

**How Long Have You Been Waiting?**  
**Explaining the Role of Irrelevant Information in the Promotion of U.S. Navy Officers**

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**Abstract**

While all information is potentially valuable to economic agents in making decisions, if there are acquisition and processing costs, they may choose to privilege cheaper information. This can be problematic when decisions, such as personnel evaluations for promotions, are important yet time sensitive. Using administrative data of U.S. Navy officers and exploiting a Department of Defense personnel policy change, we explore how removing information which reveals how many times a candidate has been judged for promotion in the past impacts current promotion boards' up-or-down decisions. We find that removal of this cheap information increases promotion chances of first-time as well as previously pass-over candidates, implying that promotion boards have relied on the judgement of future and past promotion boards as short-cuts to processing relevant information. Results reveal that hiding these short-cuts may improve decision-making by forcing agents to do the hard work to acquire and process relevant information.

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## 1. Introduction

Worker evaluation for promotion is an oft-studied topic, but mostly in theoretical literature on the role of information in hiring, promotion, and firing.<sup>1</sup> Some empirical studies examine large population data and attempt to infer promotion, but there are very few papers that have data at the individual firm or organization level where promotion outcomes are observed. One notable example is academia, where the public nature of the promotion candidate's qualifications (research papers, teaching evaluations, etc.) has made empirical analysis possible.<sup>2</sup> We use personnel data from the U.S. Navy, providing a rare opportunity to look inside the "black-box" to examine the role of different types of information on promotion outcomes. In particular, we demonstrate how reliance on future or past evaluations can alter the "reservation value" of the ability of the worker as well as the probability of promotion.

In the U.S. Navy, promotion is rigidly formalized and tournament in style. Each year, at approximately the same time, promotion boards meet over the course of a week to make decisions for officers at all ranks up to Rear Admiral (RADM).<sup>3</sup> Upon joining the Navy, an officer is placed in a queue (also called the lineal list) that generally corresponds to the cohort year in which they were commissioned as Ensign (most junior-level officer). Each year, officers eligible for promotion enter one of three promotion zones: Below Zone (BZ), In Zone (IZ), and Above Zone (AZ).<sup>4</sup> The three zone corresponds roughly to three consecutive cohort years, with the youngest of the three cohorts in BZ, and the oldest in AZ. There is a fixed number of slots at each rank available for promotion, and the board's task is to select the officers from across the three zones to fill vacancies.

The design of the lineal list and zones ensures that all officers get at least three chances at promotion for each rank, usually once in each zone. Since promotion boards are required to make up-or-down decisions on many candidates in a compressed schedule, deriving useful, quick-to-understand signals of officer quality is crucial. Prior to 2017, board members viewed dossiers of officers with their zones indicated prominently. However, a change in Navy policy now obscures the officer's zone designation.<sup>5</sup> See the appendix for a detailed description of the promotion process.

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<sup>1</sup> See Chan (1996), DeVaro (2006), Fairburn and Malcomson (2001), Ghosh and Waldman (2010), Gibbons and Waldman (1999), Waldman and Zax (2020), for example.

<sup>2</sup> See Ginther and Hayes (2003), Schöttner and Thiele (2010), and Wise (1975), for example.

<sup>3</sup> Ranks above RADM are appointees who are not selected by promotion boards.

<sup>4</sup> Ensigns are automatically promoted to Lieutenant (LT) after 4 years of service. LTs typical flow point for promotion to Lieutenant Commander (LCDR) is 9-11 years of service. LCDRs to Commander (CDR) promotion flow point is 15-17 years of service. CDRs to Captain (CAPT) promotion flow point is 21-23 years of service. Beyond CAPT, navy ranks are, in ascending order, Rear Admiral (lower half) (RDML), Rear Admiral (upper half) (RAMD), Vice Admiral (VADM), and Admiral (ADM).

<sup>5</sup> Board members can, by looking at years of service, back out the zone with some accuracy. However, there is a non-trivial information cost, especially at the junior-grade officer promotion boards. Each officer's dossier is reviewed with limited time and attention, due to the large volume of candidates. For example, in FY-20, there were 8,360 LTs up for promotion.

In this article we show that promotion zones may have impacted promotion, where boards evaluated candidates' qualities differently, based on zones. The next section describes the data. Section 3 describes competing theory models to explain the observed patterns in the data. Econometric analysis and results follow in Section 4. Section 5 concludes.

## 2. Data

We use administrative data on active-duty U.S. Navy officers, as well personnel data on promotion outcomes and zone designations from NAVPERS. Summary statistics from our sample which consists of all Navy officer promotion board outcomes from 2012 to 2020 are provided in Table 1. It should be noted that the number of active-duty officers in the Navy during the sample period is much larger. In 2020, there were approximately 53,000 commissioned officers in the U.S. Navy. For our sample, we exclude junior officers where promotion is automatic, senior officers where promotions do not arise from promotion boards, and officers who are relatively newly promoted and not in any of the promotion zones yet. This trims our dataset considerably, to approximately 20,000 promotion outcome observations.

Table 1: Summary Statistics

Variable	Mean at Each Rank			
	All	LT	LCDR	CDR
Female	0.170	0.201	0.164	0.127
Minority	0.098	0.112	0.096	0.078
Not married	0.145	0.167	0.116	0.143
> 3 children	0.061	0.052	0.065	0.071
MA degree	0.697	0.532	0.777	0.872
MD/JD	0.152	0.152	0.163	0.138
Prior enlisted	0.228	0.284	0.225	0.137
Below Zone	0.538	0.607	0.533	0.431
In Zone	0.277	0.318	0.260	0.231
Above Zone	0.184	0.075	0.207	0.338
Promoted	0.207	0.261	0.193	0.135
Observations	20,022	8,485	6,446	5,091

Note: United States Navy officers' socio-demographic and promotion summary statistics. Data from 2012 to 2020. Minority refers to all officers who are not categorized as white in the administrative data. Prior enlisted refers to an officer who previously served in enlisted status (with a HS degree) but has since received a commission (and a bachelor's degree).

The Navy officers' corps is predominately male and white, although lower ranks are somewhat more diverse. They are highly educated, with almost 85 percent of the population holding post-

graduate degrees. Promotion at the ranks above LT is competitive. Success in any given year is about 20 percent, but each officer has at least 3 chances to be promoted.<sup>6</sup>

Table 2 shows the stark differences in promotion probabilities depending on the officer's current zone, both before and after the policy change. The likelihood of being promoted at BZ is always at or below 1 percent. Only "super stars" are selected to be promoted ahead of their cohort group. Once officers are IZ, promotion is much more likely, especially at the more junior ranks. If officers are passed over at least twice and move into AZ, their promotion probabilities decrease sharply, dipping into single digits for senior positions. The right-most three columns show that IZ promotion probability decreases, while BZ and AZ promotion probabilities increase across all three ranks.

Table 2. Probability of promotion to rank, conditional on zone designation.

	Before policy change			After policy change		
	to LCDR	to CDR	to CAPT	to LCDR	to CDR	to CAPT
Below Zone (BZ)	0.003	0.004	0.000	0.02	0.01	0.01
In Zone (IZ)	0.75	0.66	0.49	0.71	0.59	0.46
Above Zone (AZ)	0.23	0.11	0.05	0.35	0.16	0.08

Note: U.S. Navy officers' promotion probabilities. Before policy change refers to 2012-2016 and has 10,620 observations. After policy change refers to 2017-2020 and has 9,402 observations.

### 3. Theoretical Arguments

We present two competing models for the observed patterns of promotion probabilities described above. Although both are related to the process of dynamic information acquisition, the empirical predictions that arise out of each model are quite different. The first model is one of Bayesian learning, and the second is one of use (or abuse) of discrete signals as proxies for costly information acquisition.<sup>7</sup>

The scenario described in the previous section is consistent with the promotion board gradually learning about the ability of an officer by seeing repeated draws in a Bayesian framework. Each year, the board observes an officer producing an output draw that is the sum of his or her ability plus a mean zero error term. The board knows the population distribution of ability, which forms the initial prior, and is unable to separate the officer's ability from the shock.

When the officer is BZ, the board's prior will be informed by fewer draws, resulting in larger variance. If the promotion board is in any way risk averse, they will require a high ability draw to overcome the lack of information. However, for an officer who is AZ, there will have been at

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<sup>6</sup> The commissioned officer population is distinguished from enlisted sailors. Enlisted sailors typically join the Navy after graduating from high school. The population we are examining are commissioned officers, who join the Navy through a number of accession sources, including ROTC programs and the US Naval Academy. Officers typically come in with a bachelor's degree or above.

<sup>7</sup> See Ahn and Vigdor (2020) for a similar set-up.

least two draws which will have added enough information for the board's posterior to have low variance. Then, the final output will need to be high to overcome the accumulated evidence. In the data, we would expect to find low probabilities of promotion for officers in BZ and AZ.

A policy change to obscure zone designation in a Bayesian learning framework should have limited impact on promotion probabilities.<sup>8</sup> The accumulated information on officer ability and accomplishments (or lack thereof) should still be visible from the promotion packet. The zone designation adds little new information beyond the output draws.

Our second model concerns using zone designations as shortcuts in lieu of exerting effort to discern officer quality. Like the first model, each year, the officer produces an output draw that is his or her ability plus a shock term. However, the board must pay a variable cost to observe the output. While it is cheap to observe high output, it becomes progressively more expensive to observe lower output. In such a case, the board must weigh the marginal benefit of observing lower outputs with the marginal cost of paying the information acquisition cost.

When the candidate is BZ, it is optimal for the board to invest enough to identify and select super stars, and delay making expensive evaluations of officers with lower output, as there will be at least two more chances to observe them. On the other hand, if the candidate is AZ, the board derives a signal from at least two prior failures to promote. Once again, it is optimal to invest enough to identify and select officers who clearly suffered from bad luck in drawing at least two large, negative shocks.

In this model, as the board was utilizing the zone designations as inexpensive information, a policy change to obscure it is expected to have substantive impact on officers' promotion probabilities. Without knowing how many times the officer has (or has not) been evaluated, promotion boards will have to invest to learn more about candidates who are BZ or AZ.

Evaluation of BZ and AZ candidates should approach the outcomes observed for IZ candidates.

## 4. Empirical Corroboration

### 4.1. Econometric Analysis

We first show in a linear probability model (LPM) framework that promotion below or above zone is correlated with promotion success to the next rank. Table 3 shows that for promotion to CDR, there is no positive effect of BZ, but there is a -10 percent effect for AZ. For promotion to CAPT, there is a 14 percent positive effect of BZ, and a -6 percent effect for AZ.<sup>9</sup> Zones at promotions from the previous ranks do not appear in personnel records; therefore, BZ or AZ represent true quality differences.<sup>10</sup> As BZ promotion is very rare, and it is a positive predictor for being promoted to the next rank, early promotion is indeed reserved for "super stars." As AZ

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<sup>8</sup> In a full, formal Bayesian framework, the candidate's full body of work throughout his or her career should inform the prior for the promotion board. With a long enough career, there should be very little new information revealed via new draws.

<sup>9</sup> As promotion to LT do not have zones, regression for promotion from LT to LCDR cannot be estimated.

<sup>10</sup> Promotion at BZ and AZ imply fewer and more years of experience, respectively, compared to their colleagues.

is a negative predictor of promotion to the next rank, getting passed over at IZ (even if the officer successfully promotes next year at AZ) is detrimental to one's naval career.<sup>11</sup>

Zone designation at previous and current ranks are clearly the dominant factors associated with promotion. Interestingly, most socio-demographic characteristics as well as professional credentials, such as post-secondary education or total number of suffix codes, which proxy for ability or expertise fail to substantively predict promotion outcomes.

Table 4 shows the LPM results for a difference-in-difference-style analysis of the Navy policy change in 2017 for four different model specifications. The first specification only includes the policy variables as regressors. Each subsequent specification adds socio-demographic characteristics, professional credentials, and year dummy variables, sequentially. Parameter estimates remain remarkably stable across all specifications. We should note that promotion in the Navy is a tournament with a fixed number of positions. IZ officers, who would usually form the control group in a difference-in-difference framework, are impacted by the treatment, as increases/decreases in promotion rates for BZ and AZ alter their probability of promotion. However, as we argue below, the treatment effect on the IZ group is marginal.

With the entire sample aggregated and the policy change explicitly accounted for, we find that post-secondary education and professional credentials do matter in promotion. Higher current ranks are substantially negatively correlated with promotion, reflecting the pyramidal hierarchy of the Navy where selection to higher ranks become progressively more competitive, as seen in Table 2. Across Tables 3 and 4, officers who started their career as enlisted sailors are shown to be at a disadvantage in promotion. While this may be due to differing ability, it is also possible that the significantly older prior enlisted officers are in different career tracks that make promotion more difficult. Most enlisted sailors start their careers without a college degree, and those that transition to officers would most likely have earned their bachelor's degree while on active duty. Thus, commissioning age for these officers tend to be considerably higher.

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<sup>11</sup> The perception of promotion at each zone is corroborated by interviews with active duty Naval officers attending the Naval Postgraduate School.

Table 3. Probability of promotion conditional on promotion below/at/above zone at prior rank.

Variables	Promotion to CDR	Promotion to CAPT
Promoted BZ at prior rank	0.0648 (0.111)	0.142** (0.0708)
Promoted AZ at prior rank	-0.104*** (0.0220)	-0.0582*** (0.0225)
Below Zone (BZ)	-0.584*** (0.0138)	-0.428*** (0.0179)
Above Zone (AZ)	-0.294*** (0.0241)	-0.265*** (0.0282)
MD / JD	-0.0128 (0.0153)	0.0530** (0.0222)
MA degree	0.0139 (0.0145)	0.0259 (0.0269)
Female	0.00952 (0.0163)	-0.00676 (0.0208)
Minority	-0.0237 (0.0161)	0.0190 (0.0213)
Not married	0.0370* (0.0196)	0.0385 (0.0274)
> 3 children	0.0162 (0.0133)	0.0355* (0.0187)
Prior Enlisted	-0.0365*** (0.0132)	-0.00637 (0.0201)
Total Suffix Codes	0.0005 (0.0043)	0.0031 (0.0048)
Observations	2,390	1,521
R-squared	0.464	0.312

Note: Linear Probability model. Standard errors in parentheses. Year dummies included. Suffix Codes are credentials which proxy for ability. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Prior to the policy change, when zones are visible to the boards, being BZ or AZ severely decreases an officer's likelihood of being promoted. Once the policy takes effect and zones are obscured, promotion probability in BZ and AZ increase substantially: across the four specifications, BZ promotion likelihood increases by about 1 percentage point from a base of less than 1 percent, AZ by 5 to 6 percentage points from a base of about 13 percent.<sup>12</sup> Although IZ promotion impact is not statistically significant in the last specification, it is worth noting that the point estimate is -1.3 percentage points (from a base of 65 percent). As mentioned above, the IZ group is technically not a control group, as promotion is a tournament. However, we maintain the simple econometric framework as IZ make up the vast bulk of officer candidates promoted

<sup>12</sup> We also test for robustness by estimating specification (4) by ranks. See the appendix.

(some 90 percent); therefore, changes in BZ and AZ promotion rates should only marginally impact IZ promotion rates. This is confirmed in the model estimates.

Table 4. Impact of zone obscuring on promotion probability conditional on below/at/above zone.

Variables	Promotion Probability			
	(1)	(2)	(3)	(4)
Below Zone (BZ)	-0.660*** (0.00671)	-0.660*** (0.00670)	-0.659*** (0.00660)	-0.659*** (0.00660)
Above Zone (AZ)	-0.560*** (0.00874)	-0.560*** (0.00874)	-0.520*** (0.00866)	-0.522*** (0.00876)
Zone Obscured	-0.0303*** (0.00794)	-0.0302*** (0.00794)	-0.0292*** (0.00783)	-0.0131 (0.0110)
BZ x Zone Obscured	0.0393*** (0.00978)	0.0389*** (0.00978)	0.0431*** (0.00958)	0.0433*** (0.00963)
AZ x Zone Obscured	0.0849*** (0.0126)	0.0851*** (0.0126)	0.0770*** (0.0120)	0.0776*** (0.0124)
Female		0.0150*** (0.00560)	-0.00707 (0.00570)	-0.00724 (0.00570)
Minority		-0.0154*** (0.00588)	-0.0199*** (0.00582)	-0.0200*** (0.00586)
Not married		0.00227 (0.00598)	0.00169 (0.00590)	0.00147 (0.00591)
> 3 children		0.0111 (0.00880)	0.0133 (0.00867)	0.0133 (0.00867)
MD / JD			0.0215*** (0.00595)	0.0216*** (0.00595)
MA degree			0.0435*** (0.00524)	0.0439*** (0.00524)
Current Rank LCDR			-0.0719*** (0.00506)	-0.0720*** (0.00506)
Current Rank CDR			-0.143*** (0.00581)	-0.143*** (0.00582)
Prior Enlisted			-0.0098* (0.00513)	-0.0097* (0.00513)
Total Suffix Codes			0.0106*** (0.00156)	0.0107*** (0.00156)
Year Dummies?	No	No	No	Yes
Observations	20,022	20,022	20,022	20,022
R-squared	0.468	0.469	0.482	0.486

Note: Linear probability model. Total observations: 20,022. Data from 2012 to 2020.  
Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Without enough information about the officer's true ability, the board reserves BZ for those who are clear-cut super stars, where the officer's output is highly unlikely to be the result of luck. Since passed-over officers will be evaluated at least twice more, there is little lost by being risk-

averse.<sup>13</sup> As the board evaluates an AZ officer’s current dossier, it updates its guess of the officer’s ability using the knowledge that he or she has been denied promotion multiple times. The implication is that many officers in AZ may have low ability. To overcome the negative information shock of the prior two boards, the officer’s current dossier must be exceptional. Therefore, many will be rejected one final time, resulting in the lower probability of promotion.

When the zone designations are eliminated, the board can no longer easily discern how many chances the officers have had or will have for evaluation. As such, boards must rely more on the dossier and the probability of promotion in BZ and AZ increase, while chances of promotion IZ declines, due to the fixed number of vacancies. While the empirical results may not seem surprising as laid out here, the original intent of the policy change was to increase BZ promotions. Potential impacts on AZ promotions were not considered.<sup>14</sup>

## 4.2. Threats to Identification

In this section, we briefly discuss various threats to identification and why the nature of the data allows us to have confidence that the estimated treatment effects are valid. Specifically, we discuss the potential for unanticipated labor demand and supply shocks, as well as the relevance of the reward in the tournament.

Because of the unique characteristics of the mission of the U.S. Navy and the need to maintain force-strength levels regardless of “market demand,” the number of positions that need to be filled each year remains relatively static and predictable.<sup>15</sup> As such, there are relatively few unanticipated shocks to labor demand that can affect promotion probabilities.

Also, there are very few labor supply shocks in the Navy, because it must “grow” its own workforce. The structure and organization of the officer’s corps is such that it is virtually impossible to hire someone “mid-stream” to fill a vacant position. As such, even if there were a critical need, the Navy would not be able to significantly grow or shrink its workforce.

Finally, the fixed, stable, and publicly visible rate of pay for active duty officers means that promotion is the only substantive reward for good performance, especially at the more junior ranks. As such, the outcome in our regression model is the pivotal incentive that officers are competing over.

## 5. Discussion

Evaluating workers for promotion is complicated, messy, and almost always hidden behind the veil of intra-firm proprietary data. The availability of internal data from the U.S. Navy and codified standard operating procedures for promotion provided a unique opportunity to assess how promotion decisions are made (and sometimes not made).

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<sup>13</sup> Provided of course, the officer is not induced to leave the Navy due to the negative outcome.

<sup>14</sup> As per Chief of Naval Personnel (CNP) comments during a brief of this research.

<sup>15</sup> Technically, positions or vacancies for officers are called billets. Billet equals authorized space. You need a billet to be able to place an officer into. Law dictates the number of spaces differentiated by rank that is allowed. See the appendix for further details.

We compare two competing models of information acquisition and find that zone designations may be serving as inexpensive signals used by decision makers who rely on past or future outcomes to inform their decisions or defer judgement. Both the availability of future chances at evaluation and past negative outcomes raise the reservation value of worker productivity, negatively impacting the likelihood of promotion. The treatment effect of the change in Navy policy obscuring zone designations empirically corroborated our theoretical model.

The surprisingly large treatment effect of such a modest change in personnel policy shows that we have an incomplete understanding of how promotions within firms or organizations work. More nuanced research with better internal data into how information, signals, and timing impact personnel policies and outcomes in hiring, promotion, and terminations is required.

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## Appendix

### *Description of promotion process and change in board room pre- and post- reform*

Congressional law dictates that every officer, O-4 (equivalent to LCDR) and above, only support a funded requirement; thus the Navy's promotion system can only promote officers based on vacancies within their respective community. Positions cannot be created unless dictated by law, and even supremely qualified candidates must be rejected if vacancies do not exist.

Being selected for promotion is highly competitive, based on a variety of qualifications to include: education, types of duty, and most importantly, sustained superior performance. Promotion boards use what is called a lineal list to identify eligibility for promotion. Lineal lists sort officers into a rank and seniority hierarchy. Each year, prior to the promotion board convening, the lineal list becomes available with visible promotion zones. Promotion zones are managed by three factors: the number of officers authorized for that rank within a community, projected vacancies, and selection opportunity. 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.

Prior to officer promotion boards meeting, board recorders scrub records to correct for accuracy. Once the board begins, members are provided a random selection of records to review and grade. Once the reviews are complete, the records are briefed in a board room, known as the tank. After each record is briefed, members of the board anonymously vote a score of either: 100, 75, 50, 25, 0. Once all of the above-zone and in-zone records are briefed and scored, the members must determine which officers stand out for selection. Records not selected are re-evaluated a second time by a different member of the board to be given a grade. These records are brought into a process known as the crunch.

The board then has an opportunity to review below zone records starting with the most senior working down the lineal list. Only records that receive a unanimous vote to be reviewed are then evaluated and graded in a similar process as described above. The only difference are that below zone records brought into the crunch will only have one grade, or colored notes. The records are then briefed in the same manner as described in the tank and given an anonymous score. Once all records have received a vote, the board again decides which officers which the highest scores to select for promotion. The process continues until all vacancies have been filled.

The promotion board made changes in 2016 that removed the zone label from the officers record. This makes it harder for board members to identify above-zone and in-zone officers. Below-zone officers when given a grade within the tank only have one grade as described above so they continue to be more easily discernable.

Table A. Impact of zone obscuring on promotion probability conditional on below/at/above zone, by rank.

Variables	Promotion Probability		
	to LCDR	to CDR	to CAPT
Below Zone (BZ)	-0.746*** (0.00950)	-0.651*** (0.0120)	-0.488*** (0.0135)
Above Zone (AZ)	-0.504*** (0.0185)	-0.544*** (0.0152)	-0.432*** (0.0143)
Zone Obscured	-0.006 (0.0160)	-0.0672*** (0.0201)	-0.0258 (0.0222)
BZ x Zone Obscured	0.0507*** (0.0136)	0.0642*** (0.0175)	0.0376*** (0.0206)
AZ x Zone Obscured	0.142*** (0.0253)	0.0992*** (0.0215)	0.0469*** (0.0216)
Observations	8,485	6,446	5,091

Note: Linear Probability model. Standard errors in parentheses. Socio-demographic, education, professional variables, and year dummies from Table 4 are all included. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1