school dropouts must be at least 19 years of age, and show a proven work history.

JROTC participation, the variable of interest is hypothesized to reduce attrition. Not withstanding the specified purpose of the JROTC program, we assumed that participants who self-selected into the program would have a positive taste for the military; thus, remain in active service.

The effects of service of accession were expected to vary across cohorts. Ones liking for a particular type of job and work environment would dictate the choice of service chosen. All of the services were statistically significant and positively impacted attrition. It was surprising that enlisted personnel who chose the Marine Corp were not more inclined to attrite. As mentioned previously, the Marine Corp is a challenging career choice and after an initial enlistment some may not be inclined to sign on for an additional tour. It is likely that enlisted personnel who incur an initial obligation of 5 or 6 years would be less likely to attrite. We hypothesized that enlisted personnel who accepted an initial obligation of more than 5 years are somewhat committed to their decision to serve and will be less likely to attrite.

Previous research has indicated that blacks and minorities are more prone to the military and less likely to attrite. The reasons are varied and it has not been definitively proven; however, the opportunities for education and personal growth without many of the obstacles that exist in the civilian sector are what draw blacks and minorities to military service. Additionally, the south has always had the largest number of Army enlistees and that is attributed to the overwhelming Army presence in the South. There are Army bases in over 26 of the states the highest concentration is in the Southern region. Blacks and minorities tend to migrate to where the opportunities for growth and advancement are residing and the military has been a stepping stone for many.

AFQT Mental category is a predictor of ones aptitude and skill ability. We hypothesized that enlisted personnel who fall into the top two AFQT categories (CATI, II) would be more likely to leave the military because they would typically qualify for the more technical jobs; hence, would gain the training and knowledge on behalf of the military and proceed to the civilian sector where the average wage is proportionally higher. This was the effect we encountered. Enlisted personnel in the top two AFQT categories were found to have a higher probability of attrition. Prior enlisted personnel were also found to have a greater propensity to remain in the military. That can be explained by their decision to return to military after some specified period of times. Many enlisted persons leave the military after their initial enlistment only to find themselves unprepared to function in the civilian sector. If an enlisted person leaves the

military they can reenter prior to expiration of 180 days. Typically, there is no loss of paygrade; however, job availability may dictate military occupational specialty (MOS) received.

### 2. Interpretation of Hazard Ratios

The interpretation of hazard ratios requires careful consideration. The output included p-values for the tests of the null hypotheses that each regression coefficient is zero, or, equivalently, that each hazard ratio is one. That all hazard ratios are apparently close to one is a matter of scale. Hence, any value less than one represents a decrease in the hazard, and any value greater than one represents an increase in hazard.

#### *a. JROTC Graduates*

The variable of interest, JROTC, indicates that holding all other variables constant, JROTC participants have a smaller hazard ratio than non-JROTC participants. In fact, the hazard ratio can be interpreted to indicate that JROTC participants have about 91 percent of the hazard of non-JROTC participants, which is highly significant at the .01 level compared against the base case, which was non-JROTC participant. JROTC participants' survival rate is greater than that of non-JROTC participants. All of the covariates in the model were found to be influential in affecting the survival of enlisted personnel with the exception of the three previously mentioned.

#### *b. Military Experience*

All of the variables for service of accession were found to be highly significant (<0.01 level) when compared against the base case which was Army. Enlisted personnel who join the Navy, as hypothesized, exhibited a hazard just 88 percent of the hazard for Army enlistees. Personnel who joined the Air Force exhibited a hazard just 84 percent of the hazard for Army enlistees, *ceteris paribus*. Additionally, Marine enlisted personnel exhibit a hazard just 80 percent of the hazard for that of Army enlisted personnel indicating that their survival rate is higher than Army enlistees.

The most influential of the length of contract variables was term of enlistment (6 yrs). Enlisted personnel who signed an initial contract of 6 years when compared against the base case, which is 4 year term of enlistment , exhibited a hazard

just 92 percent of the hazard for 4 year contract holders, *ceteris paribus.* Conversely, 3 year contract holders exhibit a hazard 115 percent that of 4 year contract holders indicating that their survival rate is much lower than 4 year contract holders.

The AFQT Mental Categories were found to be highly significant when compared against the base case which was Mental Category IIIA. Enlisted personnel in Mental Category IIIB, as hypothesized, exhibited a hazard just 94 percent of the hazard for CAT IIIA personnel, *ceteris paribus.* On the other hand, CAT I personnel exhibit hazards 104 percent that of CAT IIIA personnel indicating that their survival rate is much lower than CAT IIIA personnel.

The model indicates that, *ceteris paribus*, prior service enlisted personnel have a smaller hazard ratio than non-prior service personnel. Consequently, the hazard ratio can be interpreted to indicate that prior service personnel have about 97 percent of the hazard of the non-prior enlisted personnel, which is significant at the 0.10 level. Prior enlisted personnel have a higher survival rate than non-prior enlisted personnel.

The variable entry paygrade was found to be highly significant when compared against the base case which was E1. None of the entry paygrades had a dominant impact on survival. Enlisted personnel who entered at paygrade E2 exhibited hazards 104 percent that of E1 personnel indicating that their survival rate is much lower than E1 personnel.

The variable highest paygrade was statistically significant. The highest paygrade that had the most significant impact on attrition was E9. Enlisted personnel who acquired the rank of E9, as hypothesized, exhibited a hazard just 62 percent of the hazard of E1 personnel, *ceteris paribus*. Conversely, E7 personnel exhibit hazards 161 that of E1 personnel indicating that their survival rate is much lower than E1 personnel. Typically, once enlisted personnel reach paygrade E7 they are usually eligible for retirement and this would explain the low survival rate for personnel with highest paygrade E7.

The fiscal year that an enlisted person joins the military has been found to impact their survival rate. All cohorts were found to be highly significant (<.01 level)

when compared against the base case which was FY80. Enlisted personnel who joined in FY97, FY98, FY99 and FY00, exhibited a hazard 87 percent, 84 percent, 77 percent and 73 percent, prospectively for FY80 enlisted personnel, *ceteris paribus*.

***c. Demographics***

The interpretation of the hazard rate for age at enlistment, which was also significant at the .01 level, is slightly different from that for binary variables. The hazard ratio of 1.010 indicates that a one-year increase in age increases the hazard by 100(1-1.010) percent, or -1.0 percent. Thus, if all else is held constant, the difference in hazard between a 22 and 20 year old enlisted person would be (-)2 percent increase for the 22 year old. The size of the hazard for the variable age was unexpected and not as hypothesized. We assumed that as an enlisted persons age increased their survival rate would increase.

As hypothesized, the variables for minorities were found to be significant at the .01 level. The variable Black was found to be the most influential affecting the survival of enlisted personnel. The variable Hispanic was also found to have a profound affect on the survival rate of enlisted personnel, when compared against the base case which was white. Black enlisted personnel, as hypothesized, exhibited a hazard just 78 percent of the hazard for white enlisted personnel, *ceteris paribus*. In addition, Hispanic enlisted personnel exhibited a hazard just 88 percent of the hazard for white enlisted personnel, *ceteris paribus*. Hence, Black and Hispanic enlisted personnel have a higher survival rate than white enlisted personnel.

Marital status, as hypothesized, was found to be significant at all levels. Enlisted personnel who are single with children exhibit a hazard 104 percent that of personnel who are single with no children, which is the base case. Ceteris paribus, personnel who are single with children have a lower survival rate than personnel who are single without children. These results imply that enlisted personnel who are single with children, married and or married with children have a lower survival rate than enlisted personnel who are single with no children.

One significant effect was related to gender. The model indicates that, *ceteris paribus,* female enlisted personnel have a larger hazard ratio than male enlisted

personnel. The hazard can be interpreted to indicate that female enlisted personnel have about 116 percent of the hazard of male enlisted personnel, which is significant at all levels. As hypothesized, the survival rate for female enlisted personnel is lower than that of their male counterparts.

The education variables were all found to be significant at the .01 level with the exception of GED when compared to the base case high school diploma graduate. As hypothesized, enlisted personnel with some college, college grads, or GED-holders all have low survival rates. Personnel with college degrees exhibited a hazard 147 percent of the hazard for high school diploma graduates, *ceteris paribus*. The survival rate of enlisted personnel who are college graduates is lower than that of enlisted personnel who are high school diploma graduates.

## E. SUMMARY OF RESULTS

There was not a significant difference between the outcomes of the logit and probit models. The covariate of interest, JROTC was found to have a positive impact on the log odds of reenlisting. Descriptive statistics reported that of the 4,992, 962 observations analyzed, 1,985,986 or 39.78% reenlisted and 3,006,976 or 60.22% of the overall population did not reenlist. Of those enlisted personnel that did reenlist 61,448 or 3.09% were JROTC participants. Additionally, JROTC was found to increase the logs odds of reenlisting by .168 (a small margin). This finding leads one to conclude that JROTC participants do not make up a significant segment of the enlisted ranks in the armed forces; furthermore, the fact that they participated in JROTC does not necessarily mean they will reenlist.

There are possible implications from these findings because millions of dollars are spent annually to establish new JROTC units across the country. If JROTC is a program devised to build youth with discipline and high moral caliber than the program should continue to be funded and additional monies allocated. If the underline purpose of JROTC is build an arsenal of young men and women trained and ready to respond to the nation at a moments notice than the plan should be re-evaluated. There is a misinterpretation that JROTC builds the future military force by introducing military

theory in the countries highs schools. When in all actuality, JROTC is merely a club or organization for youth in rural and urban areas to grow and learn to be responsible citizens.

The results indicate that JROTC participation has a small impact on survival rates and there are other variables that have a greater impact. Nevertheless, JROTC participation does impact attrition of enlisted personnel. JROTC participants have a higher survival rate than non-JROTC participants. The variable that had the greatest impact on survival rates was highest paygrade. As a performance indicator, highest paygrade can be used to measure sustained superior performance and military aptitude.

The military experience variable that had the most significant impact on survival rates, when compared to the base case (Army) is service of accession (Air Force). The Air Force has a long reputation of being the service of choice for many youth, who desire technical training, well maintained bases, and a civilianized culture. When compared to the Army, which is known for teamwork, technical expertise and decision making, enlisted personnel have a lower hazard ratio in the Air Force.

The demographic variable that had the greatest impact on survival rate is enlisted personnel who are black when compared to the base case which is enlisted personnel who are white. This is an important observation because the number of JROTC participants that are black has increased two-fold over the past ten years. (Refer to Table 15). Enlisted personnel who are Hispanic were also found to have high survival rates. As hypothesized, females have low survival rates due in part to the smaller number of females that enlist in the military. When compared to the base case, enlisted personnel who are married with or without children had lower survival rates than enlisted personnel who are single with no children. This outcome was contrary to what we hypothesized. We assumed that married personnel have more responsibility and thus remain in the military as a means of stability. In addition, the military has a comprehensive health insurance program, which is typically a tremendous expense in the civilian sector. Lastly, enlisted personnel who are high school diploma graduates have a higher survival rate than non-high school diploma graduates to include GED recipients.

Table 25 below summarizes the coefficients, hazard ratios and partial effects derived from the model estimates. All estimation methods employed yield statistically significant results for JROTC.

Table 25. Summary of JROTC coefficients

| | LOGIT Odds Ratios | PROBIT Partial Effects | Hazard Ratios |
|---|---|---|---|
| JROTC | 0.168 | 0.035 | 0.914 |
| Standard Error | (0.008)*** | (0.002)*** | (0.003)*** |

# VIII. CONCLUSION

## A. INTRODUCTION

Our primary research objective is to conduct an empirical analysis of the impact of JROTC participation on military enlistment, retention and reenlistment. The High School & Beyond (HSB) survey data provides us with individual level data on JROTC participation and military enlistment decisions. Using single equation probit and logit models, we find that JROTC participation increase youths' probability of enlisting in the military. On the other hand, there is a possibility that the high school students self-select into the JROTC participation based on certain characteristics but have no bearing on the enlistment decision. Using two methods, two-stage least squares (2SLS) and bivariate probit equation, we find that JROTC participation has no impact on the enlistment decision.

From the Defense Manpower Data Centre (DMDC) enlisted personnel cohort data, we find that enlisted personnel who graduated from JROTC have a positive influence on the reenlistment decision. Using survival analysis on the survival rate of JROTC graduates and non-JROTC graduates tend to stay longer than non-JROTC graduates.

## B. IMPLICATIONS OF STUDY

Our thesis research is a departure from previous studies that look at JROTC military outcomes in only general descriptive terms. Our study looked at individual-level data from the 1980 HS&B study and enlisted personnel cohort data, and conduct empirical analysis of the impact of JROTC participation on military enlistment, retention and reenlistment. The study should be of interest to many, not least that the funding for JROTC programs in high schools comes from the Defense budget in which insofar, the effectiveness and efficacy of the JROTC program with respect to the military has not been examined.

First, the multivariate analysis of JROTC influence on propensity to enlist using the 1980 HS&B data suggest that the JROTC program, at least in the 1980s, supports the

claim that it is a "thinly disguised recruiting tool" before taking into consideration self-selection into the JROTC program itself. In our treatment of JROTC participation as an endogenous variable, we use instrumental variables that attempt to characterize "at-risk" youths like extra help in schoolwork, disciplinary problems and low socio-economic status, which are related with the decision to participate in the JROTC program. The results then show that JROTC has no impact on recruitment numbers. Therefore, depending on the specification model chosen, the benefits of funding the JROTC program by DoD could or could not spillover to recruitment numbers.

On the other hand, our findings on JROTC military retention outcomes suggest that participants in the JROTC program are more likely to remain in the military and reenlist once they chose the military as a career. The JROTC program with its objectives of preparing the students for leadership roles while making them aware of their rights, responsibilities, and privileges as American citizens seem to make them better able to adapt to military service without difficulty. Moreover, JROTC participants are introduced to military training and ideology so they are fully aware prior to joining the military what is required and what the military has to offer in the way of benefits and opportunities. We would expect that JROTC participants who join the military would chose to continue their service because of the opportunities and benefits allotted to them.

Therefore, policy-makers might find it worthwhile to actively target JROTC cadets for enlistment because in the long run, it pays off in terms of higher first-term completion rates. This translates to sustaining a given end-strength with smaller number of accession which results in cost savings in the form of enlistment bonuses and training costs. Policy-makers could then utilize the JROTC program as a recruitment tool by bringing in recruiters to give guest lectures or have the instructors providing an overview of the various recruitment websites and other enlistment information. If the JROTC cadets do not wish to join the military after high school but opt to go to college, information on ROTC scholarships or other military educational incentives could also attract them to enlist in the military.

## C. LIMITATIONS OF STUDY

Our study acknowledges the datedness of the 1980 HS&B data. Moreover, it is a highly stratified sample and the number of JROTC participants made up approximately three percent of the population. The information that we have also does not allow us to differentiate between JROTC participants who choose not to enlist in the military after high school or those who would like to enlist but not accepted by the military. The choice of the instrumental variables (IV) is also subjective and good IVs are hard to find. Ideally, data from JROTC units that track high school students and post-high school employment decisions will give us better information.

Our reenlistment and survival analysis models did not factor in labor statistics such as economic conditions and unemployment rates. Instead, we attempt to capture changes in the economic conditions over the past twenty years using the cohort year dummy variables. The inclusion of the actual statistics might help explain our models better. We also would like to model the promotion rate of the enlisted personnel but we are not able to with the format of the enlisted personnel cohort data that DMDC has provided to us.

## D. FUTURE SCOPE

We see our research as the first step toward more comprehensive studies pertaining to JROTC military outcomes. One possible extension of our study is to monetize our results for a cost-benefit analysis of the JROTC program vis-à-vis other recruitment programs. Quantifying the net benefits and costs of the JROTC program will allow policy-makers to make more informed decisions with regard to the future direction of the JROTC program

We also feel that the analysis of the impact of JROTC participation on the military could be further strengthened with data collected from JROTC units and matching them to DMDC enlistment data. At the present moment, services do not track the JROTC cadets and the numbers who subsequently choose to enter the military. We

feel that this is a worthwhile pursuit to allow policy-makers a better feel of the direct impact of JROTC participation on accession rates.

## E. CONCLUSION

The term "Junior Reserve Officer's Training Corps (JROTC)" may be appropriate in its early days where the objective is to develop a reserve force or a military training corps. Today, JROTC cadets do not have the obligation to serve in the military once they graduate from high school. The primary benefits of the JROTC program are similar to that of other non-military youth programs that teach good values and make a better person out of the participants. Still, the DoD continues to fund the JROTC program by providing the necessary teaching instructors, textbooks, equipment and uniforms.

With tight budget figures in the recent years, there has never been a greater need to justify every single defense dollar spent. Our research findings on the influence of JROTC participation on propensity to enlist, retention rates and attrition is the first step toward justifying the existence and continued funding of the JROTC program from the defense budget.

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# APPENDICES

Appendix A. Summary of Variables and Descriptions for HS&B Data

| Variables | Description | Type |
|---|---|---|
| | **Dependent Variable** | |
| Enlisted | 1 if enlisted in any of the survey years, 0 if otherwise | Binary |
| | **Covariates** | |
| JROTC | 1 if participated in JROTC for sophomores in 1980 and 1982, seniors in 1980, 0 otherwise | Binary |
| | **Demographics** | |
| Black | Composite race variable, 1 if black , 0 if otherwise | Binary |
| | | |
| White | Composite race variable, 1 if white, 0 if otherwise | Binary |
| | | |
| Native | Composite race variable, 1 if native, 0 if otherwise | Binary |
| | | |
| Hispanic | Composite race variable, 1 if Hispanic, 0 if otherwise | Binary |
| | | |
| Asian | Composite race variable, base case, 1 if Asian, 0 if otherwise | Binary |
| | | |
| Male | Composite race variable, 1 if male, 0 if otherwise | Binary |
| | | |
| Female | Composite race variable, base case, 1 if female, 0 if otherwise | Binary |
| | | |
| Not Married | 1 if never married in all survey years, 0 if otherwise | Binary |
| | | |
| Number of Children | Number of children in 1992 for sophomores and 1986 for seniors | Interval |
| | | |
| Age | Age of participants in 1992 for sophomores and 1986 for seniors | Interval |
| | | |
| Total income | Total income earned by the sophomores and seniors after high school. | Interval |
| | | |
| | **Educational Expectations and Ability to Afford College** | |
| Poor Academic | 1 if respondents' grades are mostly C's , test composite quartile falls in the C's range, or have repeated grade, 0 otherwise | Binary |
| | | |
| Completed HS | 1 if completed high school, 0 otherwise | Binary |
| | | |
| Ability to Afford College | 1 if able to afford college, 0 otherwise | Binary |
| | | |
| Parents Support | 1 if receive parental support in the form of money, car, food, lodging, medical care or clothing, 0 otherwise | Binary |
| | | |
| College | 1 if highest expected education is college, 0 if otherwise | Binary |

| | | |
|---|---|---|
| Expectations | | |
| | **Military Interest** | |
| Military Interest | 1 if aspiration at age 30 is to be in the military, seek military information, talk to military recruiter, post high school plan is to be in the military or have taken the ASVAB test, 0 if otherwise | Binary |
| | **Family Background** | |
| Parents Influence Military | 1 if parents influence respondents' post high school plans to join the military, 0 if otherwise | Binary |
| | | |
| Parent in the Military | 1 if father's or mother's occupation is military, 0 if otherwise | Binary |
| | | |
| Parents with less than High School | 1 if parents have less than high school education, 0 if otherwise | Binary |
| | | |
| Parents with High School | 1 if parents have high school education, 0 if otherwise | Binary |
| | | |
| Parents with College | Base case, 1 if parents have at least college education, 0 if otherwise | Binary |
| | | |
| Number of Siblings | Number of siblings in 1992 for sophomores and 1986 for seniors | Interval |
| | **Peer Influence** | |
| Friends Influence Military | 1 if friends influence respondents' post high school plans to join the military, 0 if otherwise | Binary |
| | | |
| Friends Influence College | 1 if friends influence respondents' post high school plans to go to college, 0 if otherwise | Binary |
| | | |
| | **Census Region** | |
| New England | 1 if New England, 0 if otherwise | Binary |
| | | |
| Mid Atlantic | 1 if Mid Atlantic, 0 if otherwise | Binary |
| | | |
| South Atlantic | 1 if South Atlantic, 0 if otherwise | Binary |
| | | |
| East-south Central | 1 if East-south Central, 0 if otherwise | Binary |
| | | |
| West-south Central | 1 if West-south Central, 0 if otherwise | Binary |
| | | |
| East-north Central | 1 if East-north Central, 0 if otherwise | Binary |
| | | |
| West-north Central | 1 if West-north Central, 0 if otherwise | Binary |
| | | |
| Mountain | 1 if Mountain, 0 if otherwise | Binary |
| | | |
| Pacific | Base case, 1 if Pacific, 0 if otherwise | Binary |
| | | |
| | **Urbanity** | |
| Suburban | 1 if suburban, 0 otherwise | Binary |

| | | |
|---|---|---|
| Rural | 1 if rural, 0 if otherwise | Binary |
| | | |
| Urban | Base case, 1 if urban, 0 otherwise | Binary |
| | | |
| | **Instrumental Variables** | |
| Live with Single Parent | 1 if live with either mother or father, 0 otherwise | Binary |
| | | |
| Remedial Lessons | 1 if taken remedial English or mathematics, 0 otherwise | Binary |
| | | |
| Values community service | 1 if respondents feel that being a social worker or being a community leader is important, 0 otherwise | Binary |
| | | |
| Low Esteem | 1 if respondents think that success is based on luck, life is full of obstacles, plan does not pay off, no pride in oneself or one is no good at all, 0 otherwise | Binary |
| | | |
| Discipline Problems in School | 1 if respondents have skipped school, suspended or faced discipline actions in school, 0 otherwise | Binary |
| | | |
| Family Income | Family income of respondents in 1982 for sophomores and 1980 for seniors | Interval |

## Appendix B Summary of Variables and Descriptions for DMDC Data

| Variable | Description | Type |
|---|---|---|
| JROTC | 1 if JROTC participant, 0 if non-JROTC participant | Binary |
| | **Demographics** | |
| Age | Age at enlistment | Interval |
| Female | 1 if female, 0 if male | Binary |
| Black | 1 if black, 0 if non-black | Binary |
| Hispanic | 1 if Hispanic, 0 if non-Hispanic | Binary |
| Marstat – SWC | 1 if Single with Children, 0 if otherwise | Binary |
| Marstat- MN C | 1 if Married with no Children, 0 if otherwise | Binary |
| Marstat – MWC | 1 if Married with Children, 0 if otherwise | Binary |
| NHSD | 1 if non-High School Grad, 0 if otherwise | Binary |
| HSDG | 1 if High School Grad, 0 if otherwise | Binary |
| SC | 1 if Some College, 0 if otherwise | Binary |
| Coll | 1 if College Graduate, 0 if otherwise | Binary |
| GED | 1 if GED, 0 if otherwise | Binary |
| | **Military Experience** | |
| TOE 1 yr | 1 if Term of Enlistment 1 yr, 0 if otherwise | Binary |
| TOE 2 yr | 1 if Term of Enlistment 2 yr, 0 if otherwise | Binary |
| TOE 3 yr | 1 if Term of Enlistment 3 yr, 0 if otherwise | Binary |
| TOE 4yr | 1 if Term of Enlistment 4 yr, 0 if otherwise | Binary |
| TOE 5 yr | 1 if Term of Enlistment 5 yr, 0 if otherwise | Binary |
| TOE 6 yr | 1 if Term of Enlistment 6 yr, 0 if otherwise | Binary |
| AFQT CAT I | 1 if AFQT Category I, 0 if otherwise | Binary |
| AFQT CAT II | 1 if AFQT Category II, 0 if otherwise | Binary |
| AFQT CAT III | 1 if AFQT Category III, 0 if otherwise | Binary |
| AFQT CAT IV | 1 if AFQT Category IV, 0 if otherwise | Binary |
| AFQT CAT V | 1 if AFQT Category V, 0 if otherwise | Binary |
| SVCOA NAVY | 1 if Service of Accession Navy, 0 if otherwise | Binary |
| SVCOA AIR FORCE | 1 if Service of Accession Air Force, 0 if otherwise | Binary |
| SVCOA MARINE CORPS | 1 if Service of Accession Marine Corps, 0 if otherwise | Binary |
| SVCOA ARMY | 1 if Service of Accession Army, 0 if otherwise | Binary |
| Prior | 1 if prior enlisted, 0 if otherwise | Binary |
| Non-Prior | 1 if non-prior enlisted, 0 if otherwise | Binary |
| Entry paygrd E1 | 1 if Entry paygrade E1, 0 if otherwise | Binary |
| Entry paygrd E2 | 1 if Entry paygrade E2, 0 if otherwise | Binary |
| Entry paygrd E3 | 1 if Entry paygrade E3, 0 if otherwise | Binary |
| Entry paygrd E4 | 1 if Entry paygrade E4, 0 if otherwise | Binary |
| Entry paygrd E5 | 1 if Entry paygrade E5, 0 if otherwise | Binary |
| FY80 | 1 if Enlisted in FY80, 0 if otherwise | Binary |
| FY81 | 1 if Enlisted in FY81, 0 if otherwise | Binary |
| FY82 | 1 if Enlisted in FY82, 0 if otherwise | Binary |
| FY83 | 1 if Enlisted in FY83, 0 if otherwise | Binary |
| FY84 | 1 if Enlisted in FY84, 0 if otherwise | Binary |
| FY85 | 1 if Enlisted in FY85, 0 if otherwise | Binary |
| FY86 | 1 if Enlisted in FY86, 0 if otherwise | Binary |
| FY88 | 1 if Enlisted in FY88, 0 if otherwise | Binary |
| FY89 | 1 if Enlisted in FY89, 0 if otherwise | Binary |
| FY90 | 1 if Enlisted in FY90, 0 if otherwise | Binary |
| FY91 | 1 if Enlisted in FY91, 0 if otherwise | Binary |

| | | |
|---|---|---|
| FY92 | 1 if Enlisted in FY92, 0 if otherwise | Binary |
| FY93 | 1 if Enlisted in FY93, 0 if otherwise | Binary |
| FY94 | 1 if Enlisted in FY94, 0 if otherwise | Binary |
| FY95 | 1 if Enlisted in FY95, 0 if otherwise | Binary |
| FY96 | 1 if Enlisted in FY96, 0 if otherwise | Binary |
| FY97 | 1 if Enlisted in FY97, 0 if otherwise | Binary |
| FY98 | 1 if Enlisted in FY98, 0 if otherwise | Binary |
| FY99 | 1 if Enlisted in FY99, 0 if otherwise | Binary |
| FY00 | 1 if Enlisted in FY00, 0 if otherwise | Binary |
| Highest Paygrade E1 | 1 if highest paygrade E1, 0 if otherwise | Binary |
| Highest Paygrade E2 | 1 if highest paygrade E2, 0 if otherwise | Binary |
| Highest Paygrade E3 | 1 if highest paygrade E3, 0 if otherwise | Binary |
| Highest Paygrade E4 | 1 if highest paygrade E4, 0 if otherwise | Binary |
| Highest Paygrade E5 | 1 if highest paygrade E5, 0 if otherwise | Binary |
| Highest Paygrade E6 | 1 if highest paygrade E6, 0 if otherwise | Binary |
| Highest Paygrade E7 | 1 if highest paygrade E7, 0 if otherwise | Binary |
| Highest Paygrade E8 | 1 if highest paygrade E8, 0 if otherwise | Binary |
| Highest Paygrade E9 | 1 if highest paygrade E9, 0 if otherwise | Binary |
| | **Censored Variable** | |
| Attrite | 1 if member separated prior to FY03, 0 if still in FY03 | Binary |

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