



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

**ANALYSIS OF PROMOTION ZONE EFFECTS ON
NAVAL OFFICERS CAREERS**

by

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March 2020

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**ANALYSIS OF PROMOTION ZONE EFFECTS ON NAVAL OFFICERS
CAREERS**

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ABSTRACT

The Navy uses “zones” to define promotion eligibility of its officers in each of the control grades, O4–O6. Recent shifts in policy have begun to move the promotion system away from strict zone eligibility in favor of a more merit-based system that have re-defined zones. Despite recent steps to minimize the effects of promotion zone, such as removing zone labels from officer records, little to no research exists that supports such a policy change or other proposed alterations.

Using data from Navy Personnel Command, we use linear probability models to show that recent policy removing zone labels from promotion eligible officer records increases probabilities of promotion both below and above-zone while lowering probabilities of promotion for in-zone officers. Additionally, using data from the Defense Manpower Data Center, we use Cox Survival analysis to show that attrition rates decline for previously fast-tracking officers and increase for slow-tracking officers. Moreover, we show that promotion probabilities increase for fast-tracking officers while they decrease for slow-trackers. Based on our findings, we therefore recommend expanding below-zone selections to allow for a more robust naval officer workforce and that if limits must be made, they should be made towards above-zone eligible officers. Future studies should look to secure data that would allow statistical methods that isolate zones and determine the causality and effects that zones have on an officer.

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LIST OF ACRONYMS AND ABBREVIATIONS

AQD	Additional Qualification Designator
CAPT	Captain
CDR	Commander
CNIC	Commander Naval Installations Command
DMDC	Defense Manpower Data Center
DOPMA	Defense Officer Personnel Management Act
FITREP	Fitness Report
FY	Fiscal Year
LCDR	Lieutenant Commander
LT	Lieutenant
LPM	Linear Probability model
NOBC	Navy Officer Billet Classification
OLS	Ordinary Least squares
OPA	Officer Personnel Act
OSR	Officer Summary Record
PERS	Navy Personnel Command
PSR	Personnel Summary Record
Tank	Promotion Board room

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I. INTRODUCTION

Navy officer promotion is competitive. Though many factors contribute to the competitive environment, principal among them is a Department of Defense policy, that places restrictions on the number of naval officers in each of the three control grades: lieutenant commander, commander, and captain. Thus, the only way for an officer to promote into a control grade is through vacancy. This tournament style of promotion creates intense competition, one that places officers against each other for a battle of limited opportunities. Like any tournament, there are winners and losers, high-performers and those that struggle to be competitive.

Despite the competition that exists between officers at the control grades, the road to promotion eligibility is controlled by seniority. As an officer moves up the career ladder, they fall into one of three zones: junior eligible (below-zone), eligible (in-zone), or all others who have been considered once for promotion but failed to be selected (above-zone). As it stands today, no accomplishment, no achievement, or high degree of merit will propel an officer into a promotion zone faster than another officer. This promotion zone eligibility system combined with a promote-to-vacancy style tournament creates ebbs and flows, causing inconsistency in the promotion rate.

Current policies that govern the number of below-zone eligible officers for promotion are found in the Defense Officer Personnel Management Act (DOMPA). DOPMA regulates promotion from below-zone to no more than 10% of total promotions. Although below-zone officers are “eligible” for promotion, lower seniority decreases the odds of their selection. Current research, however, does not support the suppression of below-zone promotion, or fast-tracking as its more commonly known. Fast-trackers have been shown to possess very desirable qualities that can enhance an organization’s competitive advantage. Other documented attributes include:

- Unique perception of their occupations
- Broad thinking style
- Ever-present time consciousness
- Independence
- High level of commitment

- A great amount of energy
- Creativity
- Varying interest in teamwork
- Continual improvement (Gritzmacher, 1989, pp. 422-423)

Other attributes include “quick learners, risk-takers, consistent high performers, have growth potentials, and positive energy” (Juhdi, Pa’wan in 2012 p. 189).

Ultimately, if fast track officers are properly managed, they can be assets to the Navy, the next top leaders, and provide a competitive advantage over other rivals. Thus, policies that restrain fast-tracking within the military are in question, as they stifle younger talent. Defense officials have been looking for more flexibility with officer career planning by arguing for changes to DOPMA.

This study comes at a time when great changes are being proposed amongst Navy policymakers. Overall, the Navy is looking to revamp how it considers eligibility for officer promotion from a very traditional time-in-grade, years of service, to a more merit-based system. This would require doing away with promotion zones entirely or at a minimum, significant reconstruction of promotion policy.

Calls for change come on the heels of a 2014 retention study conducted on both naval officers and enlisted personnel. Among the many findings, the report recommended changes to the promotion system, specifically, moving milestone-screened officers to the top of their peer groups (Navy Retention Study, 2014). In effect, the report recommended that merit be given more weight to an otherwise time-in-grade based promotion policy.

A similar study, also published in 2014, examined the U.S. Marine Corps’ promotion system and recommended an increase to below-zone officer promotion. (Marx, 2014). Used as justification, the study cited that “82 percent of survey respondents believed that half or more of the best officers were leaving the service, while 90 percent agreed that the best officers would be more likely to stay if the military was more of a meritocracy” (Marx, 2014, p. 3).

In 2018, Robert Hood, then assistant secretary of defense for Legislative Affairs, spelled out some likely changes to the promotion system. Among the changes, the promotion system would recognize merit and rising younger talent. Service officials would

be allowed to spell out rules for quicker promotion schedules, disconnected from time in service (Copp, 2018).

Finally, in 2019, the National Defense Authorization Act (NDAA) authorized changes to the promotion system that allowed “promotion boards to recommend officers of particular merit be placed higher on a promotion list” (National Defense Authorization Act for Fiscal Year 2019, sec. 504).

Other naval leaders have pushed back on the idea of opening promotion zones and accelerating the system too quickly. They caution against such a move, arguing that an increase in below-zone promotions could hurt those officers selected, reasoning that it could move them up the career ladder too fast and too soon, hurting their chances for subsequent promotion.

A. PROBLEM STATEMENT

Noticeably absent from ongoing discussions on promotion is concrete data supporting any proposed promotion system change. It remains unclear what any changes to DOPMA would have on the Navy officer community. Despite the benefits and the mentoring of fast trackers, what signal could this send to outside civilian agencies? Such talent may attract the attention of other potential employers and impact Navy retention rates. Without such data, calls for DOPMA reform could cause more harm than good.

Additionally, promotion zones could provide valuable information to board members, allowing them to quickly assess the quality of an eligible officer, assisting in the selection of the “best and most fully qualified.” Removal of zones, therefore, may impede a board’s decision and ultimately affect the health of Navy manning outcomes. This study aimed to fill those voids with this study, seeking to analyze promotion outcomes that could be used to support one argument or the other. This study provided a glimpse into the future and address the question, do promotion zones influence how officers are selected and what could happen if the Navy removed zone or if they abolished zones altogether? This study looked to connect the dots between recent officer demands and cultural needs with expectations—such policy changes could be the biggest, single mistake in the Navy and

indeed the armed forces, or it could be revolutionary, and enhance officer retention, and performance.

B. RESEARCH QUESTIONS

How did a recent Navy policy change, removing the label of below/in/above zone from its promotion process effect officer promotion probabilities?

Does an officer's speed of promotion (selection below/in/above-zone) predict subsequent promotion and career longevity? Does fast or slow tracking for promotion result in longer Naval careers, or do these officers leave for the civilian sector faster?

C. NAVY OFFICER PROMOTION BACKGROUND

1. Navy Promotion System

According to Gibbs (1994), tournament theory has two key assumptions, one of which is that the number of jobs in an organization is relatively fixed. Fixed-job slots are one way to differentiate between a tournament system and a standards-based system. The Navy utilizes a tournament promotion system, promoting to limited vacancies based on DOPMA, ensuring that each officer, O-4 and above, will support a specific funded requirement. Due to these limitations, promotion is extremely competitive. Selection opportunities vary each year, as there are many variables to consider when developing a promotion plan to include the number of officers that may be promoted in the current cycle.

Accession, attrition, and other relevant personnel factors form the basis for community managers to formulate the timeline that identifies the forward momentum or termination of an officer's career, or flow point (years in grade/service). Officers considered for promotion will be grouped into similar competitive categories to reduce variation in skill types and duties for a more equitable comparison. The selection board searches for the best and most fully qualified among the eligible applicants. Promotions from the below-zone are governed by DOPMA that limits selections to no more than ten percent of the total promotions.

The fact that tournament theory invokes such competition helps to further our understanding as to whether harmful outcomes could occur due to the nature of military

service that requires large amounts of cooperation and coordination. The Navy also provides some unique opportunities to further understand the implications of tournaments with diverse contestants, in which there has been limited analysis.

Selection for promotion is determined by a combination of factors, including qualifications, education, types of duty, and most importantly, sustained superior performance. The selection board is searching for the best and most fully qualified among the eligible applicants.

2. Lineal Number / List

Within the Navy Promotion System, naval officers are sorted into a rank and seniority hierarchy to create an Active Duty List, also referred to by a lineal list (Department of the Navy [DoN], 2005). The United States Code Title 10 directs each armed force to establish a single list of commissioned officers to determine seniority in grade and eligibility for promotion while allowing for proper timing of promotion of officers (Armed Forces, 1956). The lineal list contains names, grades, dates of rank, and precedence numbers of all officers, ensign and above (DoN, 2005).

Department of the Navy provides a fairly straightforward method of calculating an officer's date of rank. Any officers appointed as ensigns during the months of May and June, during any given year, will be assigned the same date of rank "as the date of graduation of the class of midshipmen of the United States Naval Academy" (DoN, 2005 p. 3).

As dictated by the Department of the Navy Policy, seniority on the lineal list is calculated by using an officer's grade and date of rank. An earlier date of rank, as compared to another officer, is, therefore, the more senior officer and reflected by a corresponding eight-digit precedence number (DoN, 2005).

Department of the Navy precedence numbers consists of a six-digit whole number and a two-digit suffix. The two-digit suffix allows for officers to be placed in between other officers to maintain proper ordering between whole numbers (DoN, 2005). Officers starting as ensigns are not given a lineal number until they complete one year of active duty service.

According to Navy policy, officers “will be rank-ordered by percentile of class standing among other ensigns appointed from all commissioning sources on the same date or with the same date of rank” (DoN, 2005 p. 4). A Naval Academy graduate who has the highest-class ranking will be the most senior with the lowest precedence number. Any officers for whom percentile of class standing can be calculated will then be ordered regardless of their commissioning source. Officers with no percentile class standing will rank junior to “all other officers having the same date of rank and will be ranked” (DoN, 2005 p. 5) based upon a set of criteria which includes the date of appointment and date of birth. If any officers have a matching date of birth, they are then ordered by the first letter of their last name (DoN, 2005). Department of the Navy lineal numbers are based on the following criteria: rank; date of rank; class percentile number; date of birth; and the first letter of the last name. Connelly et al. (2014) further discuss how each employee's probability of promotion is a relation of random components.

Once an officer is promoted, the United States Code Title 10 requires officers to advance in the order in which they appear on the lineal list. Recent changes in policy allow promotion boards to reorder based on merit (DoN, 2019). Officers are then given new lineal numbers for their new rank based on their new promotion date (Armed Forces, 1956). These rules create an order of seniority in the Navy, which subsequently also leads to officers being divided up into zones at promotion boards. Tournament theory rose from its earliest concept of two-player contests in which each player was identical (Lazear & Rosen, 1981). While no two officers are identical, a solution within tournament theory that may account for contestant heterogeneity is for the Navy to form sub-contests, to ensure employees compete with other similar employees (Gomez-Mejia et al., 2009).

3. Promotion Zone

Promotion boards typically convene in the spring; however, the promotion planning process starts well before, usually in September, and ends in December, with the release of the lineal list with promotion zones (Office of the Secretary [SECNAV], 2019). The lineal list serves as a key indicator for officers approaching promotion into any of the three control grades, O4-O6.

With few exceptions, promotion zones are governed by three factors: the number of officers authorized for that rank within a community, projected vacancies, and selection opportunity (SECNAV, 2019). Each of these factors differs among designations and even from year to year. Additionally, DOPMA-policy sets limits and exceptions to opportunity, flow point, and officer authorizations (OPA).

As naval officers promote to vacancy, planners must account for those officers previously selected for promotion, retiring, resigning, or otherwise exiting from the Navy. This number is then subtracted from the number of officers currently filling authorized billets, a number which provides the board with the number of officers that can be selected for a given fiscal year.

With the number of vacancies determined, zone size is calculated by using promotion opportunity. Opportunity is DOMPA regulated and is used to determine the percentage of eligible officers who can promote that fiscal year for each grade. Opportunity is applied to the number of approved vacancies, to then select the size of the promotion zone (SECNAV, 2019). As officers promote and/or exit the Navy, officers remaining continue to climb the lineal list and pass through one of three zones as they approach promotion.

4. Promotion Board

According to Navy Personnel Command PERS-80, the promotion board process begins with board recorders scrubbing and reviewing officer FITREPS for accuracy. Upon review, they are randomly provided to board members who also are careful to place any comments, notes, and highlights on the officer's corresponding OSR/PSR. After a board member's review, the records are ready to be presented and briefed before the formal board, in a room known as the Tank. Following each record brief, board members anonymously vote via a confidence factor (100, 75, 50, 25, 0) (Office of the Chief of Naval Personnel [CNP], 2018).

CNP goes on to state that once all the above-zone and in-zone officer records have been evaluated and voted on, a graphic is displayed in the promotion board room that shows the number of votes with the computed confidence level from the vote of confidence

factors. Board members must then determine which officers stand out from the others and those not meeting the board president's precept expectations. Officer records remaining after first-round selection are brought into the crunch and are then re-evaluated among the board members for an additional promotion consideration (CNP, 2018).

A secondary process that follows initial selection is if and how below-zone records should also be considered for promotion. CNP outlines this process starting with the most senior below-zone eligible and working down through the lineal list. Only unanimous votes affirming record review will be considered. Once all below-zone records receive an initial vote, a new graphic is displayed, that consists of only below-zone records. Board members then vote which of those below zone records will be brought to the crunch. The officer records that are added to the crunch are then reviewed, marked up, and given a grade, by a board member. The records are then briefed in the same manner as records in-and above zone (CNP, 2018).

With below-zone selections, it is important to note the following: DOPMA places a 10% limit on below-zone selects, board members understand that a below zone selection takes away a selection from in-or above-zone. Additionally, when officers are below-zone and not selected for promotion they do not receive a failure of selection (CNP, 2018).

All new records being brought into the crunch must be reviewed and assessed by a board member. This process mirrors that of normal officer record review as outlined by CNP. After the assessment, all records are briefed in the Tank to all board members. Similar to initial voting, all board members vote their confidence factor. The board recorder documents the overall score of the record being voted on. When the board completes voting on each record, an updated scattergram is shown to all members, who then get a chance to select which records to select or which records to drop. This systematic review remains until all the promotion vacancies are filled. On rare occasions boards are allowed to not fill all vacancies if board members can't find any officers that meet the standards. The tentative selection list is then certified and finalized by board members (CNP, 2018).

It is important to note, that promotion board policy recently changed to better align with Navy Talent Management initiatives in 2015:

5. Zone Labels

The Navy promotion board implemented changes starting in January 2016, to improve the process that ensures the best and fully qualified officers are selected regardless of seniority. Previously, records had been briefed in order of seniority, which is no longer the case. Additionally, identifying stamps denoting an officer as above, in and below the promotion were removed from the summary. Below-zone records are still retained as an initially separate review process (Office of the Secretary, 2015).

However, with such small below-zone numbers being considered by communities, there still is potential for board members being able to easily identify a below-zone officer when that record is brought into the crunch. Identification could be by name or even a year group that could be an outlier. The biggest challenge is below-zone records will have been only graded one time, with one color marked on the record. Above-and in-zone records that go on to the crunch get a second grade in a second color marked on the record by a different grader. While the below-zone label is gone it is hard to know for sure that below-zone officers truly get the full benefit of the label being removed for these reasons and their separate initial review.

6. Merit Reordering

Merit reordering places all those records that were selected for promotion back in front of that same board to figure out which person will be promoted first, based on merit as outlined in the provided convening order to the board. This allows for officers to be promoted prior to where their lineal number would have placed them. Higher placement only happens when an officer receives at least a majority of the members of the board. A board may not exceed 15% of total selections authorized for each grade and competitive category to be placed higher on the promotion list (DoN, 2019). A board may elect to not reorder based on merit. No officer selected for promotion shall be moved down except by insertion of the name of an officer of merit above that officer's name. Officers of particular merit are those officers whose records contain consistent superior performance, as documented.

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II. LITERATURE REVIEW

A. PAST PERFORMANCE PREDICTING FUTURE PERFORMANCE

This current study utilizes an officer's past performance, in this case, below-zone in-zone, and above-zone promotion, and uses it as a predictor of their future performance. This is to determine whether below-zone performers perform better throughout their career, or if above-zone performers continue to perform at a slower pace. Previous literature has shown that past performance can have impacts on employee's future performance but to what extent?

One Naval Postgraduate School 1997 thesis explored the effects of below-zone promotion on an officer's future career. Rivero et al. (1997) analyzed 10 years of officer data for three major unrestricted line warfare communities (submarine, surface, and aviation) using OLS and logit models. The researchers examined in-zone and below-zone data and excluded the above-zone data from the research. They did not find any correlations between being promoted below-zone that resulted in any disadvantages compared with fellow officers selected in-zone. Their analysis found that officers on a fast track or selected below-zone were able to advance their careers faster than in-zone peers. They found that below-zone selects were more likely to be screened for command and promoted to the next rank. The researchers concluded with three possible recommendations for future consideration:

Tracking of individuals and checking for setbacks associated with below-zone promotion - a method that needs to be applied carefully in terms of privacy.

A direct comparison of in-zone and below-zone cohorts that share the same career conditions with the method of including in-zone and above-zone officers from an older cohort would give a more complete test of the theory.

The construction of a retention model using the below-zone, in-zone, and above-zone variables at the lower board could offer information about retention behavior and how the impact of this policy is for the Navy. (Rivero et al. 1997, p. 73)

Expanding the literature to include non-military organizations, a 2012 study looked at an employee's previous career successes as a determinate of current career success as measured by civilian employment evaluations (Stumpf & Tymon, 2012), suggesting that successful employees maintained, at least a reputation for superior performance, as documented by management.

Similarly, Gibbons and Waldman (1999) found that workers who are promoted early go on to be promoted faster to the next level. Based on their findings, the question addresses why the Navy limits below-zone selection, rather than considering officers equally. In the Navy tournament, the three distinct zones or subgroups can act as a type of handicapping. The incentive is adjusted within different zones, a situation that can negatively impact one zone while positively impacting another zone (Connelly et al., 2014).

One potential reason offered by Honicke and Broadbent (2016) of sustained superior performance is that previous success builds higher levels of self-efficacy, which promotes like behavior in the future. This would indicate that below-zone selects would have elevated levels of self-efficacy and could, therefore, be expected to promote more quickly going forward, building off the momentum of previous promotions.

Zyphur, Chaturvedi, & Arvey (2008) recognized the idea of employees building on previous successes with an added component—future performance may lag from previous measuring points. The study built a model that attempted to more accurately determine an employee's future performance by looking at two distinct variables: previous performance, and an employee's unique performance trajectories. The study concluded, that an employee's career could build on successes and have high success or failures well after the initial point of success.

Despite literature documenting employees building from past successes, some research suggests that negative selections or those who stay at a job longer without promotion can contribute to adverse effects to the organization (Frederiksen & Takats, 2011). The study found that employees that stay longer in their position perform worse than other employees who receive an early promotion. If this is the case, why does the

Navy system not limit the above-zone category, instead of the below-zone to 10%? They also found that employees have greater competition from competitors below than competitors above. This influence becomes even greater after the rank ordering of employees has been relatively stable (Bothner, Kang, & Stuart, 2007). The Navy linear ordering system creates seniority ranking, while the zone limitations on the below-zone may seem to prevent crowding from competitors below the officer.

B. TOURNAMENT THEORY

As described earlier, the Navy promotion system functions, in many ways, as that of a tournament-style system. A variety of behaviors can be created from a tournament-style promotion system. Literature in tournament theory is well documented and, if parallels can be drawn between it and the Navy, it might support current research findings.

In the survey of tournament theory, Connelly et al., (2014) describe tournaments as competitions in which employees strive for a prize. The prize is a rank award based on the employee's relative seniority to incentivize the employee to an optimal level of effort. The prize concerning the Navy process is continued superior performance to advance to the next rank, with monetary and non-monetary gains. Contestants are incentivized by the monetary and non-monetary gains. Winners of a tournament gain an improved status which may be more important. The newly gained status allows the winner to gain additional monetary benefits and status in the future (Nippa, 2010).

According to O'Neill and O'Reilly (2010), sequential elimination is a hierarchical tournament where employees win promotion and then compete in another promotion round against other employees who were promoted in previous rounds. Officers promoted to rank directly compete with those officers for the next incentive or rank. Heterogeneity leads to success in early rounds for better-equipped employees, but subsequently, more effort became more important in later rounds as competition grew among the winners (O'Neill & O'Reilly).

Two predictions of tournament theory, however, fail to appear in the Navy promotion tournament. According to Gibbs (1994), the last two predictions are that "Pay grows in a convex manner with hierarchical level" (p. 1) and the last earned at CEO is "still

larger to give incentives equivalent to an infinite horizon of future competitions” (p. 1). Navy officer pay grows in a linear fashion rather than in a convex manner. Additionally, the pay of an Admiral does not have a very large increase as would be expected with tournament theory. This may be due in part to the fact salaries are paid by the government/taxpayer and/or there are additional factors that may motivate officers in the Navy.

Additionally, further research into heterogeneity has begun to uncover that, if employees know their abilities and the abilities of co-workers, they no longer have to give the most effort; they can focus attention on sabotaging co-workers (Connelly et al., 2014). This introduces the concept of sabotage by employees. Employees benefit not only from putting forth extra effort but also by reducing that of another employee (Connelly et al., 2014). The pure nature of tournament theory inducing competition brings into question whether the promotion tournaments in the military are appropriate when a high level of cooperation/coordination is required. Morgan and Wang (2010) found that tournaments can reduce cooperation where it may be needed or otherwise increase collusion among employees.

C. FAST-TRACKING EMPLOYEES

One critical component of this study is the idea of fast-tracking. Fast-tracking is beneficial to not only the employee but the organization as well (Gritzmacher, 1989). If Naval officers promoted below-zone perform better and an environment is created that fosters their growth rather than stifles it, the Navy should, therefore, expect certain benefits from fast-tracking.

Employees that are on a fast-track for promotion, those who are promoted more quickly once, have a higher probability of being promoted again before other employees that are more-able bodied but not on a fast track (Baker et al., 1994). This suggests that employee ability interacts with how fast an employee may learn. Firms want to be able to retain talent that they promote, but Baker et al. found that employees that were promoted the fastest exited the firm at a higher rate. Baker et al. further hypothesized whether the

promotion was not sufficient enough to keep top performers, and whether they were leaving for higher compensation.

Gibson (2007) found that by using a linear optimization model for U.S. Army officers he could reduce future mid-grade rank shortages by adjusting the promotion rules and shortening the required length in service by one year. This was simply an optimization problem and did not address policy implications.

Belzil et al. (2018) found that the main characteristic of promotions is unobserved employee differences, but that functional area within the business had a high descriptive power resulting in a promotion. Furthermore, Belzil et al. found fast tracks did exist for certain high-level executives, a situation which resulted from the employee differences and were not due to the integral benefit of being fast-tracked recently. Belzil et al. describe two types of fast-tracks, spurious and causal. Spurious fast-track results from employee differences in ability, while causal fast-tracks result from promotions being determined due to the speed of prior promotions. The fast-tracking found by Belzil et al. was consistent that employees on a fast track have continuous fast promotions at further levels. Although, the evidence did not support the signaling theory, that the speed or signal of promotion gave the inherent benefit for future promotion. Instead, Belzil et al. found that fast tracks are more likely the result of a consistent high-ability performer. After conditioning on the executive's prior advancement speed, they found that promotion speed had a weak negative effect on future promotion (Belzil et al., 2018).

Signal theory suggests that when employees receive a promotion, outside firms view that promotion and employee favorably and consider them a higher quality worker. DeVaro & Waldman (2012) tested the signal theory across education levels. They found that signal theory supported promotion probability predictions for employees with bachelor's and master's degrees, while finding mixed results for employees that were high school graduates or had doctoral degrees.

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III. DATA AND METHODOLOGY

A. LIMITATIONS

In earlier phases of this study's conceptualization, separate but duplicate data requests were made to ensure the needed data to complete the study. One request was to Navy Personnel Command (PERS) and the other to the Defense Manpower Data Center (DMDC). Unfortunately, both data sets lacked complete requested variables to the extent, that neither data set sufficient standalone. However, in parallel to each other and employed by different statistical models, the data told a complete narrative that supported meaningful statistical outcomes.

That said, this study is limited in its scope and application. The inability to acquire a longer panel of data with zone variables limited the study's ability to track officers' careers through multiple boards and therefore prevented more robust statistical methods that could have shown possible causality with zones. To overcome this limitation DMDC data was essential, as it answered key longevity research questions. Though it lacked the zone information, speed of promotion was used as a substitute for zones, therefore showing the effects of the speed of promotion and an officer's career.

Due to PERS data not having file dates, we had no way of knowing when an officer acquired additional AQDs, NOBCs, and subspecialties. This made it impossible to control for and correlate with promotion. As this data would have been an important proxy for experience, an attempt was made to incorporate the variables into statistical models but was unable to properly, and more importantly, reliably, use the variables and were therefore dropped from the study.

B. PERS DATA

Data from PERS contained observations of 6,117 naval officers from the fiscal year 2012 through 2020. Included were basic demographic data such as gender, ethnicity, race, and number of dependents. Additionally, the data contained crucial officer career information such as Additional Qualification Designations (AQD), subspecialties, Navy Officer Billet codes (NOBC), and education.

Vital to our study was the promotion information PERS data provided that grouped each officer into staff or line officer designations. Promotion data listed the promotion zone category, corresponding officer's selection status (i.e. fail to select or selected) and the promotion board date for promotions to lieutenant commander, commander, and captain. These variables were then cleaned and made binary.

Zone data was important to our study as it provided promotion data from before FY17 and after FY17 changes to promotion policy that removed the zone labels from inside the promotion board. This allowed us to determine the effects of promotion zones and, more specifically, what effect zone labels had on promotion.

From the provided education data, a bachelor's only or master's only dummy variables was created and used them to find changes in education, recognizing officers who, while on active duty, obtained additional education. A dummy variable education growth was then created to reflect value.

Promotion data was broken down into dummy variables starting with rank: LT, LCDR, and CDR. Zone designation dummy variables were then created for each fiscal year (FY 12-FY 20) and whether the officer was selected for promotion for any given rank during that period.

Lastly, some new variables were created. A variable called staff and line differentiated the officer type in the data. Promotion boards were coded as either line or staff and distinctions were made in our data to mirror that policy. Other variables created were called Policy, denoting whether an officer was selected for promotion after a change in promotion board policy. Likewise, two variables called the Below Policy and Above Policy were created to differentiate those officers selected above-or below-zone after a change in promotion policy. Table 1 is a general overview of dependent variables, designators, and key X variables.

Table 1. Overview of PERS Data Variables Adapted from PERS (2019).

Dependent Variables	Description
<i>Promoted</i>	= 1 if promoted to the next rank in data set '= 0 otherwise
<i>Promoted to LCDR</i>	'= 1 if promoted to LCDR '= 0 otherwise if rank = LT
<i>Promoted to CDR</i>	'= 1 if promoted to CDR '= 0 otherwise if rank = LCDR
<i>Promoted to CAPT</i>	'= 1 if promoted to CAPT '= 0 otherwise if rank = CDR
Designators	
<i>Staff</i>	= 1 if designator = Staff Corps '= 0 otherwise
<i>Line</i>	'= 1 if designator = Restricted/Unrestricted Line '= 0 otherwise
Key X Variables	
<i>Above-zone</i>	= 1 if above-zone during promotion board '= 0 otherwise
<i>Below-zone</i>	'= 1 if below-zone during promotion board '= 0 otherwise
<i>Education growth</i>	'= 1 if change in education from Bach to Masters '= 0 otherwise
<i>Policy</i>	'= 1 if observation occurred after the policy change >= FY17 '= 0 otherwise
<i>Above Policy</i>	'= 1 if Above-zone = 1 & Policy = 1 during promotion board '= 0 otherwise
<i>Below Policy</i>	'= 1 if Below-zone = 1 & Policy = 1 during promotion board '= 0 otherwise

Tables 2 through 7 provide summary statistics broken down by individual rank promotion boards and officers promoted. These statistics show PERS data is consistent with demographics and data not only in the DMDC data set but also within the Navy.

Specifically, Tables 2 and 3 are the summary statistics for the lieutenant commander promotion board. Tables 4 and 5 are summary statistics for the commander promotion board. Tables 6 and 7 contains summary statistics for the captain promotion board.

Table 2. PERS LCDR Board Summary Statistics. Adapted from PERS (2019).

<u>Variables</u>	<u>Means</u>
<i>Sample Population</i>	N = 8,485
<i>promoted</i>	0.261
<i>abovezone</i>	0.074
<i>belowzone</i>	0.607
<i>priorenlisted</i>	0.284
<i>married</i>	0.166
<i>lessthan3kids</i>	0.484
<i>morethan3kids</i>	0.052
<i>female</i>	0.200
<i>white</i>	0.833
<i>black</i>	0.085
<i>staff</i>	0.346
<i>belowpolicy</i>	0.288
<i>abovepolicy</i>	0.040
<i>educgrowth</i>	0.511

Table 3. PERS LCDR Promoted. Adapted from PERS (2019).

Variable	Mean
<i>Sample Population</i>	N = 2,217
<i>abovezone</i>	0.084
<i>belowzone</i>	0.022
<i>priorenlisted</i>	0.279
<i>married</i>	0.156
<i>lessthan3kids</i>	0.531
<i>morethan3kids</i>	0.058
<i>female</i>	0.191
<i>white</i>	0.851
<i>black</i>	0.069
<i>staff</i>	0.336
<i>belowpolicy</i>	0.018
<i>abovepolicy</i>	0.054
<i>educgrowth</i>	0.594

Table 4. PERS CDR Board Summary Statistics. Adapted from PERS (2019).

<u>Variables</u>	<u>Means</u>
<i>Sample Population</i>	N = 6,446
<i>promoted</i>	0.193
<i>abovezone</i>	0.206
<i>belowzone</i>	0.533
<i>priorenlisted</i>	0.225
<i>married</i>	0.116
<i>lessthan3kids</i>	0.614
<i>morethan3kids</i>	0.064
<i>female</i>	0.163
<i>white</i>	0.855
<i>black</i>	0.074
<i>staff</i>	0.351
<i>belowpolicy</i>	0.242
<i>abovepolicy</i>	0.104
<i>educgrowth</i>	0.742

Table 5. PERS CDR Promoted. Adapted from PERS (2019).

Variable	Mean
<i>Sample Population</i>	N = 1,246
<i>abovezone</i>	0.141
<i>belowzone</i>	0.012
<i>priorenlisted</i>	0.188
<i>married</i>	0.121
<i>lessthan3kids</i>	0.633
<i>morethan3kids</i>	0.070
<i>female</i>	0.167
<i>white</i>	0.869
<i>black</i>	0.061
<i>staff</i>	0.330
<i>belowpolicy</i>	0.006
<i>abovepolicy</i>	0.083
<i>educgrowth</i>	0.829

Table 6. PERS CAPT Board Summary Statistics. Adapted from PERS (2019).

<u>Variables</u>	<u>Means</u>
<i>Sample Population</i>	N = 5,091
<i>promoted</i>	0.134
<i>abovezone</i>	0.338
<i>belowzone</i>	0.430
<i>priorenlisted</i>	0.137
<i>married</i>	0.142
<i>lessthan3kids</i>	0.635
<i>morethan3kids</i>	0.070
<i>female</i>	0.126
<i>white</i>	0.875
<i>black</i>	0.065
<i>staff</i>	0.352
<i>belowpolicy</i>	0.187
<i>abovepolicy</i>	0.154
<i>educgrowth</i>	0.854

Table 7. PERS CAPT Promoted. Adapted from PERS (2019).

Variable	Mean
<i>Sample Population</i>	N = 686
<i>abovezone</i>	0.165
<i>belowzone</i>	0.013
<i>priorenlisted</i>	0.117
<i>married</i>	0.130
<i>lessthan3kids</i>	0.682
<i>morethan3kids</i>	0.073
<i>female</i>	0.133
<i>white</i>	0.889
<i>black</i>	0.063
<i>staff</i>	0.353
<i>belowpolicy</i>	0.013
<i>abovepolicy</i>	0.087
<i>educgrowth</i>	0.905

C. DMDC DATA

Data from DMDC contained 17 years of monthly naval officer data from January 2002 through December 2018. Unlike PERS data, it did not have promotion zone information; however, using a provided File Date, a determination could be made of when an officer advanced to the next rank. This ability, coupled with a much larger period, 17-years, made it possible to track an officer's retention and future promotion and therefore, any effects of below-zone referred to as fast-tracking and above-zone hereto referred to as slow tracking.

DMDC data came with much of the same demographic and career information, as PERS with some exceptions. Instead of the birth-state variable, regional variables were created that followed Commander Naval Installations Command CNIC regions. Another unique demographic variable, to the DMDC dataset, was religion.

There were various other career variables provided in the DMDC data, not otherwise seen in the PERS data, principally officer designator, and special pay. For officer designator, the created a broader variable of line, staff, and unrestricted line, much like

PERS data, with the addition of a narrower career description, that defined individual officer designators. Special pay variables, e.g., hazard pay or foreign language pay, provided specific abilities and or achievements of any given officer and were then separated into different dummy variables.

New variables, important to be able to determine long-term effects on an officer's career, were created. A time to attrite binary variable was created for each rank that indicated how many months after putting on the next control grade, did they attrite. The study uses the term attrite to define any officer that leaves the service, whether that be to retire or separate.

Similarly, a variable was created for each rank that captured time, in months, to each subsequent rank. This variable told us how long it took to put on the next control grade. This variable was key, as from it, a determination could be made if an officer was fast-tracking or slow-tracking. Table 8 is a general overview of dependent variables, community, and key X variables.

Table 8. Overview of DMDC Data Variables. Adapted from DMDC (2019).

Dependent Variables	Description
<i>LCDRattribution</i>	= Months until attrition from data when promoted to LCDR
<i>CDRattribution</i>	'= Months until attrition from data when promoted to CDR
<i>CAPTattribution</i>	'= Months until attrition from data when promoted to CAPT
<i>timetoCDR</i>	'=Months until promotion to CDR
<i>timetoCAPT</i>	'= Months until promotion to CAPT
Community	
<i>Staff Corps</i>	= 1 if a Staff Corps Officer '= 0 otherwise
<i>Restricted Line</i>	'= 1 if a Restricted Line Officer '= 0 otherwise
<i>Unrestricted Line</i>	'= 1 if a Unrestricted Line Officer '= 0 otherwise
Key X Variables	(By Community & Designator)
<i>fasttrackbelowzone</i>	= 1 if Officer time in rank %ile = similar %ile match from PERS promotion pdf below-zone board statistics '= 0 otherwise
<i>slowtrackabovezone</i>	'= 1 if Officer time in rank %ile = similar %ile match from PERS promotion pdf above-zone board statistics '= 0 otherwise
<i>fasttracker</i>	'= 1 if Officer time in rank %ile <=20% at time of promotion '= 0 otherwise
<i>slowtracker</i>	'= 1 if Officer time in rank %ile >=70% at time of promotion '= 0 otherwise
<i>fastatpreviousrank</i>	'= 1 if Officer was fasttracker==1 at previous promotion '= 0 otherwise
<i>slowatpreviousrank</i>	'= 1 if Officer was slowtracker==1 at previous promotion '= 0 otherwise
<i>fastbelowatprevious</i>	'= 1 if Officer was fasttrackbelowzone==1 at previous promotion '= 0 otherwise
<i>slowaboveatprevious</i>	'= 1 if Officer was slowtrackabovezone==1 at previous promotion '= 0 otherwise

Tables 9 through 11 provide summary statistics for DMDC data. Tables show DMDC data is consistent with demographics and data not only in the PERS data set but also within the Navy. Table 9 provides summary statistics of DMDC data of promotion to LCDR. Table 10 provides summary statistics of DMDC data of promotion to CDR. Table 11 provides summary statistics of DMDC data of promotion to CAPT.

Table 9. DMDC LCDR Promoted. Adapted from DMDC (2019).

Variable	Mean
<i>Sample Population</i>	N = 32,712
<i>female</i>	0.154
<i>Married</i>	0.811
<i>white</i>	0.851
<i>black</i>	0.080
<i>StaffCorps</i>	0.355
<i>UnrestrictedLine</i>	0.418
<i>NRMidAtlantic</i>	0.412
<i>NRNorthwest</i>	0.077
<i>NRSouthwest</i>	0.149
<i>specialpay</i>	0.224
<i>educgrowth</i>	0.504
<i>educgrowthx2</i>	0.037
<i>Bachdegree</i>	0.591
<i>Mastdegree</i>	0.216
<i>Docdegree</i>	0.190
<i>desigfasttracker</i>	0.169
<i>desigslowtracker</i>	0.243
<i>desigfasttrackbelowzone</i>	0.041
<i>desigslowtrackabovezone</i>	0.163
<i>desigfastatpreviousrank</i>	N/A
<i>desigslowatpreviousrank</i>	N/A
<i>desigfastbelowatpreviousrank</i>	N/A
<i>desigslowaboveatpreviousrank</i>	N/A

Table 10. DMDC CDR Promoted. Adapted from DMDC (2019).

Variable	Mean
<i>Sample Population</i>	N = 17,991
<i>female</i>	0.130
<i>Married</i>	0.887
<i>white</i>	0.877
<i>black</i>	0.066
<i>StaffCorps</i>	0.355
<i>UnrestrictedLine</i>	0.433
<i>NRMidAtlantic</i>	0.458
<i>NRNorthwest</i>	0.075
<i>NRSouthwest</i>	0.139
<i>specialpay</i>	0.213
<i>educgrowth</i>	0.607
<i>educgrowthx2</i>	0.029
<i>Bachdegree</i>	0.378
<i>Mastdegree</i>	0.436
<i>Docdegree</i>	0.183
<i>desigfasttracker</i>	0.158
<i>desigslowtracker</i>	0.273
<i>desigfasttrackbelowzone</i>	0.032
<i>desigslowtrackabovezone</i>	0.175
<i>desigfastatpreviousrank</i>	0.130
<i>desigslowatpreviousrank</i>	0.067
<i>desigfastbelowatpreviousrank</i>	0.033
<i>desigslowaboveatpreviousrank</i>	0.039

Table 11. DMDC CAPT Promoted. Adapted from DMDC (2019).

Variable	Mean
<i>Sample Population</i>	N = 8,342
<i>female</i>	0.126
<i>Married</i>	0.911
<i>white</i>	0.916
<i>black</i>	0.046
<i>StaffCorps</i>	0.380
<i>UnrestrictedLine</i>	0.423
<i>NRMidAtlantic</i>	0.481
<i>NRNorthwest</i>	0.070
<i>NRSouthwest</i>	0.122
<i>specialpay</i>	0.196
<i>educgrowth</i>	0.539
<i>educgrowthx2</i>	0.014
<i>Bachdegree</i>	0.267
<i>Mastdegree</i>	0.508
<i>Docdegree</i>	0.220
<i>desigfasttracker</i>	0.147
<i>desigslowtracker</i>	0.272
<i>desigfasttrackbelowzone</i>	0.034
<i>desigslowtrackabovezone</i>	0.170
<i>desigfastatpreviousrank</i>	0.136
<i>desigslowatpreviousrank</i>	0.073
<i>desigfastbelowatpreviousrank</i>	0.026
<i>desigslowaboveatpreviousrank</i>	0.044

D. METHODOLOGY

A linear probability model (LPM) was first used to interpret and determine the probability of promotion being either a 0 or 1. This allows for a simple linear regression model to determine the probability of our key X variables of specific promotion zones and how they affect the chance of promotion. LPM allows us to model binary dependent variables with the PERS dataset. The coefficients of β 's can be estimated using ordinary least squares. A drawback of using a linear probability model is that estimated coefficients can give probabilities outside the unit interval of 0 or 1. The probit model was used to validate our LPM model results by confirming the direction of the probability of promotion and whether the results remained significant. Additionally, the study ran a fixed-effects model to provide another layer of validating to the LPM. The fixed-effects model allows for analyzing the impact of a key variable that varies over time. This type of model carries an assumption that something about an officer may impact the outcome of promotion and

thus the need to control for it. Those characteristics are unique to each officer and should not correlate with others.

The study was interested in the factors that influence whether an officer wins a promotion or not. Our outcome variables are binary (0/1), promote or not, promote to LCDR or not, promote to CDR or not, and promote to CAPT or not. The dependent variables are regressed on a variety of predictor variables of interest which include demographics, education level, experience level, officer community, and promotion zone. This allowed for four LPM models to be run for each subsection of the data sorted by rank. This provided insights into overall sample promotion probabilities and comparisons between each rank. LPM estimates provide the increase or decrease in the probability of being promoted per increase in the x variable. Due to the fact, the x variables are also dummy variables, the outcome is attributed only when the officer has that attribute.

Additionally, survival analysis is used to analyze data where the time until an event is of interest, in our case “time to attrition after a promotion,” using DMDC data. Survival analysis is used to compare groups when time is an important factor. Whether or not an officer attrites during the study period is coded as an indicator variable, 1=attrited or 0=not-attrite did not occur during the study observation period. Not all survival data is observed thus is considered censored. Censored implies data is missing at the end of the observation period which means these officers are counted as not attriting during the study.

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IV. RESULTS AND CONCLUSIONS

A. ANALYSIS

LPM regressions helped describe probabilities of promotion from any of the three promotion zones before and after the 2017 policy change that removed zone labels for officers during the promotion board. To add validity to LPM regressions, the data was also regressed using both a Probit and a Fixed Effect model (see Table 12) Data shows that before the policy change, naval officers overall were 66 percentage points less likely to promote when below-zone and 56 percentage points less likely to promote when above-zone compared with in-zone officers. However, after the policy change, probabilities for below-zone promotion increased by four percentage points, yet showed statistical significance, while the above-zone also improved by eight percentage points as compared with the in-zone officers before the policy change. Both below-zone and above-zone remained to have an overall reduced likelihood of promotion compared with in-zone officers. As illustrated in Figure 1. Other general but significant control variables that helped to explain relationships with promotion were demographics and education. Specifically, females had a slightly higher probability of promotion than males at two percentage points. Officers with education growth were 3 percentage points more likely to promote than those that did not accomplish continued academic education.

Table 12. Overall Comparison of Models. Adapted from PERS (2019).

VARIABLES	LPM	Probit	FE
Below-Zone	-0.660 ***	-3.236 ***	-0.706 *
Above-Zone	-0.560 ***	-1.696 ***	-0.136 ***
Policy	-0.026 *	-0.075	-0.237 ***
Below-Zone After Policy	0.040 ***	0.620 ***	0.058 ***
Above-Zone After Policy	0.084 ***	0.336 ***	0.024 *
Female	0.019 ***	0.129 ***	
White	0.002	-0.023	
Black	-0.022	-0.159	
Hispanic	0.002	-0.014	
Declined	-0.005	-0.068	
Prior Enlisted	-0.002	-0.004	
Married	0.005	0.021	
> 3 Kids	0.011	0.053	
Education growth	0.031 ***	0.219 ***	
Master's Only	-0.001	-0.013	
Bachelor's Only	0.008	0.063	
Staff Officers	-0.010 **	-0.049	0.250
FY 13	-0.010	-0.087	-0.017 *
FY 14	-0.006	-0.053	-0.045 ***
FY 15	-0.013	-0.094	-0.088 ***
FY 16	-0.004	-0.034	-0.121 ***
FY 17	-0.013	-0.092 *	0.047 ***
FY 18	-0.014	-0.064	0.018 *
FY 19	-0.011	-0.063	0.008
Constant	0.645 ***	0.335 ***	0.641 ***
Observations	20,022	20,022	20,022
Note: PERS 2019 Data - Robust standard errors in parentheses			

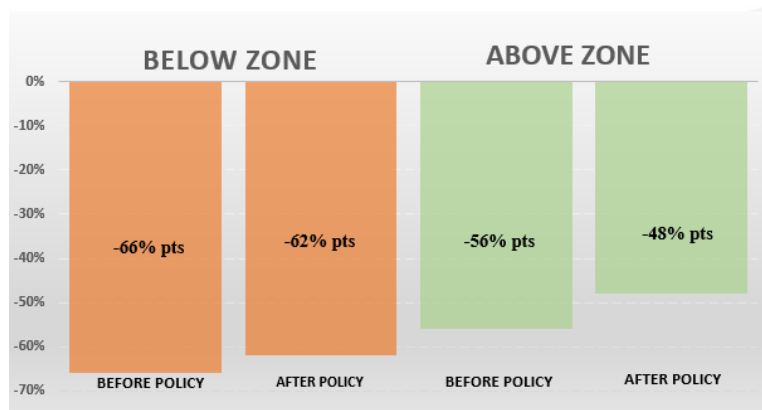


Figure 1. Data LPM Model Results That Show Overall Promotion Probability for Below/Above-Zone Before/After Policy Change. Adapted from PERS (2019).

Table 13 shows LPM results for lieutenant commanders, analyzing specific control grades. Not surprisingly, lieutenants were 75 percentage points less likely to promote compared to in-zone officers. Additionally, before the policy change, above-zone officers were 51 percentage points less likely to promote compared to in-zone officers. After the change in policy, lieutenants showed 14 percentage points of improvement in promotion probabilities for above-zone and five percentage points improvement for below zone compared in officers in-zone.

Like regressions seen in the overall LPM, officers who pursued additional education were six percentage points more likely to promote than those not pursuing education growth. However, females in this model did not show a significant advantage over males for promotion. One race variable, black, was noted as having five percentage points lower probability than non-blacks for promotion.

Table 13. Linear Probability Model to Lieutenant Commander. Adapted from PERS (2019).

VARIABLES	(1) Promoted to LCDR	(RSE)
Below-Zone	-0.748 ***	(0.012)
Above-Zone	-0.510 ***	(0.027)
Policy	-0.027	(0.020)
Below-Zone After Policy	0.053 ***	(0.017)
Above-Zone After Policy	0.147 ***	(0.039)
Female	0.007	(0.008)
White	-0.010	(0.021)
Black	-0.056 **	(0.024)
Hispanic	-0.046	(0.029)
Declined	-0.025	(0.028)
Prior Enlisted	-0.008	(0.008)
Married	0.005	(0.008)
> 3 Kids	0.022	(0.014)
Education growth	0.064 ***	(0.009)
Master's Only	0.015	(0.022)
Bachelor's Only	0.005	(0.010)
Staff Officers	-0.011	(0.007)
FY 13	-0.013	(0.012)
FY 14	-0.006	(0.013)
FY 15	-0.029 **	(0.013)
FY 16	0.001	(0.013)
FY 17	-0.010	(0.013)
FY 18	-0.014	(0.014)
FY 19	-0.017	(0.014)
Constant	0.738 ***	(0.026)
Observations	8,485	
R-squared	0.577	
Note: PERS 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

The results for commanders promotions from either below-or above-zone were significantly less likely, 65 percentage points and 54 percentage points, than in-zone as shown in Table 14. After the policy changes, promotion probabilities also showed significant statistical improvements for officers in the below-zone, six percentage points, as well as for those officers above-zone at 10 percentage points. Education growth was seven percentage points more likely to promote and remained significant in this model.

Two additional control variables, prior-enlisted and staff corps officers, were noted as a significant indicator of promotion when promoting to commander. An officer that was prior enlisted had a negative effect on promotion, three percentage points less likely to promote than non-prior enlisted officers while staff officers also showed diminished promotion probabilities at two percentage points less likely when compared to other line officers.

Table 14. Linear Probability Model to Commander. Adapted from PERS (2019).

VARIABLES	(1) Promoted to CDR	(RSE)
Below-Zone	-0.651 ***	(0.016)
Above-Zone	-0.546 ***	(0.020)
Policy	-0.063 **	(0.028)
Below-Zone After Policy	0.062 ***	(0.024)
Above-Zone After Policy	0.102 ***	(0.030)
Female	0.013	(0.011)
White	0.012	(0.028)
Black	-0.012	(0.031)
Hispanic	0.014	(0.037)
Declined	0.018	(0.036)
Prior Enlisted	-0.028 ***	(0.009)
Married	0.020 *	(0.011)
> 3 Kids	0.017	(0.015)
Education growth	0.069 ***	(0.016)
Master's Only	0.021	(0.025)
Bachelor's Only	0.014	(0.018)
Staff Officers	-0.020 **	(0.008)
FY 13	-0.007	(0.015)
FY 14	-0.014	(0.016)
FY 15	-0.006	(0.015)
FY 16	-0.014	(0.015)
FY 17	-0.011	(0.016)
FY 18	-0.012	(0.016)
FY 19	0.001	(0.016)
Constant	0.607 ***	(0.037)
Observations	6,446	
R-squared	0.453	
Note: PERS 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Promotion to captain using the LPM model captures the results of commanders promoting to captain as shown in Table 15. Before policy changes, commanders were less likely to promote to captain as either below-zone or above-zone 49 percentage points, and 43 percentage points respectively. Similar to previous models, the policy changes impacted zone. Below-zone commanders improved their likelihood of promotion to captain by four percentage points and five percentage points from above-zone. Additionally, the education growth variable remained a significant positive promotion predictor along with various race demographics showing significance.

Table 15. Linear Probability Model to Captain. Adapted from PERS (2019).

VARIABLES	(1) Promoted to CAPT	(RSE)
Below-Zone	-0.490 ***	(0.019)
Above-Zone	-0.432 ***	(0.021)
Policy	-0.024	(0.033)
Below-Zone After Policy	0.038	(0.030)
Above-Zone After Policy	0.049	(0.032)
Female	0.005	(0.013)
White	0.062 **	(0.024)
Black	0.065 **	(0.029)
Hispanic	0.099 **	(0.046)
Declined	0.052	(0.032)
Prior Enlisted	-0.017	(0.012)
Married	-0.008	(0.011)
> 3 Kids	0.006	(0.016)
Education growth	0.069 ***	(0.019)
Master's Only	0.045	(0.030)
Bachelor's Only	0.026	(0.022)
Staff Officers	0.008	(0.009)
FY 13	-0.022	(0.016)
FY 14	-0.017	(0.016)
FY 15	-0.010	(0.017)
FY 16	-0.015	(0.017)
FY 17	-0.017	(0.019)
FY 18	-0.030 *	(0.018)
FY 19	-0.024	(0.018)
Constant	0.379 ***	
Observations	5,091	
R-squared	0.317	
Note: PERS 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

Using the DMDC data, the study turned to survival analysis models to show the long-term effects of the speed of promotion. First, Table 16 shows the risk of attrition when selected for lieutenant commander. Key variables identified that fast-tracking officers to lieutenant commander attrite eight percent faster than non-fast trackers or whom were deemed as officers in-zone. Slow-tracking officers to lieutenant commander also attrite 18 percent faster as compared to non-slow trackers or in-zone officers as shown in Figure 2. When examining the difference between the two groups, fast-trackers attrite at a higher rate than in-zone; they attrite 10 percentage points slower than slow-trackers.

It is important to note the impact a variety of demographic variables had on attrition. All demographic control variables showed significance at the 99 percent confidence interval. However the education growth variable showed a reduction in the speed of attrition. Table 16 also shows that rates of attrition, as compared to surface warfare officers, are universally lower across all communities.

Table 16. Time to Attrite at Lieutenant Commander. Adapted from DMDC (2019).

VARIABLES	(1) t	(RSE)
Female	0.175 ***	(0.029)
Married	0.083 ***	(0.023)
White	0.100 ***	(0.038)
Black	0.193 ***	(0.047)
Medical Corps	-0.601 ***	(0.088)
Dental Corps	-0.893 ***	(0.111)
Medical Service Corps	-0.252 ***	(0.045)
Jag Corps	-1.151 ***	(0.118)
Nurse Corps	-0.196 ***	(0.042)
Supply Corps	-0.280 ***	(0.045)
Chaplain Corps	-1.653 ***	(0.121)
Civil Engineer Corps	-0.184 ***	(0.057)
HR Officer	-0.170	(0.094)
Engineer Officer	-0.522 ***	(0.078)
Aero Engineer Maintenance Officer	-0.174 *	(0.081)
Public Affaris Officer	-0.447 ***	(0.123)
Foreign Affairs Officer	-1.731 ***	(0.586)
Ocean/METOC Officer	-0.447 ***	(0.107)
Info Warfare Officer	-0.136 *	(0.067)
Info Professional Officer	-0.158	(0.092)
Intel Officer	-0.375 ***	(0.054)
Submarine Officer	-0.524 ***	(0.049)
Special Forces/ Seal Officer	-0.464 ***	(0.087)
Explosive Ordnance Officer	-0.580 ***	(0.119)
General URL	-0.414 *	(0.176)
URL-in-training	-0.760 *	(0.305)
Pilot Officer	-0.207 ***	(0.029)
Flight Officer	-0.537 ***	(0.039)
MidAtlantic Region	-0.530 ***	(0.021)
Northwest Region	-0.452 ***	(0.036)
Southeast Region	-0.462 ***	(0.025)
Hazard-Pay (bonus)	-0.029	(0.020)
Bachelors Degree	-0.033	(0.082)
Masters Degree	-0.136	(0.085)
Education Growth	-1.118 ***	(0.020)
Fast-Tracker	0.076 ***	(0.026)
Slow-Tracker	0.177 ***	(0.037)
Fast-Tracker (below-zone)	0.018	(0.046)
Slow-Tracker (above-zone)	-0.050	(0.044)
Observations	32,352	
Note: DMDC 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

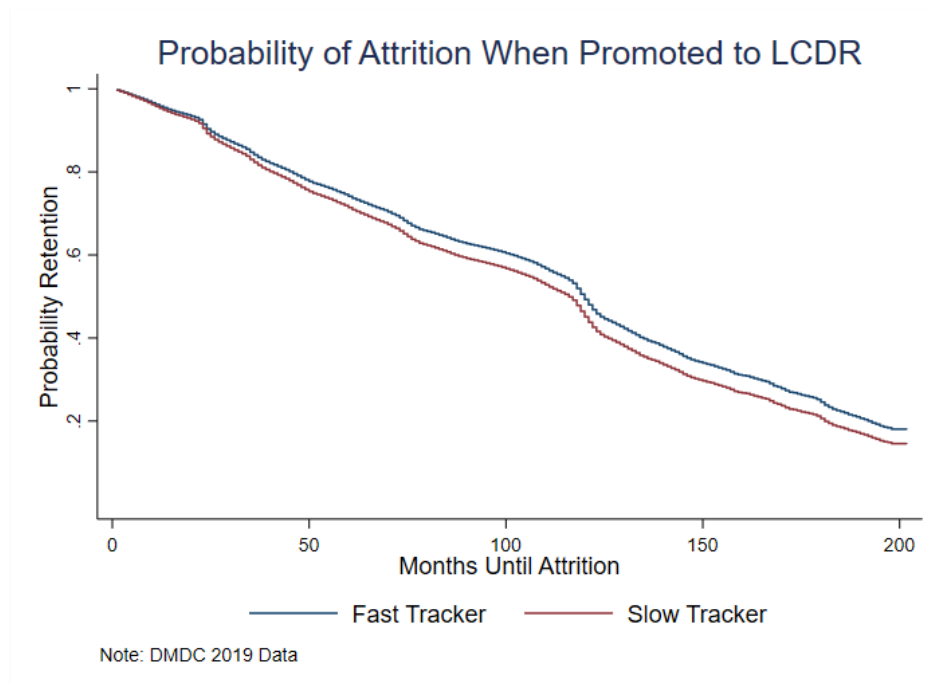


Figure 2. Probability of Attrition When Promoted to Lieutenant Commander.
Adapted from DMDC (2019).

Table 17 displays the risks of attrition for commanders. In stark contrast to lieutenant commander, fast-tracking commanders had slower attrition rates than in-zone officers however; these results were not significant. The data identified that slow-tracking commanders did have a significant 17 percent faster attrition rate as compared to in-zone, as shown in Figure 3.

Demographic variables that were observed to have such significant impacts for lieutenant commander attrition did not have the same effect for commanders, though some variables remained an impact on attrition. Of the demographic variables, only white and black both show significance. Education growth remained significant as well, with almost 70 percent slower attrition rates as compared to those that did not have education growth throughout their career. Lastly, the almost unilateral reduction in attrition risk by community, as seen with lieutenant commanders, was not apparent with commanders.

Table 17. Time to Attrite at Commander. Adapted from DMDC (2019).

VARIABLES	(1) t	(RSE)
Female	0.011	(0.041)
Married	0.025	(0.038)
White	0.099 *	(0.056)
Black	0.138 *	(0.072)
Medical Corps	-0.089	(0.161)
Dental Corps	-0.958 ***	(0.190)
Medical Service Corps	0.051	(0.057)
Jag Corps	-0.261	(0.181)
Nurse Corps	0.185 ***	(0.063)
Supply Corps	0.012	(0.057)
Chaplain Corps	-0.485 ***	(0.178)
Civil Engineer Corps	0.416 ***	(0.072)
HR Officer	0.16	(0.100)
Engineer Officer	-0.094	(0.069)
Aero Engineer Maintenance Officer	0.163 ***	(0.062)
Public Affaris Officer	0.163	(0.133)
Foreign Affairs Officer	-0.072	(0.241)
Ocean/METOC Officer	0.135	(0.087)
Info Warfare Officer	0.144 *	(0.082)
Info Proffesional Officer	-0.006	(0.094)
Intel Officer	-0.1	(0.063)
Submarine Officer	-0.332 ***	(0.059)
Special Forces/ Seal Officer	-0.217 ***	(0.107)
Explosive Ordinance Officer	-0.228	(0.146)
General URL	0.509 ***	(0.103)
URL-in-training	-0.433	(0.582)
Pilot Officer	0	(0.038)
Flight Officer	-0.079 *	(0.045)
MidAtlantic Region	-0.483 ***	(0.027)
Northwest Region	-0.44 ***	(0.046)
Southeast Region	-0.434 ***	(0.034)
Hazard-Pay (bonus)	-0.032	(0.026)
Bachelors Degree	0.546 ***	(0.153)
Masters Degree	0.288	(0.153)
Education Growth	-0.691 ***	(0.026)
Fast-Tracker	-0.043	(0.030)
Slow-Tracker	0.168 ***	(0.050)
Fast-Tracker (below-zone)	-0.074	(0.058)
Slow-Tracker (above-zone)	0.056	(0.059)
Observations	17,923	
Note: DMDC 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

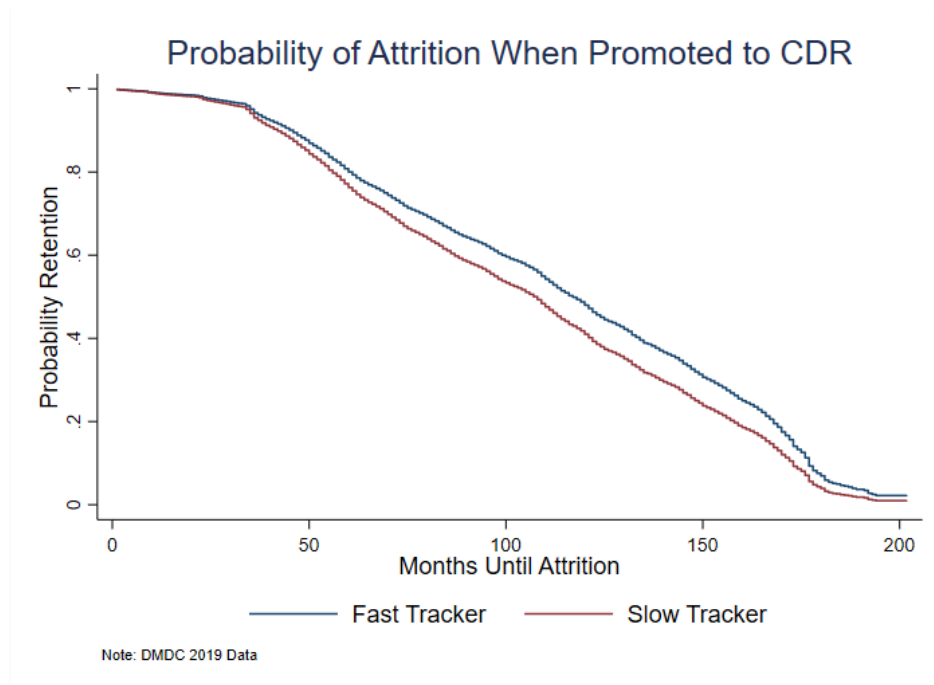


Figure 3. Probability of Attrition When Promoted to Commander. Adapted from DMDC (2019).

The results for the last model which studies attrition on captains as shown in Table 18. Similar to commanders, fast-trackers attrite 8 percent slower than in-zone while slow-trackers attrite 13 percent faster than in-zone, as shown in Figure 4.

There was some return to statistical significance observed with demographic variables to include being female, married and white. Educational growth continued its significance of slower attrition for promoting captains. Additionally, some officer communities showed significant attrition rates, though these attrition probabilities are widely varied in intensity and direction, with some slower or faster rates compared to rates of surface warfare officer.

Table 18. Time to Attrite at Captain. Adapted from DMDC (2019).

VARIABLES	(1) t	(RSE)
Female	0.148 **	(0.060)
Married	0.178 ***	(0.052)
White	0.166 *	(0.085)
Black	-0.028	(0.107)
Medical Corps	-0.486 ***	(0.151)
Dental Corps	-1.299 ***	(0.167)
Medical Service Corps	-0.066	(0.080)
Jag Corps	-0.641 ***	(0.183)
Nurse Corps	-0.049	(0.089)
Supply Corps	0.110 *	(0.062)
Chaplain Corps	-0.390 **	(0.172)
Civil Engineer Corps	0.098	(0.084)
HR Officer	0.358 ***	(0.133)
Engineer Officer	-0.041	(0.073)
Aero Engineer Maintenance Officer	0.533 ***	(0.068)
Public Affaris Officer	0.095	(0.202)
Foreign Affairs Officer	-0.232	(0.220)
Ocean/METOC Officer	0.324 **	(0.127)
Info Warfare Officer	0.240 **	(0.114)
Info Proffesional Officer	-0.025	(0.115)
Intel Officer	-0.019	(0.080)
Submarine Officer	-0.215 ***	(0.053)
Special Forces/ Seal Officer	0.138	(0.107)
Explosive Ordinance Officer	0.098	(0.141)
General URL	0.184	(0.134)
URL-in-training	-0.215 ***	(0.056)
Pilot Officer	0.128 ***	(0.044)
Flight Officer	0.133 **	(0.054)
MidAtlantic Region	-0.452 ***	(0.033)
Northwest Region	-0.500 ***	(0.056)
Southeast Region	-0.459 ***	(0.044)
Hazard-Pay (bonus)	-0.032	(0.033)
Bachelors Degree	0.327 **	(0.137)
Masters Degree	0.123	(0.136)
Education Growth	-0.465 ***	(0.031)
Fast-Tracker	-0.076 *	(0.040)
Slow-Tracker	0.127 **	(0.052)
Fast-Tracker (below-zone)	-0.002	(0.068)
Slow-Tracker (above-zone)	0.062	(0.066)
Observations	8,328	
Note: DMDC 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

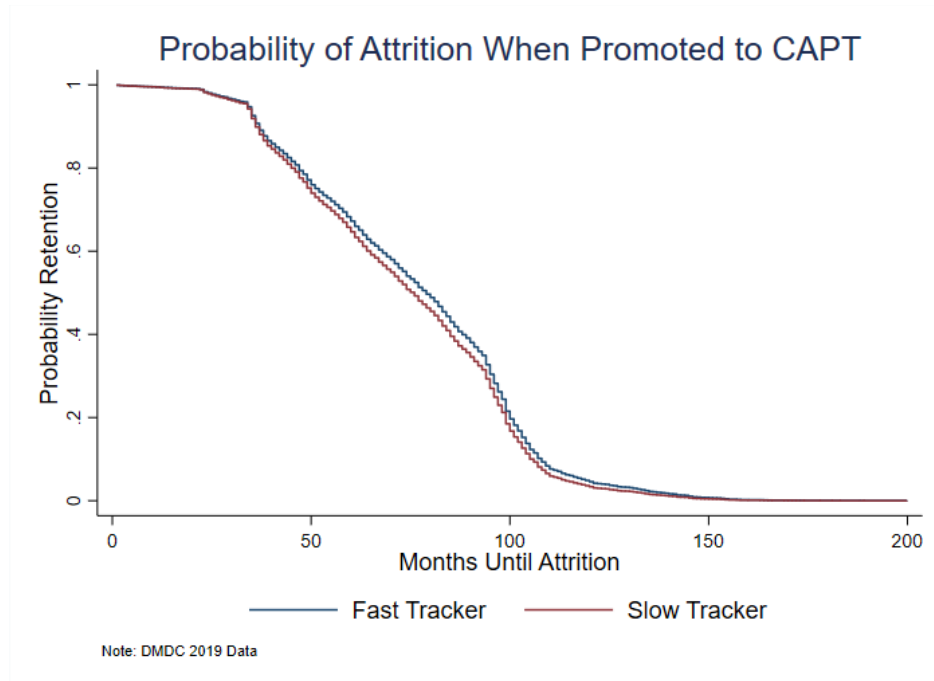


Figure 4. Probability of Attrition When Promoted to Captain. Adapted from DMDC (2019).

Exploring the different effects of fast/slow-tracking, Table 19 shows the results of officers who promote to commander. Results showed that officers who had previously fast-tracked to lieutenant commander promoted 52 percent slower than non-previous fast-trackers, and were subsequently deemed to have been previously in-zone officers at the time of promotion to lieutenant commander. Previous slow-trackers promoted 28 percent faster than previous in-zone officers. While this is illustrated in Figure 5, it also illustrates the distinction that, while previous fast-trackers take longer to promote, they have higher probabilities of promotion. Results appear to contradict intuition that fast-trackers could be expected to continuously promote as fast, or at the very least, not promote slower than previous slow-trackers. This is more likely due to the effects the lineal list has on the promotion timing of officers than the effect of being either fast or slow-tracked.

Other demographic variables show some significance and effects the time it takes to promote to commander. Though outside the scope of this study, lieutenant commanders that had received hazard pay, most likely denoting deployment to a hostile environment,

promoted to commander 16 percent slower than those that did not deploy to a hazardous location. Additionally, education growth was not a significant factor for promotion to commander, while officers with those with master's degrees promoted slower and those with bachelor's degrees promoted at faster rates.

Table 19. Time to Promote to Commander. Adapted from DMDC (2019).

VARIABLES	1 _t	(RSE)
Female	-0.041 *	(0.025)
Married	0.048 *	(0.026)
White	0.044	(0.032)
Black	-0.011	(0.045)
Medical Corps	-0.741 ***	(0.071)
Dental Corps	-0.772 ***	(0.085)
Medical Service Corps	-0.565 ***	(0.043)
Jag Corps	-0.342 ***	(0.091)
Nurse Corps	-0.581 ***	(0.039)
Supply Corps	-0.042	(0.045)
Chaplain Corps	-0.624 ***	(0.101)
Civil Engineer Corps	0.344 ***	(0.058)
HR Officer	0.070	(0.099)
Engineer Officer	0.506 ***	(0.074)
Aero Engineer Maintenance Officer	-0.228 ***	(0.051)
Public Affaris Officer	-0.078	(0.186)
Foreign Affairs Officer	-0.878 ***	(0.055)
Ocean/METOC Officer	-0.916 ***	(0.050)
Info Warfare Officer	-0.549 ***	(0.052)
Info Proffesional Officer	-0.350 ***	(0.064)
Intel Officer	-0.852 ***	(0.039)
Submarine Officer	-0.727 ***	(0.044)
Special Forces/ Seal Officer	-0.002	(0.060)
Explosive Ordinance Officer	0.504 ***	(0.078)
General URL	0.826 *	(0.366)
URL-in-training	1.663 ***	(0.037)
Pilot Officer	0.416 ***	(0.027)
Flight Officer	0.494 ***	(0.033)
MidAtlantic Region	0.006	(0.019)
Northwest Region	-0.052	(0.032)
Southeast Region	-0.039	(0.023)
Hazard-Pay (bonus)	-0.156 ***	(0.021)
Bachelors Degree	0.177 ***	(0.065)
Masters Degree	-0.224 ***	(0.065)
Education Growth	0.037	(0.022)
Previous Fast-Tracker	-0.523 ***	(0.024)
Previous Slow-Tracker	0.279 ***	(0.045)
Previous Fast-Tracker (below-zone)	0.048	(0.042)
Previous Slow-Tracker (above-zone)	0.144 *	(0.058)
Observations	17,991	
Note: DMDC 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

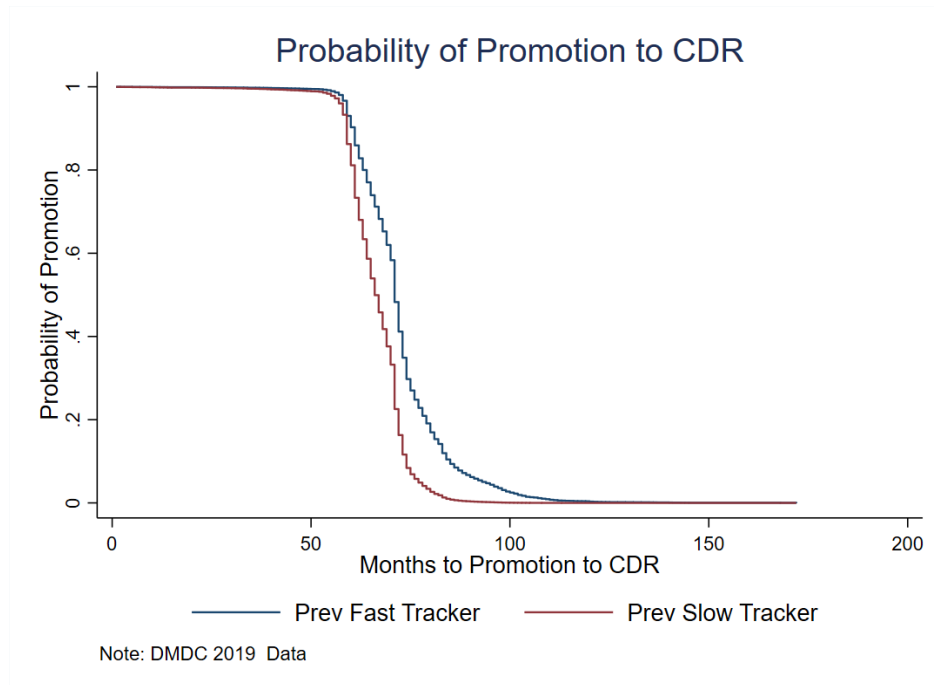


Figure 5. Promotion to Commander if Officer Was Previous Fast or Slow-Tracker. Adapted from DMDC (2019).

The results of the time of promotion to captain are shown in Table 20. Model results show that commanders who had been previous fast-trackers when promoted to the rank of commander subsequently promoted 15 percent slower to captain compared to previous in-zone officers. Likewise, slow-tracked commanders promoted to captain 21 percent slower than previous in-zone officers. When calculating the difference between the two groups, results showed that even though fast-trackers promoted at slower rates than the in-zone promoted commander, they promoted six percentage points faster than previous slow-tracking commanders as shown in Figure 6. Study results align with intuition that fast-trackers are able to overcome the effects of lineal list ordering, which is why time to promotion results differ from those to the rank of commander.

Demographic variables when promoting to captain were not found to be significant. All education control variables were found to be significant when promoting to captain.

Table 20. Time to Promote to Captain. Adapted from DMDC (2019).

VARIABLES	(1) _t	(RSE)
Female	0.068	(0.052)
Married	-0.030	(0.042)
White	0.074	(0.059)
Black	-0.056	(0.079)
Medical Corps	0.501 ***	(0.118)
Dental Corps	0.312 **	(0.131)
Medical Service Corps	1.466 ***	(0.145)
Jag Corps	1.729 ***	(0.162)
Nurse Corps	-0.202 ***	(0.070)
Supply Corps	0.141 ***	(0.046)
Chaplain Corps	1.050 ***	(0.169)
Civil Engineer Corps	1.102 ***	(0.099)
HR Officer	0.126	(0.125)
Engineer Officer	1.274 ***	(0.087)
Aero Engineer Maintenance Officer	0.629 ***	(0.068)
Public Affaris Officer	0.926 ***	(0.166)
Foreign Affairs Officer	0.239	(0.181)
Ocean/METOC Officer	0.527 ***	(0.136)
Info Warfare Officer	0.821 ***	(0.100)
Info Proffesional Officer	0.840 ***	(0.124)
Intel Officer	0.094 *	(0.062)
Submarine Officer	0.228 ***	(0.036)
Special Forces/ Seal Officer	0.211 ***	(0.055)
Explosive Ordinance Officer	0.005	(0.081)
General URL	-0.031	(0.142)
URL-in-training	2.728 ***	(0.065)
Pilot Officer	0.151 ***	(0.030)
Flight Officer	0.136 ***	(0.034)
MidAtlantic Region	-0.082 ***	(0.031)
Northwest Region	-0.069	(0.047)
Southeast Region	-0.121 ***	(0.041)
Hazard-Pay (bonus)	-0.192 ***	(0.034)
Bachelors Degree	0.876 ***	(0.120)
Masters Degree	0.614 ***	(0.116)
Education Growth	-0.187 ***	(0.034)
Previous Fast-Tracker	-0.153 ***	(0.034)
Previous Slow-Tracker	-0.214 ***	(0.081)
Previous Fast-Tracker (below-zone)	-0.249 ***	(0.076)
Previous Slow-Tracker (above-zone)	0.183 *	(0.098)
Observations	8,342	
Note: DMDC 2019 Data - Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1		

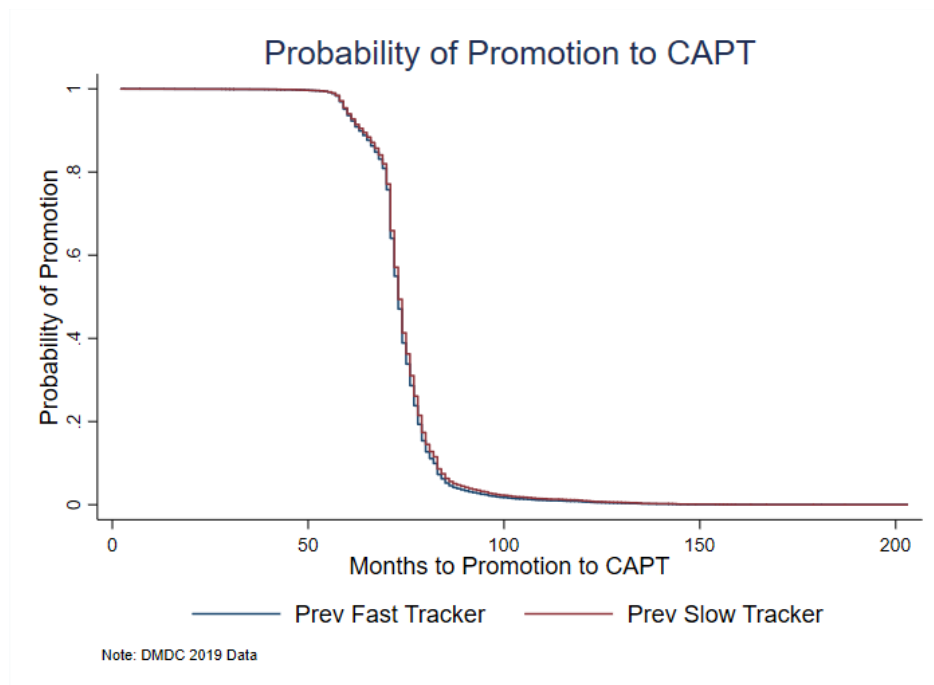


Figure 6. Promotion to Captain if Officer Was Previous Fast or Slow-Tracker. Adapted from DMDC (2019).

B. SUMMARY

Study results from LPM using PERS data revealed that the removal of zone labels from the promotion board increased the probabilities of promotion both below and above-zone while lowering the probabilities of promotion in-zone officers before the policy. From this result we could expect the wider removal of zone information from promotion eligible officers would result in a further increase with both below and above-zone selections, thus further reducing the probability of promotion from in-zone.

The response from the policy influenced the overall probability of promotion within differing promotion zones. Multiple questions or concerns arise from this finding. Is this a good thing that below-and above-zone officers now have a better chance at promotion? Does that mean these officers are the best and most fully qualified? Or did removing the zone stamps from the board take away valuable information the board members had to evaluate an officer quickly? Does this increase the chances that boards will now promote officers that otherwise shouldn't have been? Or is the complete opposite true, that this

allows for the right officer to be selected? A deeper analysis needs to be completed by separating the ranks.

Furthermore, survival analysis using DMDC data, showed that slow-trackers or above-zone officers attrite faster from the service when promoted at each additional rank. Previously promoted fast-trackers or below-zone were found to have been more likely to promote to each subsequent rank as compared to slow trackers but, they promoted to that next rank slower than the officers who had previously been slow-trackers, although, this finding is not surprising with an understanding of how the promotion and lineal list system work together. When a group of officers is promoted, the above-zone officers are placed higher on the list than the other officers being promoted. A few years later, when the zones are then determined for the next rank, the above-zone has a higher probability of being considered by the promotion board before the below-zone promotees.

C. DISCUSSION

Research Question #1: How did a recent Navy policy change removing the label of below/in/above zone effect promotion probabilities?

Analysis of the PERS data through an LPM statistical model revealed that the removal of zone labels affected the promotion probabilities by increasing the likelihood of both the above-zone and the below-zone selection. The direction of the effects was confirmed using a probit and fixed effects model to cross-validate. However, some questions remain regarding the magnitude of effects between the zones. Did we not observe the full effect of the below-zone officers because boards can still easily distinguish them from more senior peers? We may not be able to fully understand or answer that question, but based on research we do know although the Navy policy was to remove zone labels, we believe the policy did not go far enough to ensure full equity across the zones in the promotion board. Current policy and practice when bringing below-zone records into the crunch are to have that officer's record reviewed and graded. The record is then marked up and given a grade by the reviewer in a single color. Any above-zone and in-zone records brought into the crunch are given a second review and graded in a second color. It is presumed that board members can still identify below zone too easily when compared to

the other two zones. That identification can still be incorporating some bias and preventing more below-zone selections. There are a few ways Navy policy could address this potential bias and we feel should be implemented.

- All below-zone records brought in the crunch, automatically get a second reviewer for two grades (two colors), or
- Ensure all records in crunch only have one grade (one color)

To update the Navy's policy regarding the removal of zone labels, we believe all records in the crunch should have an equitable grading system. The Navy could take an approach that all below-zone records brought into the crunch be required to be graded by two reviewers and thus ensure boards cannot easily identify zones based number of grades or color. We understand that adding a reviewer and grade can add more time by the board; therefore, an alternative approach could be to limit all records in the crunch to one reviewer or grade. This would also ensure all records do not have an easily identifiable marker consisting of two different colors. These recommendations take this policy one small step further to take to ensure zone labels are properly removed from the promotion board and ultimately realize the full effects of the policy.

At issue would be that boards may still not be able to identify or have a general idea of which zone an officer was in based on year group or the number of fitness reports present in an officer's record. While this may hold for officers at the extreme ends of the spectrum, it would be extremely difficult for boards to identify officers in the margins. This is because many year groups get split up by zones currently; which would make individuals difficult to identify. Additionally, boards have a very limited time to evaluate an officer. With these possibilities deep in the details, it would be unlikely a board member could determine this information. The main importance is to eliminate any immediate/initial bias with the instant recognition of an officer's zone.

Additional considerations in the future could proceed in another direction with proper research. The policy could elect to eliminate promotion zones, and/or to have the boards consider every officer in that community that meets the DoD minimum law time in grade. The minimum time in grade tends to be much lower than the services flow point calculations. Careful research could attempt to understand the impacts of eliminating

zones, and whether or not that would reduce zone bias and provide a more effective promotion system that promotes the best and most fully qualified while retaining the best officers the longest.

Research Question #2: Does an officer's speed of promotion (selection below/in/above-zone) predict subsequent promotion and career longevity? Does fast or slow tracking for promotion result in longer Naval careers, or do these officers leave for the civilian sector faster?

There have been two common negatives cited with the below-zone or fast-tracking. One concern for fast-tracking is that officers have lower retention rates. This idea stems from literature documenting fast-trackers exiting a firm or organization at higher rates in pursuit of other jobs and higher salaries. Based on the analysis of the DMDC data our findings showed that Navy fast-trackers did not exit the firm at higher rates and are in stark contrast to literature.

Possible explanations for the disparity could begin with the service component of people who have elected to take an oath and serve. Naval service invokes a sense of national pride and commitment that could affect retention rates. Another possible explanation could have been the military's previous 20-year retirement plan that promoted cliff vesting. Research showed a steep drop at 20 years of service on the survival curve for lieutenant commanders and commanders, denoting that there may have been enough incentive for Navy fast-tracker officers to stay just long enough to reach the cliff or 20 years of service.

The second concern following fast-trackers is the idea that fast-tracking put officers at a disadvantage for subsequent promotion because of their junior status. Organizations worry that fast-trackers just won't have the career development needed for additional and upcoming promotions. In contradiction to this concern, this study did not find evidence to support this claim but did however find evidence to support fast-trackers appear to have higher probabilities for ensuing promotion. The evidence shows that fast-trackers in the Navy do have higher subsequent probabilities of promotion but it simultaneously found that they promoted slower to that next rank. At face value, the study could have concluded

that the fast-track disadvantaged them somehow because of their junior status. Alternatively, though, if we re-examine how the historical system promotes officers, it makes logical sense as to why we found this outcome.

Before merit re-ordering, when officers were promoted, their date of rank would be based on their level of seniority or active-duty lineal number. All the above-zone selections would be promoted first followed by all in-zone, and then finally any below-zone officers, in order of how they appeared on the lineal list. Merit-re-ordering now allows the board to “mix up” the order in which the selected officers are promoted based on merit. Due to this policy being so new and there be only limited data after merit re-ordering, this may need to be explored more and how it affects promotion long term. Study findings do question if merit-reordering goes far enough. Based on the data, it may be in the Navy’s best interest to always merit reorder as much as possible instead of leaving merit reordering up to board decision.

Furthermore, what would a mandatory re-order policy look like? Always re-order below-zone to the front since they have already shown superior qualifications? What would this do for promotion board timelines? How much more time would this always take? A potential solution would be to use the board’s confidence voting system to rank all the officers that were selected for promotion and, based on that ranking, promote in that order. The promotion timeline can have significant advantages based on the findings. Not only is the immediate financial incentive for promotes which could potentially earn \$8,000-11,000 more than peers based on the promotion date, but it also has long-term impacts on the next promotion timeline. Whether an officer is promoted first or last can significantly affect their time to promote to the next rank, as the study found concerning previous fast-trackers promoted slower to the next rank. There are a few ways Navy policy could address these conclusions that we feel should be implemented.

- Increase below-zone selections
- Reduce above-zone selections

With our recent findings, discussions within Navy policymakers should consider allowing for the expansion of below zone selections, as data would suggest that by doing so would enhance the Navy’s workforce with more promotable and longer retaining

officers. This would align the Navy with its talent management initiatives. When increasing below-zone selections the Navy and DoD can explore removing the restriction on the number of selects from that zone or look for ways to increase the selections numbers while staying within the law. The Navy typically does not even come close to selecting 10 percent of officers from below-zone, so one could imagine a time that the Navy consistently always selects 10 percent of the promotes from below-zone. Additionally, if restrictions must be made on the number of zone selections, then the evidence would suggest that such a limit be placed on above-zone selections. Based on study findings, this group of officers does not provide for the best return on investment concerning career longevity when compared with in-zone and below-zone officers.

D. FUTURE RESEARCH

This study lacked some key variables that would have made it possible to determine the causal effect zones had on an officer's career. Though this was overcome by switching to speed of promotion vice zones, we were limited regression models that examined relationships between the speed of promotion and its effects on an officer's career. Therefore, future studies should look to secure data that would allow statistical methods that isolate zones to determine causality.

The assignment of zones, which is conditional on lineal numbers, is assigned via an arcane set of rules involving promotion date, rank, birthday, and the first letter of an officer's last name. Therefore, because lineal number ordering seems to be random, it would allow for a regression discontinuity analysis. Regression discontinuity would elicit the causal effects of interventions by assigning a cutoff, in this case, the demarcation of zones, which an intervention is assigned. By comparing observations closely on either side of the promotion zone line, it is possible to estimate the average treatment effect in a promotion system in which randomization is unfeasible.

Additionally, a propensity score matching model could analyze across different zones to estimate the treatment effect. Propensity score matching is a technique used to attempt to estimate the effect of a treatment, policy, or in this case promotions zone by accounting for the variables that predict receiving the treatment. The goal is also to reduce

the bias of variables that could be found in an estimate of the treatment effect obtained, rather than just comparing outcomes among officers that received the treatment versus those that did not. The treatment is whether the officer is below/in/above the zone.

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