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NUMERACY AND LITERACY SKILLS AND EARLY PROMOTION

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THESIS

NUMERACY AND LITERACY SKILLS AND EARLY PROMOTION

by

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This paper will report to what extent cognitive ability plays a role in predicting future promotion. This knowledge could be useful for those who are more likely to fill a higher position during their military careers, given their cognitive ability. U.S. Navy leaders could use this information to allocate resources to these Sailors in advance in order to help them achieve a higher margin of productivity and better set of skills to help them later in their careers. By doing so, the Navy would be incentivizing Sailors with the greatest cognitive ability to stay longer in the military; in turn, the Sailors will see that they get a better payoff for staying in the military longer. This study looks specifically at promotions from E-3 to E-7 between 2001 through 2011. The results of this study suggest there is a significant positive correlation between promoting early and basic cognitive ability. In fact, in most cases, the higher the score, the more likely a Sailor will promote early across the whole Navy and at the community level. Furthermore, the relevance of being more cognitively advanced becomes more important as the military member ascends the hierarchy. Given that the Armed Forces Qualification Test's (AFQT) formula emphasizes literacy skill more than math knowledge, I argue that the AFQT's metric captures literacy better. Therefore, by displaying higher literacy capacity, an enlistee has a better chance of early promotion.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFQT	Armed Forces Qualification Test
AR	arithmetic reasoning
ASVAB	Armed Service Vocational Aptitude Battery
FMS	final multiple score
MK	mathematics knowledge
NALS	National Adult Literacy Survey
PAR	personnel advancement requirement
PC	paragraph comprehension
PNA	pass not advance
TIR	time in rate
WK	word knowledge

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I. INTRODUCTION

Using data derived from the U.S. Navy personnel records from 2001 to 2011, I estimated the effect of the Armed Forces Qualification Test (AFQT) score on early promotion to ranks E-4, E-5 and E-6; early promotion was defined using the median of each promotion. The analysis uses an econometric model utilizing a linear probability approach with variables—enlistee's group age, gender, race, marital status, deployments, dependents, and type of job—across the Navy and the community level, performing regression analysis to derive an indicator for early promotion to each rank. These variables are considered to see whether any have a significant impact on early promotion apart from the AFQT score. The results of this study suggest there is a significant positive correlation between promoting early and basic cognitive ability. In fact, in most cases, the higher the score, the more likely a sailor will promote early across the whole Navy and at the community level. Furthermore, the relevance of being more cognitively advanced becomes more important as the military member ascends the hierarchy. Given that the AFQT's formula emphasizes literacy skill more than math knowledge, I argue that the AFQT's metric captures literacy better. Therefore, by displaying higher literacy capacity, an enlistee has a better chance of early promotion. There are obvious implications related to enlisted accessions, specifically as they apply to early preparation for the AFQT examination, which may induce those willing to join the Navy to put more emphasis on preparation and the development of basic cognitive ability. Additionally, these conclusions shed light on the positive role literacy and numeracy skills have on higher earnings. Finally, the Navy might sort future enlistees using the basic cognitive abilities metrics at its disposal to increase basic and technical training success rates, especially in the face of future budgetary constraints.

Another interesting finding is that male sailors are associated with a higher probability of early promotion, but this statement becomes weaker when the analysis is conducted at each community. Changing marital status is consistently associated with a lower probability of early promotion and statistically significant at the level of 0.01. In line with this finding, deployments reduce the likelihood of promoting early, which contradicts the common belief that the Navy rewards its deployed sailors. This thesis also supports the idea that some communities have an advantage over others in early promotion. Finally, the younger the enlistee is, the more likely he is to promote early.

The purpose of this research is to investigate to what extent the AFQT score predicts promotion for any given enlisted member of the Department of the Navy. Those who want to join the U.S. Navy need to apply for the AFQT test. Four subsets of the Armed Service Vocational Aptitude Battery (ASVAB) comprise the AFQT examination. The subsets of the AFQT score include paragraph comprehension, word knowledge, arithmetical reasoning, and mathematical knowledge. The first two are added together and then multiplied by two to assign a value to the test taker's verbal expression ability while the remaining two sections receive no multiplier and are merely added together. Using these questions, the AFQT tests an applicant's ability to solve the kinds of daily problems he will experience in the service, including word problems or other questions that are structured to emulate the way senior officers speak.

Common sense dictates that those who are better able to understand their bosses are more likely to be promoted to a higher position. Thus, it stands to reason that the AFQT variable could be used in a logistic model to predict future promotion. Verbal ability is a driver of good performance because the first step in problem-solving is the ability to comprehend words. Given the weight that verbal ability receives in the raw AFQT score, Navy leaders have long acknowledged the importance of this ability in a military career (Sticht, 1982).

More importantly, perhaps, math is one of the hardest fields for any person to learn as much of the material in this field is abstract (Stodolsky, Salk, & Glaessner, 1991). Therefore, it is likely that if a person scores high on the math portion of the test, that score also reflects how well that person might comprehend orders as the AFQT presents some technical problems, such as word problems, just as in real life. Therefore, enlistees who display the capacity for good mathematical comprehension on the AFQT may perform better in their careers than those with lower capacity because a pivotal component of the military environment is the capacity to understand orders in the face of complex challenges. These abilities are considered when military members are promoted.

Test results could signal one's degree of commitment. This is seen throughout scholarly contexts, wherein professors judge students based on their test performance through grades and grade point averages. Similarly, the AFQT seems to measure merit similarly. It is likely sailors who score higher are seen by naval leaders as more responsible, smarter, and more dedicated than others; they believe these candidates should be selected to be part of the naval establishment. Also, it makes sense that people with higher cognitive ability would be more willing to pursue higher positions and greater responsibility as well as see themselves as more capable of leading.

However, while common sense and conventional wisdom both hold that those with higher AFQT scores have a better chance of promotion than those with lower scores, the question remains whether, in the long run, higher-scoring individuals, in fact, have a greater chance of promotion later in their career, given that professional traits associated with comprehension might play a bigger role than is believed. Currently, there has been negligible research exploring this field (Asch, Romley, & Totten, 2005). It is possible the AFQT score has predictive power for future promotion. Therefore, this research seeks to determine how well the AFQT score can forecast promotion.

The hypothesis of this thesis is that sailors with good comprehension skills are more likely to be promoted. Senior officers value this skill as it correlates with the subordinate's ability to follow their orders and instructions. Therefore, this ability is tested every day since it is linked to personal performance.

It is unlikely that this skill will decrease as sailors put it in practice every day (Bynner & Parsons, 1998). In this regard, there is no reason to factor or consider the loss or atrophy of comprehension skills in this analysis. In fact, comprehension ability can improve with time and practice through exposure to problems. Therefore, sailors who score better in the AFQT exam have an advantage over those who score lower because, as previously stated, superiors value subordinates who are able to comprehend and implement orders while also being dynamic problem solvers.

II. BACKGROUND

A. AFQT: WHAT IT MEASURES

The U.S. Navy uses an accessions system to recruit and filter civilian candidates to strengthen its workforce. One of the first ways the U.S. Navy measures vocational aptitudes of potential recruits is through the Armed Service Vocational Aptitude Battery (ASVAB). The exam is designed to measure 10 different categories, among which are word knowledge (WK), paragraph comprehension (PC), arithmetic reasoning (AR), and mathematics knowledge (MK). The purpose of the ASVAB is to determine the best job for any given participant willing to join the Navy. The other services use the ASVAB as an initial indicator of recruit potential as well. Navy planners collect one summarized score—the AFQT—which calculates four subsets of the ASVAB: WK, PC, AR, and MK. The AFQT is collected just once; the Navy does not request that military members take the exam again later though recruits are not prevented from retaking the test.

Literacy skill is composed of verbal expression, which is determined by PC and WK. The AFQT also captures numeracy skills in terms of AR and MK. On arithmetical problems, the test taker is evaluated on basic mathematical principles.

In the WK section, the questions test the examinee's vocabulary. Additionally, the test taker demonstrates his or her ability to make strong inferences about the meaning of particular unknown words. This segment also captures cognitive ability through thinking logically and decoding strategies. The PC section tests the ability to comprehend questions and identify the main ideas in the text; examinees must answer questions using solely the information that is given in each passage. The main goal of AR is to test the ability to solve word problems. In addition to understanding mathematical concepts, the test taker must possess some literacy skills. As Rivera-Batiz (1992) points out, numeracy and literacy skills are closely related. The MK section tests how well the test taker applies and understands the basic concepts of arithmetic, algebra, and geometry. The questions in this section are delivered in math language; a great degree of literacy skill is not necessarily required to answer these questions. The approach to solving the problems is more mechanical in nature.

The score obtained after answering all questions is called the raw AFQT score (unobservable):

$$\boldsymbol{Raw\ AFQT\ score} \\ = 2 * [Word\ Knowledge + Paragraph\ Comprehension] \\ + [Arithmetic\ Reasoning + Mathematical\ Knowledge]$$

The next step is to transform the result into a percentile that indicates how participants performed in the exam relative to a base group. This group is composed of individuals 18–23 years old who took the same exam and were selected as a nationally representative sample. If an individual scores 99, it means that he scored as well or better than the 99% of the participants included in the base group, which is an excellent indicator that the person is intellectually superior. Additionally, since the AFQT measures the basic numeracy and literacy skills, the AFQT score can be used among low-quality military members for these abilities.

In a RAND study, Asch, Romley, and Totten (2005) observed a positive association between the AFQT score and all paygrades among all services. The authors based their study on the premise that the AFQT is a predicting measurement for job performance and training success. Thus, the AFQT is a metric for current, and possibly future, quality when a military member enters the service. They acknowledged that promotion rates are driven by external factors that can vary over time and the use of a more dynamic metric that accounts for observable and unobservable features of members. Asch et al. (2005) used data derived from tests taken between 1978 and 1992. This thesis observes a more recent dataset covering 2001–2011; in addition, the definition of what the AFQT score represents varies.

B. MILITARY PROMOTION SYSTEM

The Navy enlisted promotion system applies different standards and criteria based on the group rank; from E-1 to E-3, promotion is essentially automatic, so long as the sailor avoids serious disciplinary action. Promotions to E-4 through E-7 are based on merit, whereby candidates are filtered with more scrutiny via standardized tests and a board evaluation of individual performance. From E-8 to E-9, promotions are driven almost entirely by board evaluation and do not require examinations.

Three components are required for any enlisted member to be considered for promotion from rank E-4 to E-7: time in rate (TIR), personnel advancement requirements (PARs), and the final multiple score (FMS). In addition, the number of accessions is limited per year. TIR means the minimum time that a military member must spend in his current pay grade (rank) to participate in the promotion process. PARs are noncompetitive requirements for any member with the purpose of measuring work-related skills and qualification for promotion. Lastly, the U.S. Navy uses the FMS system to calculate a candidate’s knowledge, performance, and experience using a standardized measurement; FMS is composed of six factors: the standard score on a Navy-wide advancement test, the performance factor, length of service, service in pay grade, awards, and pass not advance (PNA) points. A board analyzes these considerations to determine who will promote. Because candidates are sorted ordinally, the likelihood of being promoted increases with the number of points a candidate possesses. Due to external circumstances, such as promotion quotas, not all candidates are promoted, even if they fill all requirements. Therefore, the Navy’s promotion system assigns PNA points to those qualified but unpromoted members for the next promotion cycle.

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III. LITERATURE REVIEW

Assessing whether the AFQT score has any predictive value regarding promotion requires drawing on numerous areas of research in the literature. This chapter first discusses the importance of the AFQT-assessed skills of literacy and numeracy in private-sector earnings and, given that promotions and earnings are parallel outcomes, serve as an analogy for promotions in the Navy. Then, this study explores how these skills are acquired, which may signal the relevance of the AFQT score in advancement.

It is important to note, first, that there is a diversity of thought in current research on how cognitive ability and literacy are defined. This capacity is sometimes bundled in a single term or, in other cases, referred to simply as *cognitive ability*. The following paragraphs discuss basic literacy and numeracy skills. Literacy involves the ability to understand and comprehend paragraphs; this ability is also driven by an individual's vocabulary. Numeric skills include mathematics proficiency and the understanding of basic math principles such as arithmetic and geometry. People use this kind of knowledge in their daily activities. Cognitive ability is driven by both factors as literacy and numeracy are cognitive skills. Given that the AFQT tests those abilities, it represents a comparatively solid measurement of them, especially in defining literacy, given that the formula for the raw AFQT score gives more weight to verbal expression. It is, therefore, assumed that the AFQT captures literacy better than numeracy skills among participants because the raw AFQT score puts more emphasis on verbal skills and also because of the presence of math word problems in the test.

A. DEMAND FOR LITERACY AND NUMERACY SKILLS IN THE WORKPLACE

Examining the importance of literacy and numeracy in professional contexts generally provides insight into the role these skills, which are measured by the AFQT, play in predicting the promotion of enlisted sailors. Given the perceived mismatch between what businesses are demanding and what society is offering, basic literacy and numeracy skills are considered relevant in determining earnings, and more than ever, the development of those abilities is increasingly required even for low-skill workers. Murnane, Willett, and Levy (1995) demonstrated the long-term increasing relevance of literacy in the workplace. They pointed out that the demand for such cognitive ability is not limited to small firms but is desirable among businesses nationally. Given that the amount of information available today is immense, it is necessary for workers to deal with this volume of information in a productive and efficient manner (Murnane et al., 1995).

Furthermore, such skills affect the productivity of not only individual workers but also the economy as a whole. Bishop's work has suggested that cognitive ability and productivity are correlated. He attributed part of the decrease in productivity growth (GDP) during the mid-1970 to 1980s to low test performance; low scores, he claimed, mean that people were acquiring fewer abilities and developing fewer capabilities (Bishop, 1989). Comparing the results of the 1992 National Adult Literacy Survey (NALS) raises concern about future economic growth and productivity. The major results of the survey indicated that of the 1992 U.S. adult population, approximately 21–23%—which roughly represented 40 to 44 million people—fell into the lowest literacy skills group, levels 1 and 2 out of 5. Overall, these participants were unable to solve arithmetic problems that involved successive operations or setting up problems and struggled to summarize long texts (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993).

Of particular interest to this study, though, are trends in youth vis-à-vis adult literacy and numeracy, which might indicate whether these skills can be acquired over an individual's lifetime, and the scarceness of these skill in the labor market—a fact that could bear on the predictive value of the AFQT. Prior to 1992, the NALS had last taken place in 1985; a comparison of both surveys shows that in 1992, young adults displayed lower literacy skills, so younger generations had become less literate. This trend matters because a low level of literacy is associated with lower productivity (Fisher, 2007). However, this evidence contradicts Charette and Meng's (1998) conclusion that older people are less literate than young people. One possible explanation is that these studies analyzed different populations, one Canadian and the other one American; in addition, the American data included immigrants, so it was unable to draw a concrete picture. At the same time, looking specifically the at the quantitative portion of the survey, one trend showed a decrease in numeracy ability across time, reinforcing Charette and Meng's findings that older people are better at dealing with basic math problems than younger cohorts. One possible reason is the emphasis on the importance of basic math knowledge in the past or well-designed math programs in schools (Charette & Meng, 1998).

The level of basic skills is declining among the U.S. population while the demand for these skills is concurrently increasing. Universally, businesses desire skills like literacy and numeracy. At the same time, there is disagreement in the literature about the extent to which these skills are rewarded by higher pay and promotions, which is analogous to the relationship between promotion in the U.S. Navy and the skills measured by the AFQT. Classical economics holds that skill is rewarded when an individual increases one's earnings or is promoted. The difference in earnings among workers in the same type of job can be explained by the levels of productivity of each worker. In theory, a productive worker should have a higher income due to one's productivity, and productive workers are rewarded by the market. In a skills-based economy, the importance of having a broader set of skills helps determine who is promoted and who is not, which translates to a higher wage. At the same time, the set of skills an individual possesses should help employers distinguish who is productive and who is not. Fisher (2007) described a plausible scenario in which a worker who exhibits greater literacy, in particular, makes more progress in terms of job title and salary than one who exhibits a lower skill. Therefore, individuals with lower skills tend to populate lower positions (Fisher, 2007). Some evidence suggests that those who have better literacy skills have a greater chance to be employed and stay employed (Rivera-Batiz, 1992). In the end, literacy matters and relates to employment status.

By contrast, Dougherty (2003) found that the numeracy factor had more of an influence on earnings, suggesting the variable that controls for literacy was not relevant in the model or had a small impact on earnings. Dougherty's findings are more conclusive as the author was able to isolate greater numeracy and literacy skills. In the body of research, sometimes the definition of literacy also includes the basic numeracy skill, but because this study was unable to isolate their impact, those findings are relevant as possible outcomes.

This discrepancy in the body of research on the effect of literacy and numeracy on earnings may be explained by the application of different labor models. Thurow (1972) discussed two applicable models in the labor market: job and wage competition. In the job competition model, having low basic skills such as literacy and numeracy should be associated with lower earnings because it signals that a worker is less cognitively skillful and, therefore, less trainable. What matters from the business perspective is that an individual is trainable; if the worker is not skilled cognitively when he joins an organization, he may remain in the lowest ranks and, therefore, receive fewer promotions and less earnings. This consideration is relevant, for if the Navy operates on this principle, the AFQT score *will* indicate future promotion potential. It makes sense that the Navy would use this model because it does not generate revenue and is subject to the sort of profit-related budget constraints found in the private sector. Its incentive is to spend less money on training by accepting applicants who are more trainable. Thus, the AFQT scores help to filter people according to their trainable capacity.

In the wage competition model, when individuals enter an organization with low skills, it does not matter because they can compensate for their lack of literacy and numeracy skills by pursuing more skill proficiency. In turn, future promotions are not driven by tested cognitive capacity but influenced by educational programs as long as the workers improve their basic skills. In this case, the AFQT would *not* signal clearly who has the desire to improve ability. Hypothetically, there is a negative correlation between having low ability and a low desire for improvement (Thurow, 1972). The fact that enlisted members are less likely to possess higher education might lead to the assumption that they are less likely to enhance their basic numeracy and literacy skills. There is evidence that formal schools, as the following sections show, are the primary center for greater skill acquisition.

Whether or not skills like literacy or numeracy affect pay and promotion in the market depends on how the actual market or business values cognitive workers. This dynamic matters because the common belief is that if the trend is to hire more people with college degrees, basic skills will no longer be valued or considered important in the market. Inevitably, this belief has led to a surplus of high-skilled workers and a shortage of workers with low skills. Indeed, Vignoles, De Coulon, and Marcenaro-Gutierrez (2011) found that the value of basic literacy and numeracy skills, though already relatively high, did not increase between 1995 and 2004. However, there is room to improve one's skill set, thereby opening the door for higher wages. That is to say, the transition from a lower to a higher skill would increase earnings over a certain time. Skill improvements should be rewarded by the market, as found in analysis by Vignoles et al. of the United Kingdom's labor market. If this principle holds, possessing higher skills matters. In fact, because cognitive ability is essentially a skill, the weight of literacy and numeracy abilities on promotion is relevant. This analysis is important in part because studies do not discuss what models firms are using in their assessments. Therefore, their conclusions may be misleading and may explain the variation found within this specific approach.

Blunt (1991) found that there was no salary benefit to increasing literacy proficiency because the Canadian market operates like a job competition model in which it matters to choose adequately trained workers. Blackburn's evidence suggests that the inclusion of test scores might explain a small part of the wage gap between males and females. He found that for women, the paragraph comprehension ability is not rewarded by the market even though they score better on comprehension ability (Blackburn, 2004). On the other hand, Blunt's (1998) work offered empirical evidence that literacy skills are rewarded in terms of higher earnings and promotion advancement.

B. OVEREMPHASIS ON SCHOOLING AS A PREDICTOR OF EARNINGS

Most research suggests that education is a relevant factor in determining job outcomes such as salary, employment status, and promotions, but school involves various elements, and literacy and numeracy are just two of them. Thus, these components should be evaluated separately to determine the true impact. The inclusion of the AFQT variable may lead to a decrease in the impact of other regressors in a predictive model for earnings and promotion. Some evidence shows that when literacy is included in a predictive model for earnings, there is a decrease in the impact of school. The latter statement assumes that the AFQT score is important in any predicting model for promotion as earnings and promotion tend to be associated. Moreover, De Anda and Hernandez (2007) found that when the variable of literacy is included in a predicting model for earnings, the effect of the categorical variable that controls for education reduces its effect on earnings. Their findings suggest that there is an upward bias toward education in models that do not account for literacy skills as a variable (De Anda & Hernandez, 2007). This finding is supported by Charrete and Meng's (1998) supposition that including variables that control for numeracy and literacy skills reduces the effect of years of schooling on earnings. In addition, Green and Riddell (2003) found that literacy skills reduce the effect of schooling on earnings and that literacy has a relatively large impact on predicting earnings. Therefore, the notion that schooling significantly forecasts earnings should be reconsidered. In contrast to those findings, Blackburn (2004) established that the coefficient of schooling is decreased by a small amount after including the variable that controls for test performance as a predictive model of earnings.

C. THEORIES OF LITERACY SKILL ACQUISITION

Given that low-level and basic skills have an impact on professional success that is distinct from schooling per se, it is important to identify all possible sources of those skills. Those skills have a bearing on whether an enlisted sailor's abilities, as indicated by the AFQT, will remain largely constant or potentially improve. Much has been discussed in recent research about what factors determine literacy skills and where they are acquired. Desjardins (2003) has pointed out that literacy skills are driven by factors such as socioeconomic background, work, home, community, and leisure. If literacy and numeracy skills can be acquired through experience or school, the measurement of the AFQT will not matter as much because, with enough time, military members can acquire these abilities and perform their jobs well, which, as noted earlier, is the foundation for promotion. Enlisted personnel may not revisit formal school during their stay in the Navy; instead, they will be trained. People can attend those training programs without improving their skills, but training is a possible source of skill improvement. The literature has identified two possible vehicles for improving basic skills: experience and schooling.

1. Experience

Charrete and Meng (1998) argue that both literacy and numeracy skills can be acquired by mechanisms not related to formal schooling, such as mass media sources. In fact, they conclude that older cohorts are less literate than younger ones because younger cohorts are more apt to use technological advances to build their skills. The younger set takes advantage of educational substitutes while older individuals are more developed in numeracy ability (Charette & Meng, 1998).

By contrast, Green and Riddell (2003) concluded that experience does not produce literacy skills after they analyzed the Canadian International Adult Literacy Survey, focusing on individuals over 16 years who participated actively in the labor market but excluding students who worked. In another study, Desjardins suggested that the improvement and acquisition of literacy skills need the engagement of pro-literacy activities at the community level, at home, and at work. Otherwise, the contribution of school and background on developing literacy is offset (Desjardins, 2003). In addition, Wayne, Liden, Kraimer, and Graf (1999) identified that training was not necessarily relevant to career advancement.

2. School

Some research points out that the acquisition of basic skills comes primarily or even solely through school attendance. In other words, experience on any given job does not help workers to enhance their literacy skills (Green & Riddell, 2003). Supporting the claim that schools are the centers for developing knowledge and basic skills, Bishop (1989) has suggested that after 50 years of continuous improvement in test scores, the decline in test scores between 1967 and 1980 had a large aggregate impact on productivity growth in terms of foregone gross domestic product. This finding shows that schools are a key component of cognition because if students could have acquired basic abilities through other mechanisms, lower test scores would not have mattered (Bishop, 1989). The bottom line of Bishop’s work is that schools develop literacy skills on a grand scale. It seems that schooling to a great extent forces participants to acquire this ability to the highest degree.

Scribner and Cole (1978) illustrated more emphatically the importance of formal schooling in skill acquisition. They measured the effect of not going to school on becoming literate. They defined “literate” as a function of reading and writing. The implication of their study is overwhelming; the improvement of cognitive processes, such as logical reasoning and critical thinking, is linked with going to school, which suggests that a learning process based on experience does not produce the same outcomes as one produced by the act of attending school (Scribner & Cole, 1978). This evidence supports the idea that schools are the primary centers for acquiring numeracy and literacy skills.

Consequently, literacy skills remain more or less constant unless an individual decides to improve them. This claim is supported by Bynner and Parsons’s (1998) study. They based their study on statistical techniques and found that literacy skills suffer less of a negative impact when an individual is not working due to their virtue of being used in daily activities. On the other hand, numeracy skills are more perishable and prone to memory loss. In addition, when a certain threshold is reached, base skills are less likely to be lost. Finally, Bynner and Parson (1998) found that work helps people retain skills. This finding sheds light on how cognitive abilities behave in normal life.

D. NO CONSENSUS

The acquisition of basic skills matters because of its relevance to the AFQT score. If cognitive ability can be acquired in workplaces, the AFQT score would not be an indicator of promotion potential because those enlisted can develop these skills later without impacting their likelihood of ascending through the ranks. Some might argue that senior Navy leaders should be the smartest people in the whole community because what is at stake at higher levels is larger and more important; therefore, the link between cognitive ability—the set of skills measured by the AFQT—and rank is positive.

IV. DATA AND METHODOLOGY

A. DATA OVERVIEW

This research uses administrative data maintained and collected quarterly by the U.S. military from 2001 to 2011. The original data contained approximately 14,813,426 entries in an unbalanced panel of 775,923 Navy members including both officers and enlisted. The Defense Enrollment Eligibility Reporting System provided demographic information such as gender, race, age, marital status, and dependents as well as service information such as rank. The Defense Manpower Data Center added other service characteristics into the data such as occupation and the AFQT score if the member was enlisted. The data characterized individual enlistees by demographic variables such as having dependents (binary), marital status (binary), race, gender, and job specialty.

Not all of these data are included in this analysis. Because this study focuses exclusively on the professional performance of enlistees, data about officers were excluded from the analysis. Furthermore, this research also excluded those whose time in rank was unclear due to the limits of the dataset. For example, in the case of a member who was an E-3 in the first quarter of 2001, it is unclear when he became an E-3 and for how long he had been in that pay grade. Accurately assessing the effect of basic cognitive ability on early promotion requires knowing the time cycle of any given rank, so I have discarded such cases and included only those I could assess fully. The analysis of this thesis lies in observing how long military members had been in their current pay grade in relation to their AFQT score to gauge the effect of basic cognitive abilities on promotion. These data were removed by dropping entries in which the current rank equaled the first except when that rank reappeared later as a result of the military member going through demotion. Those entries had relevant information, and the continuity of the data was preserved.

The remaining data exhibited some constraints. One constraint on was that it did not allow the researcher to differentiate among ranks below E-3 and or among those above E-6; this research, therefore, investigated the performance of enlisted members between E-3 and E-6. This constraint was not a significant obstacle, however, because the first two promotions within the naval system are less stringent, a given military member is likely to be promoted if he or she stays out of trouble and does not receive a bad review from commanding officers. These less strenuous promotion standards for ranks below E-3 made it difficult to assess the impact of basic cognitive ability on the success of this population and was, consequently, less informative for the purposes of this study.

Another limitation on the data was that some variables that should have been constant were inconsistent over time in the dataset, which required making assumptions and choices about the proper value of those data points. For instance, the specialty of some members, which should remain the same in most cases, sometimes oscillated across time. For a given year, the specialty of a certain enlistee might be reported as combat, but at a later point in the data, the specialty might have changed to medical service. In such cases, I used the mode of the enlistee's specialty because the true entry was likely the one that occurred most often.

B. VARIABLE DESCRIPTION

This section describes each of the variables created out of the dataset and used in this thesis.

Promote Early to E-4, to E-5, to E-6: Enlisted members are not allowed to remain in a certain pay grade for long periods. In other words, current pay grades are transient states, and exiting and promoting are the absorbing states in any military career. Eventually, military members must seek promotion if they want to stay in the Navy; otherwise, there are various mechanisms that force them to leave the service. The time that any military member is allowed to stay in the military given by his or her current pay grade is called high years of tenure. One possible reason for this system is that it encourages people to seek higher responsibilities, thereby refreshing lower positions with new manpower. Therefore, I decided to measure the research question by finding whether basic cognitive abilities help military members achieve early promotion and, if so, to what extent.

This variable was created to reflect those military members who were promoted before the population median for each rank. I used the median as a reference because it is more robust in the presence of outliers. As expected, this metric varies across ranks; the lower the rank, the faster a sailor promotes. The median for promotion to E-4 is five quarters (15 months); the median for promotion to E-5 is seven quarters (21 months); and the median for promotion to E-6 is 16 quarters (48 months). The early promotion variables were adopted after trying to use time in rate (TIR) as a definition of early promotion and not having conclusive results because relatively few sailors promote earlier than that threshold. TIR indicates the least amount of time an individual would spend in service to be eligible for promotion.

It is easy to tell from Figure 3 that the quarters before promoting to E-6 are the closest to a normal distribution; Figures 1 and 2 are more skewed to the left. It is also obvious that military members spend less time promoting when they are at lower ranks, perhaps because the scrutiny at those ranks is less strict and the number of billets is larger.

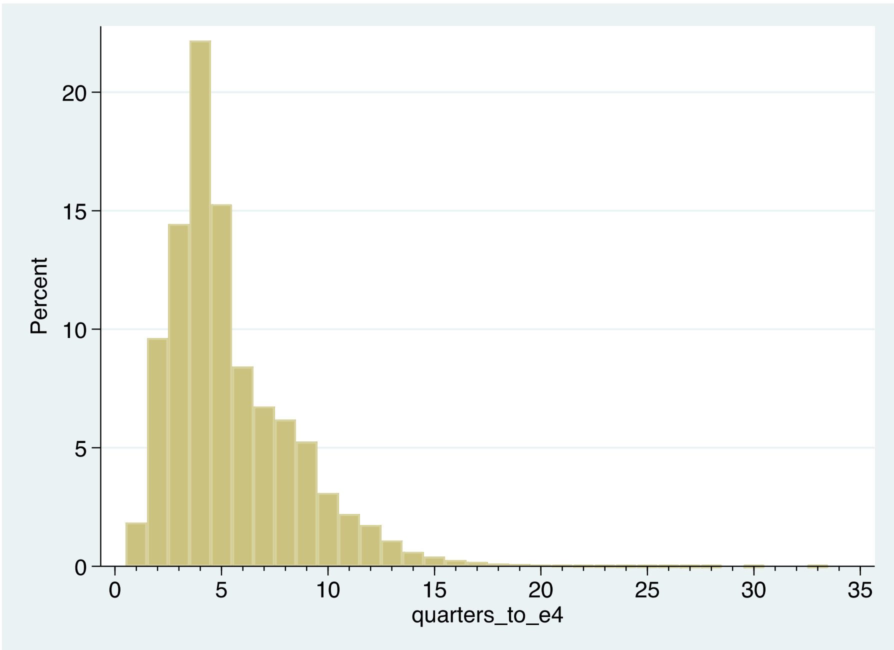

Figure 1. Distribution of quarters spent as E-3 before being promoted

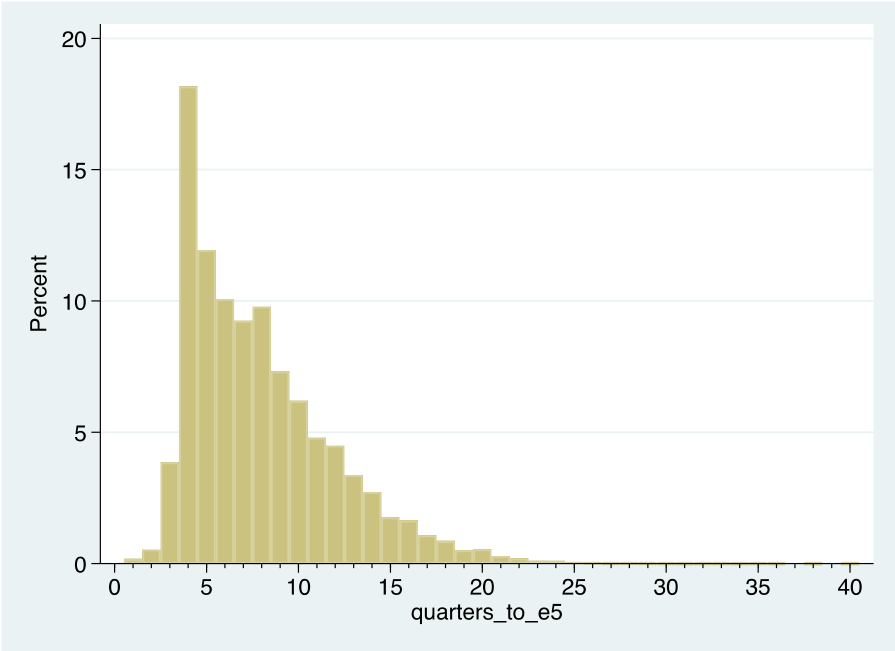

Figure 2. Distribution of quarters spent as E-4 before being promoted

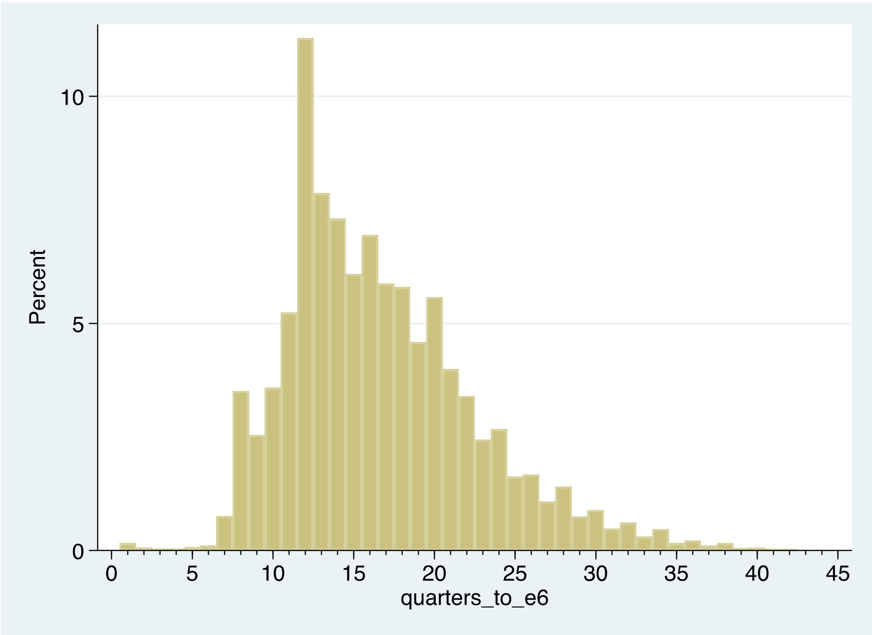

Figure 3. Distribution of quarters spent as E-5 before being promoted

AFQT Score: The measurement for the AFQT score was broken into four binary variables. The first controls for scores that are equal to and above 93, which represents the most advanced enlistees in terms of basic cognitive ability relative to the whole test-taking population. Next, another binary variable indicates those military members who received scores of at least 65 and less than 93. Another binary variable was created to group the people who received scores from 50 to 64. Finally, the last binary variable indicates those whose scores fell between 31 and 49. The U.S. Navy has set 35 as the minimum acceptable score in the AFQT examination. Exceptions to this rule are exceedingly rare.

Married: This variable contains information about whether and when an individual transitions from single to married or vice versa. This variable is coded as “1” when married and “0” when single. Becoming single again is assumed to be the result of divorce; there may be cases in which this means that the military member has become widowed, but this is a relatively unlikely outcome. It may be that marriage makes an enlistee push harder to promote early.

Male: This variable displays the gender of any given member. It is coded as “1” for male and “0” for female.

Job Specialty: The model includes different binary variables for each type of job, which in this case are *combat*, *aviation*, *medical*, *combat service*, and *service support*, using the mode at the individual level as described previously. Each variable is coded as “1” if the member meets the respective criteria and "0" otherwise. For instance, *combat* is coded as “1” when a member’s job is being a fighter and “0” when not. The same logic is applied to the rest of the job specialty variables. *Combat* represents those members whose primary job is to be fighters, such as shooters; *aviation* includes people who are engaged in aircraft-related activities, such as aviation mechanics and air traffic controllers; *medical* comprises the people engaged in activities related to medical care, such as nursing and assisting a doctor; *combat service* includes the people who are engaged in activities that are one step back from the fighting but related to it, such as ammunition loaders; *service support* involves the people who are engaged in activities that are even further from fighting, such as cooking and cleaning.

This thesis incorporates stressors that could affect the likelihood of being promoted since the data include information about marital status and deployments. Common sense dictates that major life events such as getting married or divorced or deploying during a recent promotion cycle should negatively influence the likelihood of an individual making the next pay grade. These events add pressure to candidates that might affect their overall performance. Given the uncertain factor of knowing when the promotion process starts, any major event that occurred from two quarters to five quarters in the past (in one year) was included separately. The most recent quarter was not considered because even in the most optimistic scenario, the Navy needs time, likely more than one quarter, to process and promote military members. In other words, at the time when promotion occurred, the effect of major events was not relevant.

Number of Deployments: This variable represents the number of deployments that occurred before being promoted to the next rank. This number is not an aggregated number, so it exhibits a memoryless property with respect to deployments in previous ranks. It counts the number of deployments until the following rank is reached. For those who went through demotions, deployments were counted until they reached the next upper rank because, technically, they had not been promoted. For instance, for an enlistee demoted to E-4, deployments were counted in the E-5 to E-4 to E-5 rank space to measure the number of deployments within the promotion process to E-6.

Marital Status and Having Dependents: The first binary variable has information if a military member was married at each rank because if enlistees get married, they might push harder to promote early since promotion represents a higher income. The same logic applies to the variable of having dependents. Careful readers will notice that the time-space for those who were demoted is larger since both variables will capture entries until they reach the higher rank (the same example used for the number of deployments).

Re-single: This binary controls if the outcome of becoming single again before the higher rank is reached since it may discourage members to pursue an early promotion. This also means that those who are demoted will have more time to be observed (same logic as in the previous variable).

Age: The measurement for age was broken into six binary variables. The first controls for age between 18 and 22. Subsequently, another binary variable indicates those military members between 22 and 25. Another binary variable reflects those between 25 and 30. Next, a binary variable was created for those between 30 and 35. The next binary variable is for those between 35 and 40. Finally, the last binary variable indicates those who are 40 years or older.

White, Black, Hispanic, Asian, and Other Race: These variables contain the information on the race of military members. They are set as binary variables. For example, “1” means the member is white and "0" means otherwise. This setup follows for the remaining variables that fall in this category.

Looking at the results from Table 1 we can say that the percentage of most advanced sailors cognitively speaking, across the Navy, is relatively small, just around 6.4% of enlistee meet this criterion. We can see that most sailors fall between AFQT score 65 and 92 as well that the Navy is predominant dominated by males. We can also see that the white community is the greatest one across the navy, followed by the black community.

We also can see that the average of deployments tends to increase as ranks are higher. This could be explained by the fact that sailor tend to spend more time before promoting to E-6. In addition, sailors tend to get married more from promotion process to E-5. The population of individual who experienced any type of stressors for any given rank is low. Furthermore, Age for E-4 rank tend to dominated by younger enlistee and moves on step forward as the rank moves up. Overall, people who participate for promotion to E-6 tend to have at least one dependent.

Table 1. Summary statistics

Variables	Promotion to E-4	Promotion to E-5	Promotion to E-6
AFQT (93, 100)	0.064	0.064	0.064
AFQT (65, 92)	0.380	0.380	0.380
AFQT (50, 64)	0.259	0.259	0.259
AFQT (31, 49)	0.296	0.296	0.296
Male	0.834	0.834	0.834
White	0.530	0.530	0.530
Black	0.197	0.197	0.197
Hispanic	0.144	0.144	0.144
Asian	0.056	0.056	0.056
Other race	0.125	0.125	0.125
Marriage Stressor	0.027	0.024	0.006
Re-ingle Stressor	0.002	0.004	0.002
Deployed Stressor	0.094	0.086	0.023
Has dependents	0.302	0.388	0.529
Number of Deployments	0.652	0.878	1.096
Std. Dev.	1.390	1.802	1.911
Marriage	0.072	0.089	0.067
Re-single	0.006	0.016	0.027
Age (18, 22)	0.325	0.164	0.015
Age (22, 25)	0.167	0.277	0.138
Age (25, 30)	0.052	0.121	0.174
Age (30, 35)	0.010	0.024	0.042
Age (35, 40)	0.002	0.006	0.011
Age above 40	0.000	0.000	0.002
Observations			434,357

C. ESTIMATION AND MODEL

The basic premise was to run three different regressions using the same regressors and to change the dependent variable to see whether the relevance of basic cognitive ability in the promotion bracket is salient and whether its impact is important, economically speaking. There may be certain ranks for which cognitive ability has a predictive value, but in others, it may not be valuable, which would mean that promotion processes are independent of each other.

The following equation represents a linear probability model for each promotion (E-4, E-5, and E-6):

$$Promote\ early\ = \beta_0 + \beta_1 AFQT\ 93 - 100 + \beta_2 AFQT\ 65 - 92 + \beta_3 AFQT\ 50 - 64 + \beta_4 Male + \beta_5 Black + \beta_6 Hispanic + \beta_7 Asian + \beta_8 Other\ race + + \beta_9 Aviation + \beta_{10} Medical + \beta_{11} Combat\ service + \beta_{12} Service\ support + \beta_{13} Other\ MOS + \beta_{14} Marriage\ stressor + \beta_{15} Single\ again\ stressor + \beta_{16} Deployment\ stressor + \beta_{17}\ Having\ dependants + \beta_{18} Number\ of\ Deployments + \beta_{19}\ Being\ married + \beta_{20}\ Re - single + \varepsilon.$$

I ran the same model but excluded the Navy enlisted classification while the job type was used as a conditional statement to run the model. This means that the following models aim to determine the significance and economic impact of basic cognitive ability across Navy communities. I took this route because the demand for basic cognitive abilities might differ from one community to another, so a total of 21 models were run for this thesis.

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V. RESULTS AND ANALYSIS

The results demonstrate that my model has the most predictive power for early promotion to E-4 and E-6, respectively, across the Navy. Consistent with this finding, my model tends to have its best overall performance when it is being used for early promotion to E-6. Basic cognitive abilities are statistically noteworthy at significance levels of 99% for all promotion processes studied in this research, both at the community level and when all communities are considered jointly. Another pattern identified in the study is that basic cognitive abilities are always positively correlated with early promotion. For most cases, the higher the AFQT score, the more likely a sailor promotes early. This evidence could be explained by the fact that people who are more cognitively advanced are more likely to be ambitious or that the Navy is sorting people using the AFQT scores because the most desired outcome is to promote the best people. Another tendency in the data is that the gap between group scores is bigger as a member is climbing the military hierarchy. For instance, the coefficient of the AFQT for the people with the highest AFQT score becomes 6 percentage points higher when comparing its coefficient for early promotion to E-6 against early promotion to E-4 at the Navy level; this analysis is driven from Table 2 where the coefficient for being in the most advanced group, cognitively speaking, increases from 22.8% for early E-4 to 28.8% for early E-6. Another similar example is when the coefficient of the most advanced individuals is analyzed across all promotions covered in this thesis for the service support community. This analysis is reached after comparing results in Tables 3, 4, and 5 but just for members with a service support MOS. The relevance of a higher AFQT is lower at early stages and becomes greater later on; it starts with a coefficient estimate of 17.3% and becomes 20.4% for early promotion to E-5, reaching 37.4% for early promotion to E-6. These examples might lead to the conclusion that workers at the top are more likely to be those more cognitively advanced. When it comes to the Navy promoting members early, the AFQT score might be used as a yardstick to sort sailors.

Another interesting finding in this research is that male sailors are associated with a higher likelihood than female sailors to promote early, with statistically relevant p-values lower than 0.05, at the Navy level. this analysis is driven from having analyzed Table 2, the factor that controls for male is always positive correlated with any early promotion. It is worth noting this statement becomes weaker as the promotion process is analyzed at the community level because sometimes its coefficient is close to zero, and the regressor is no longer statically significant. In other cases, the coefficient that controls for being male is associated with a negative effect on early promotion. For instances, looking at the combat community, being male increases the probability of early promotion to E-4 by 4.3% with p-values of 0.01 but for early E-5 the coefficient of being male is .4 % and no longer statistically significant, a same outcome for early E-6, the coefficient of male just increases the likelihood of early promotion to E-6 by 0.7% and it is not statistically significant. This analysis is reached after compering results in Table 3, 4, and 5 but just for members with a combat MOS.

Changing marital status is always associated with a lower likelihood of early promotion to any given rank when the event occurs before reaching the higher rank. This analysis is driven after comparing the coefficient of marriage and re-single in Tables 2, 3, 4, and 5; this means at the Navy level and the community level. Both factors—married and re-single—are always negative correlated with any early promotion and they are statistically significant using confidence level of 99%. Surprisingly, the number of deployments is negatively correlated with an early promotion to any given rank, at the Navy level and at the community level which seems to contradict the common belief that overseas duty matters in a military career, especially at the Navy and community level. This means that as the number of deployments goes up, the likelihood for any given early promotion decreases. This analysis is driven after comparing the coefficient of deployments in Tables 2, 3, 4 and 5. This coefficient is always negative correlated with any early promotion and is statistically significant using confidence level of 99%. There are also communities whose members are more likely to be promoted than others. For instance, the combat service support community is the group with the highest likelihood of promoting early, and others are at a disadvantage; this analysis is extracted by looking Table 2—Navy level—and noticed that the coefficient of combat service support is the only one positively associated with any early promotion and by having great disparity among the reaming factors that controls for others type of jobs. This conclusion might be explained by the Navy's needs during the timeframe of the data. Finally, the younger the sailor is, the more likely he is to promote early across all categories. This analysis is driven after looked Tables 2, 3, 4, and 5, and found that the base group—age 18 to 22—is almost never beaten by other age variables.

One of the best models—Table 2—clearly shows that having an AFQT score between 93 and 100 increases the probability of being promoted early to E-4 by 23%, regarding the lowest advanced group, holding other factors constant, with p-values lower than 0.01, when it comes to analyzing the whole Navy.

Table 2. Modeling results across the Navy

VARIABLES	(1) Early E-4	(2) Early E-5	(3) Early E-6
AFQT (93, 100)	0.228***	-0.034***	0.288***
	(0.006)	(0.005)	(0.009)
AFQT (65, 92)	0.155***	0.027***	0.115***
	(0.003)	(0.003)	(0.006)
AFQT (50, 64)	0.069***	0.055***	0.036***
	(0.003)	(0.004)	(0.006)
Male	0.029***	0.007**	0.044***
	(0.003)	(0.004)	(0.007)
Black	-0.053***	-0.040***	-0.080***
	(0.003)	(0.004)	(0.006)
Hispanic	-0.008**	-0.013***	-0.018***
	(0.003)	(0.004)	(0.007)
Asian	-0.036***	-0.048***	-0.087***
	(0.006)	(0.007)	(0.013)
Other race	0.011***	0.003	0.018*
	(0.004)	(0.005)	(0.010)
Aviation	-0.245***	0.018***	-0.121***
	(0.003)	(0.004)	(0.007)
Medical	-0.398***	-0.137***	-0.026***
	(0.005)	(0.006)	(0.009)
Combat SRV	0.021***	0.158***	0.010*
	(0.003)	(0.003)	(0.005)
SRV Support	-0.162***	0.054***	-0.060***
	(0.005)	(0.005)	(0.009)
Other MOS	-0.004	0.279***	0.039***
	(0.004)	(0.005)	(0.011)
Marriage Stressor	-0.057***	0.213***	0.208***
	(0.006)	(0.006)	(0.010)
Re-ingle Stressor	-0.064***	0.129***	0.130***
	(0.022)	(0.015)	(0.017)
Deployed Stressor	0.098***	0.270***	0.149***
	(0.004)	(0.004)	(0.006)
Has dependents	0.059***	0.024***	-0.017***
	(0.003)	(0.003)	(0.005)
Num of Deployments	-0.150***	-0.171***	-0.065***
	(0.002)	(0.002)	(0.002)
Marriage	-0.179***	-0.285***	-0.177***
	(0.005)	(0.004)	(0.005)
Re-single	-0.147***	-0.221***	-0.143***
	(0.017)	(0.011)	(0.009)
Age (22. 25)	-0.034***	-0.053***	-0.138***
	(0.003)	(0.003)	(0.017)
Age (25, 30)	-0.029***	-0.068***	-0.340***
	(0.004)	(0.004)	(0.017)
Age (30, 35)	-0.020**	-0.059***	-0.397***
	(0.009)	(0.007)	(0.018)
Age (35, 40)	-0.043**	-0.096***	-0.388***
	(0.020)	(0.012)	(0.021)
Age above 40	-0.084	-0.078	-0.461***
	(0.179)	(0.069)	(0.032)
Observations	157,974	124,480	43,206
R-squared	0.230	0.197	0.216

Note: *** p<0.01, ** p<0.05, * p<0.1 Standard errors in parenthe:

Table 3. Modeling results for early promotion to E-4 at the community level

VARIABLES	(1) Combat Early E-4	(2) Aviation Early E-4	(3) Medical Early E-4	(4) Combat SRV Early E-4	(5) SRV Support Early E-4	(6) Other MOS Early E-4
AFQT (93, 100)	0.249***	0.238***	0.179***	0.260***	0.173***	0.142***
	(0.013)	(0.015)	(0.019)	(0.010)	(0.031)	(0.035)
AFQT (65, 92)	0.182***	0.099***	0.071***	0.228***	0.091***	0.102***
	(0.005)	(0.006)	(0.008)	(0.006)	(0.010)	(0.014)
AFQT (50, 64)	0.064***	0.072***	0.026***	0.111***	0.039***	0.062***
	(0.006)	(0.006)	(0.008)	(0.006)	(0.009)	(0.014)
Male	0.043***	0.028***	0.067***	-0.005	0.026***	0.035***
	(0.006)	(0.006)	(0.007)	(0.006)	(0.010)	(0.012)
Black	-0.085***	-0.039***	-0.028***	-0.031***	-0.074***	-0.075***
	(0.006)	(0.007)	(0.008)	(0.006)	(0.010)	(0.014)
Hispanic	-0.018***	-0.010*	-0.005	0.004	-0.034***	-0.007
	(0.006)	(0.006)	(0.008)	(0.006)	(0.012)	(0.016)
Asian	-0.049***	-0.039***	-0.060***	-0.022*	-0.024	-0.072**
	(0.012)	(0.012)	(0.013)	(0.012)	(0.020)	(0.031)
Other race	0.009	0.007	0.018*	0.010	0.004	0.000
	(0.008)	(0.008)	(0.011)	(0.007)	(0.016)	(0.023)
Marriage Stressor	-0.065***	-0.014	-0.008	-0.115***	-0.025	-0.014
	(0.013)	(0.011)	(0.013)	(0.013)	(0.021)	(0.028)
Re-ingle Stressor	-0.093*	-0.097**	0.003	-0.051	-0.073	-0.070
	(0.049)	(0.039)	(0.038)	(0.053)	(0.074)	(0.098)
Deployed Stressor	0.121***	0.113***	0.046***	0.121***	0.122***	0.136***
	(0.008)	(0.007)	(0.010)	(0.008)	(0.013)	(0.018)
Has dependents	0.080***	0.088***	0.027***	0.068***	0.056***	0.130***
	(0.005)	(0.005)	(0.007)	(0.005)	(0.009)	(0.012)
Num of Deployments	-0.190***	-0.144***	-0.071***	-0.184***	-0.158***	-0.154***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)	(0.008)
Marriage	-0.211***	-0.213***	-0.107***	-0.167***	-0.227***	-0.233***
	(0.010)	(0.009)	(0.010)	(0.011)	(0.017)	(0.022)
Re-single	-0.227***	-0.124***	-0.092***	-0.234***	-0.132**	-0.224***
	(0.038)	(0.031)	(0.028)	(0.042)	(0.057)	(0.076)
Age (22. 25)	-0.040***	-0.028***	-0.010	-0.041***	-0.054***	-0.062***
	(0.005)	(0.005)	(0.007)	(0.005)	(0.009)	(0.013)
Age (25, 30)	-0.026***	-0.028***	-0.005	-0.046***	-0.040***	-0.040**
	(0.008)	(0.008)	(0.010)	(0.008)	(0.013)	(0.019)
Age (30, 35)	-0.006	-0.027	-0.025	-0.060***	0.021	-0.050
	(0.017)	(0.017)	(0.021)	(0.018)	(0.025)	(0.040)
Age (35, 40)	-0.035	-0.055	0.060	-0.087*	-0.130**	-0.134
	(0.042)	(0.039)	(0.043)	(0.044)	(0.053)	(0.089)
Age above 40			-0.155	0.113	-0.665	
			(0.345)	(0.221)	(0.462)	
Observations	44,991	40,987	13,887	45,083	14,253	6,886
R-squared	0.160	0.121	0.073	0.153	0.120	0.135

Note: *** p<0.01, ** p<0.05, * p<0.1 Standard errors in parentheses

Table 4. Modeling results for early promotion to E-5 at the community level

VARIABLES	(1) Combat Early E-5	(2) Aviation Early E-5	(3) Medical Early E-5	(4) Combat SRV Early E-5	(5) SRV Support Early E-5	(6) Other MOS Early E-5
AFQT (93, 100)	-0.159***	0.161***	0.079***	-0.054***	0.204***	0.178***
	(0.009)	(0.015)	(0.021)	(0.009)	(0.023)	(0.032)
AFQT (65, 92)	-0.037***	0.063***	0.043***	-0.003	0.145***	0.121***
	(0.007)	(0.007)	(0.011)	(0.007)	(0.011)	(0.016)
AFQT (50, 64)	0.056***	0.044***	0.020*	0.041***	0.089***	0.041**
	(0.007)	(0.007)	(0.011)	(0.007)	(0.011)	(0.016)
Male	0.004	-0.046***	0.078***	-0.034***	0.047***	0.082***
	(0.007)	(0.008)	(0.010)	(0.006)	(0.011)	(0.014)
Black	-0.085***	-0.038***	-0.033***	0.011	-0.017	-0.116***
	(0.007)	(0.008)	(0.012)	(0.007)	(0.011)	(0.016)
Hispanic	-0.032***	-0.021**	-0.037***	0.013*	-0.013	-0.052***
	(0.007)	(0.008)	(0.012)	(0.007)	(0.013)	(0.019)
Asian	-0.081***	-0.006	-0.030	-0.040***	-0.046**	-0.082**
	(0.013)	(0.015)	(0.018)	(0.013)	(0.020)	(0.036)
Other race	-0.006	-0.032***	-0.007	0.015*	0.055***	-0.033
	(0.009)	(0.011)	(0.017)	(0.009)	(0.018)	(0.028)
Marriage Stressor	0.224***	0.225***	0.119***	0.242***	0.162***	0.213***
	(0.010)	(0.013)	(0.019)	(0.011)	(0.019)	(0.030)
Re-ingle Stressor	0.139***	0.119***	0.076**	0.155***	0.098**	0.086
	(0.029)	(0.029)	(0.036)	(0.030)	(0.046)	(0.061)
Deployed Stressor	0.241***	0.272***	0.175***	0.323***	0.247***	0.308***
	(0.007)	(0.008)	(0.012)	(0.007)	(0.012)	(0.019)
Has dependents	0.081***	0.044***	0.013	0.030***	0.020**	0.070***
	(0.005)	(0.006)	(0.009)	(0.005)	(0.009)	(0.013)
Num of Deployments	-0.167***	-0.170***	-0.101***	-0.202***	-0.171***	-0.189***
	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.008)
Marriage	-0.310***	-0.282***	-0.150***	-0.341***	-0.251***	-0.330***
	(0.008)	(0.010)	(0.012)	(0.009)	(0.014)	(0.022)
Re-single	-0.242***	-0.206***	-0.131***	-0.287***	-0.189***	-0.232***
	(0.022)	(0.021)	(0.023)	(0.022)	(0.032)	(0.044)
Age (22. 25)	-0.020***	-0.102***	-0.103***	-0.050***	-0.100***	-0.142***
	(0.005)	(0.007)	(0.016)	(0.005)	(0.011)	(0.016)
Age (25, 30)	-0.020***	-0.135***	-0.117***	-0.059***	-0.149***	-0.193***
	(0.007)	(0.008)	(0.016)	(0.007)	(0.013)	(0.019)
Age (30, 35)	-0.012	-0.133***	-0.118***	-0.053***	-0.129***	-0.228***
	(0.013)	(0.014)	(0.021)	(0.013)	(0.020)	(0.029)
Age (35, 40)	-0.019	-0.158***	-0.151***	-0.100***	-0.163***	-0.281***
	(0.026)	(0.025)	(0.032)	(0.025)	(0.031)	(0.049)
Age above 40	0.040	-0.172	-0.148	-0.163	-0.047	-0.638**
	(0.151)	(0.200)	(0.130)	(0.160)	(0.128)	(0.254)
Observations	38,318	26,306	7,828	41,694	10,789	5,045
R-squared	0.151	0.168	0.107	0.158	0.198	0.230

Note: *** p<0.01, ** p<0.05, * p<0.1 Standard errors in parentheses

Table 5. Modeling results for early promotion to E-6 at the community level

VARIABLES	(1) Combat Early E-6	(2) Aviation Early E-6	(3) Medical Early E-6	(4) Combat SRV Early E-6	(5) SRV Support Early E-6	(6) Other MOS Early E-6
AFQT (93, 100)	0.258***	0.144***	0.229***	0.363***	0.374***	0.202***
	(0.014)	(0.031)	(0.050)	(0.014)	(0.039)	(0.060)
AFQT (65, 92)	0.119***	0.017	0.098***	0.170***	0.166***	0.111***
	(0.010)	(0.013)	(0.022)	(0.011)	(0.019)	(0.026)
AFQT (50, 64)	0.040***	-0.011	0.052**	0.067***	0.055***	0.024
	(0.012)	(0.013)	(0.022)	(0.013)	(0.018)	(0.025)
Male	0.007	0.055***	0.055***	0.026**	0.116***	0.013
	(0.012)	(0.018)	(0.019)	(0.011)	(0.019)	(0.021)
Black	-0.063***	-0.030**	-0.058***	-0.114***	-0.116***	-0.092***
	(0.011)	(0.015)	(0.022)	(0.011)	(0.019)	(0.024)
Hispanic	-0.013	-0.031**	0.007	-0.009	-0.056**	-0.082***
	(0.012)	(0.016)	(0.024)	(0.012)	(0.023)	(0.031)
Asian	-0.124***	-0.028	-0.117**	-0.057**	-0.136***	-0.082
	(0.022)	(0.032)	(0.046)	(0.024)	(0.042)	(0.062)
Other race	0.045***	-0.027	0.087**	-0.010	0.011	-0.025
	(0.017)	(0.026)	(0.044)	(0.017)	(0.039)	(0.053)
Marriage Stressor	0.194***	0.212***	0.158***	0.227***	0.218***	0.130**
	(0.017)	(0.025)	(0.052)	(0.017)	(0.035)	(0.053)
Re-ingle Stressor	0.152***	0.142***	0.088	0.133***	0.099*	0.324***
	(0.030)	(0.038)	(0.058)	(0.029)	(0.054)	(0.074)
Deployed Stressor	0.185***	0.119***	0.036	0.162***	0.117***	0.103***
	(0.011)	(0.013)	(0.023)	(0.010)	(0.020)	(0.030)
Has dependents	0.002	-0.012	-0.035*	-0.025***	-0.019	-0.046**
	(0.008)	(0.011)	(0.019)	(0.008)	(0.016)	(0.021)
Num of Deployments	-0.076***	-0.057***	-0.057***	-0.065***	-0.046***	-0.065***
	(0.003)	(0.004)	(0.007)	(0.003)	(0.005)	(0.008)
Marriage	-0.179***	-0.150***	-0.146***	-0.191***	-0.179***	-0.130***
	(0.009)	(0.012)	(0.023)	(0.009)	(0.017)	(0.025)
Re-single	-0.177***	-0.105***	-0.126***	-0.151***	-0.110***	-0.179***
	(0.016)	(0.018)	(0.029)	(0.016)	(0.026)	(0.036)
Age (22. 25)	-0.119***	-0.229***	-0.306	-0.148***	-0.150*	-0.081
	(0.025)	(0.076)	(0.267)	(0.027)	(0.079)	(0.112)
Age (25, 30)	-0.316***	-0.454***	-0.474*	-0.354***	-0.337***	-0.341***
	(0.025)	(0.075)	(0.265)	(0.027)	(0.079)	(0.110)
Age (30, 35)	-0.364***	-0.472***	-0.661**	-0.382***	-0.415***	-0.351***
	(0.027)	(0.076)	(0.265)	(0.029)	(0.080)	(0.112)
Age (35, 40)	-0.323***	-0.399***	-0.690***	-0.409***	-0.411***	-0.251**
	(0.034)	(0.081)	(0.266)	(0.036)	(0.084)	(0.118)
Age above 40	-0.398***	-0.490***	-0.816***	-0.401***	-0.449***	-0.313**
	(0.056)	(0.104)	(0.271)	(0.064)	(0.103)	(0.157)
Observations	14,666	7,463	3,223	14,124	3,752	2,204
R-squared	0.197	0.119	0.127	0.229	0.207	0.149

Note: *** p<0.01, ** p<0.05, * p<0.1 Standard errors in parentheses

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VI. CONCLUSIONS AND RECOMMENDATIONS

This thesis addressed the question of the role of basic cognitive ability, specifically literacy and numeracy skills, on a sailor's chance at early promotion. This question was answered by conducting an empirical study using linear probability models for each promotion process across the U.S. Navy and then at the community level. The AFQT score group was included as a regressor that controlled for basic cognitive ability. The most salient finding is that the AFQT score in most cases is positively associated with early promotion, and the coefficient becomes more important as the number of available billets for higher ranks becomes more constrained.

The caveat of this finding is that it did not establish a causal relationship between cognitive ability and early promotion because cognitively advanced people may be more ambitious or the Navy is using the AFQT score specifically as a sorting tool. Interestingly, male sailors are associated with a higher probability of early promotion, but this statement becomes weaker when the analysis is conducted at the community level. Changing marital status is always associated with a lower probability of promoting early and statistically significant at a level of 0.01. In line with this finding, I show that deployments reduce the likelihood of promoting early, which contradicts the common belief that the Navy rewards people who deploy. This thesis also supports the idea that some communities have an advantage over others in promoting early. Finally, the younger the enlistee, the more likely he is to promote early.

Further analysis should discuss what the AFQT is truly measuring. There is a broad body of research that has tried to address this question. For example, a person who faces constraints of time would say that the AFQT better captures the concept of time management; on the other hand, an individual who faces constraints of access to the material would say that the AFQT better captures material access than cognitive ability. Another may suggest that some individuals are just better test takers. Still, another may say that the AFQT better captures cognitive ability if what he faces is cognitively challenging. Furthermore, someone might argue that the AFQT better captures resilience than cognitive ability if he faces numerous challenges and constraints during preparation. Thus, what the

AFQT captures represents the individual notions of the cost required to accomplish the exam. More specifically, the AFQT reflects the true cost of each individual assigned to the task or challenge; therefore, the measurement has a deeper, more profound implication than just what common wisdom dictates.

A next step for the military may be to develop the ability to identify people’s constraints to ensure that the AFQT measures cognitive ability rather than something else to classify people in light of their brain capacity. The importance of this is due to the AFQT being used as a general yardstick to categorize people’s cognitive ability when there is no certainty that the test is meeting that purpose.

I also suggest that the Navy make an effort to capture true data entries, so future analysists have less room for mistakes. Future studies should incorporate dependents into the model to determine what type of dependent is being recorded since its definition is too broad. Another suggestion for future research is to include in the model a measurement of ambition because it may allow researchers to see more clearly how AFQT scores are being used by the U.S. Navy.

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