Volume II. Adequacy of Military Compensation

December 2020

Report of

The Thirteenth Quadrennial Review of Military Compensation

Preparation of this report and its underlying studies cost the Department of Defense a total of approximately $5,680,000 in Fiscal Years 2018–2020.

Report of the Thirteenth Quadrennial Review of Military Compensation

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Preface

Every four years, the president directs "a complete review of the principles and concepts of the compensation system for members of the uniformed services."[1] In September 2017, President Donald J. Trump instructed the Secretary of Defense to conduct the Thirteenth Quadrennial Review of Military Compensation (13th QRMC). In his charge to the secretary, the President stated:

> In addition to our support and gratitude, we owe our men and women in uniform the tools, equipment, resources, and training they need to fight and win. Our military compensation system must recognize their sacrifices and adequately and fairly reward them for their efforts and contributions. It also must encourage the next generation of men and women to answer the call to serve their fellow citizens as members of our uniformed services. Although the world and the threats to our Nation have changed over time, the structure of our military compensation system, with the exception of recent changes to military retirement, has remained largely the same.[2]

Thus, the 13th QRMC examined several structural changes to the military compensation system—a single-salary system and a time-in-grade pay table—in addition to topics concerning the adequacy of military pay.

This second volume of the 13th QRMC report contains research papers on the adequacy of military compensation prepared by federally funded research and development centers in support of the QRMC. They include more detailed discussion of the topics addressed in the main report to include description of the data sets and methodology used in the various analyses. These reports are presented, with permission, in their entirety. The views expressed in these papers represent those of the authors and are not necessarily those of the Department of Defense.

This volume includes the following:

An Updated Look at Military and Civilian Pay Levels and Recruit Quality
Troy D. Smith, Beth J. Asch, Michael G. Mattock, RAND Corporation

Thrift Savings Plan Contributions Under the Blended Retirement System
Dan Leeds, Josh Horvath, Chris Gonzales, CNA

1. United States Code, Section 1008b, title 37.

2. The White House, "Thirteenth Quadrennial Review of Military Compensation," memorandum for the Secretary of Defense, September 15, 2017.

TROY D. SMITH, BETH J. ASCH, MICHAEL G. MATTOCK

An Updated Look at Military and Civilian Pay Levels and Recruit Quality

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Preface

Quadrennial reviews of military compensation seek to ensure that pay and benefit levels for those serving in the military are adequate and able to attract the quality and quantity of recruits necessary to maintain readiness. This report, in support of the 13th Quadrennial Review of Military Compensation, builds on earlier RAND work (Hosek et al., 2018) by examining the current state of military compensation relative to civilian pay for workers of comparable ages, education levels, and labor-force participation. The Ninth Quadrennial Review of Military Compensation recommended that military pay for active-component enlisted personnel be at about the 70th percentile of civilian pay for full-time workers with some college and that military pay for active-component officers be at about the 70th percentile of civilian pay for full-time workers with four or more years of college. We compare relative pay for enlisted and officers in 2017 with their relative pay in 2009. We also examine how changes in military pay affect the quality of recruits across branches of the military, as well as how pay percentiles vary by geography.

The current research was sponsored by the 13th Quadrennial Review of Military Compensation and conducted within the Forces and Resources Policy Center of the RAND National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Navy, the Marine Corps, the defense agencies, and the defense Intelligence Community.

For more information on the RAND Forces and Resources Policy Center, see www.rand.org/nsrd/ndri/centers/frp or contact the director (contact information is provided on the webpage).

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Summary

Since the beginning of the all-volunteer force in the early 1970s, compensation and benefits have been among the most critical tools for attracting and retaining the quantity and quality of military personnel necessary for the United States to achieve its military goals. Military pay must be high enough to attract quality recruits away from other jobs that they could get given their education, skills, and ability while also being respectful of the public trust to appropriately manage public funds.[1] The Ninth Quadrennial Review of Military Compensation (QRMC) measured military pay via regular military compensation (RMC), which is the sum of basic pay, basic allowance for housing (BAH), basic allowance for subsistence (BAS), and the federal tax advantage resulting from allowances not being taxed. The report concluded, "Pay at around the 70th percentile of comparably educated civilians has been necessary to enable the military to recruit and retain the quantity and quality of personnel it requires" (Office of the Under Secretary of Defense for Personnel and Readiness, 2002, p. xxiii).[2]

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[1] This report focuses on active-component (AC) compensation and does not directly consider reserve-component (RC) compensation, though elements of the RC system are tied to that of the AC system, such as the pay table. An analysis of RC compensation would require consideration of the nature of Selected Reserve RC service, where members typically are employed full-time in a civilian job or attending school, and are employed only part-time in the RC. Such an analysis is beyond the scope of the current study.

[2] In this report we do not ask the question of whether the 70th percentile is still the correct level for military pay and instead focus on correctly measuring RMC compared with civilian wages. However, in ongoing work we do explicitly explore whether the standard set by the 9th QRMC is still the appropriate benchmark.

Like the 9th QRMC, this report also focuses on active-component personnel, and it measures military pay via RMC. We compare RMC of enlisted personnel with the annual earnings of full-time, full-year workers with high school degrees and those with some college education. In our main results we adjust the civilian earnings distribution to resemble the gender mix of the military. We compare RMC for officers with college graduates and to those with advanced degrees, again adjusting the civilian distribution to look more similar to the military distribution in terms of gender.[3]

In this report we address three main questions:

- How does military pay for active-component personnel in 2017 compare with civilian pay?
- What has happened to recruit quality given the relative changes in military and civilian pay since 2000?
- How does the difference between civilian and military pay change across geographies within the United States?

In addressing these questions, we used data from the U.S. Department of Defense's (DoD's) *Selected Military Compensation Tables* (Directorate of Compensation, 2017), also known as the Greenbook, and from Active Duty Pay Files provided by the Defense Manpower Data Center (DMDC). We also use data from the March supplements to the Current Population Survey (CPS; U.S. Census Bureau, 2018), from DMDC's August 2009 and September 2017 Status of Forces Surveys on the education distribution of enlisted personnel and officers (Office of People Analytics, 2017, 2018), and from *2015 Demographics: Profile of the Military Community* (Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy, 2016) on the gender mix in the military. We weighted civilian workers by the military gender mix then computed a civilian wage distribution for each

[3] Note that throughout the report we focus on individual comparisons and provide no evidence on how total household military pay compares with total household civilian pay.

level of education to make results comparable with previous QRMCs.[4] Treating RMC as though it were a wage, we found its placement in the distribution (i.e., we determined its percentile). We computed RMC percentiles for officers and enlisted by year of service, as well as overall RMC percentiles for officers and enlisted for 2017 and 2009.

To examine how quality changes as civilian and military pay varies, we estimated regression models to study the relationship between recruiting outcomes and the ratio of RMC to the median civilian wage of high school completers ages 18–22, controlling for other variables. We estimated separate models by branch of service for non–prior service (NPS) accessions and used two types of recruiting outcomes, the recruiting rate and the share of accessions who are not high school diploma graduates (HSDGs). We calculated the outcomes for Armed Forces Qualification Test (AFQT) score categories I, II, IIIA, and IIIB. For instance, the category II recruiting rate in a year is the ratio of HSDG accessions in category II to the population of high school completers in that category net of those going on to complete four or more years of college. The share of non-HSDG accessions in category II is the ratio of non-HSDG accessions in category II to the total number of accessions in that category (HSDG and non-HSDG).

To examine how military wages compare with civilian wages across geographies, we build on recent work in economics that has documented fundamental changes in wage patterns between rural and urban areas.[5] Using data from the 2010 U.S. Census, we split states into the ten most urban and the ten least urban and compare RMC with civilian wages for each of these groups.

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[4] We do not weight by race, as our results would not be directly comparable with the results of studies in support of previous QRMCs. However, military pay does not differ by race, and the military tends to be more diverse than the civilian population. Thus, if we were to weight the civilian population by the military racial mix our RMC percentiles would likely be higher than they presently are. In this way, our results are conservative estimates (that is, they are likely biased downward).

[5] See, for instance, Autor (2019).

The Regular Military Compensation Percentile for 2017 Was Above the 70th Percentile and Was About the Same as in 2009

Taking a weighted average across education levels based on the military education distribution for the first 20 years of service, we find that RMC for 2017 was at the 85th percentile of the civilian wage distribution for enlisted personnel and at the 77th percentile of the civilian wage distribution for officers.[6]

Many military members increase their educational attainment while in service, and this changes the mix of nonmilitary jobs that they can get. For this reason, it is important to compare military RMC with the pay of civilians with more years of formal education as enlisted members progress through their careers. For enlisted, RMC is above the 90th percentile during the first nine years of service (YOS), when we are comparing enlisted members with civilians with a high school degree; is around the 84th percentile in years 10–19, when we are comparing enlisted members with civilians with some college; and climbs from the 59th percentile to the 71st percentile between years 20 and 30, when we are comparing enlisted members with civilians with a bachelor's degree. RMC for officers is around the 85th percentile in years 1–9, when we are comparing officer members with civilians with a bachelor's degree, and climbs from the 69th percentile to the 77th percentile from years 10–30, when we are comparing officer members with civilians with more than a bachelor's degree.

Over time, the educational attainment of military personnel has increased, such that those in higher grades have reached higher levels of educational attainment than they did in 2009. This increase in educational attainment could potentially change the RMC percentiles

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[6] This is somewhat less than the 90th percentile reported by the 11th QRMC for enlisted and the 83rd percentile reported for officers. The differences come from differences in methodology as explained in Hosek et al. (2018, pp. 10–16, 28–30): namely, the method used to calculate years of experience, and weighting wages by the civilian distribution of educational attainment rather than the military distribution of educational attainment. For a discussion of the "pay gap" and how analysis of changes in basic pay and the Employment Cost Index (ECI) compare with our results, see Hosek et al. (2018, pp. 99–104).

over time. Yet we found that the overall RMC percentiles for 2017 for enlisted personnel and officers were very similar to those for 2009. This finding uses five levels of education for enlisted (high school, some college, associate's degree, bachelor's degree, and master's degree or higher), and it uses two levels for officers (bachelor's degree and master's degree or higher).

Our RMC percentile for officers—the 77th percentile in both 2009 and 2017—is below the 11th QRMC's estimate for 2009, which was the 83rd percentile. However, our methodology was also different in that we used additional education categories and imputed civilian labor force experience differently. When we compute percentiles in 2009 using a method comparable with the one we used in 2017 and include the additional education categories, we find that enlisted RMC is at around the 84th percentile in 2009, similar to our estimate for 2017. Put differently, enlisted RMC relative to civilian pay has remained unchanged between 2009 and 2017, and the differences reported here versus the 11th QRMC are attributable to differences in methodologies.

We also compared RMC with civilian wages from 2000 to 2017 for selected age and education groups. There is a steady increase in RMC relative to civilian pay from 2000 to 2010 and a leveling off afterward. This is likely due to wage stagnation in the civilian sector and continued growth in wages for military personnel through the 2000s.

Recruit Quality Rose in Three Services as Military Pay Increased Relative to Civilian Pay

Our regression findings show similar patterns to those noted in Hosek et al. (2018, pp. 52–63): namely, a positive association between enlisted recruit quality and the ratio of RMC to the civilian wage for the Navy, Marine Corps, and Air Force but not for the Army. Recruit quality is defined as individuals who enlist who are in the top half of the distribution of AFQT scores and who are HSDGs. Those who are assigned AFQT categories I, II, and IIIA are considered in the top half of the distribution. The Navy, Marine Corps, and Air Force increased quality over time as both wages and the recruiting rates for categories I and II

increased. The Marine Corps also increased the recruiting rate for categories IIIA and IIIB. As wages rose, the Army decreased the recruiting rate for category IIIB, as well as for II and IIIA. The reasons for the difference in the relationship between RMC and quality for the Army are unclear. However, some potential reasons are discussed below in this report (see also Hosek et al., 2018, pp. 71–73).

Further, the Army and the Marine Corps had positive associations between the share of accessions that were non-HSDGs and the ratio of RMC to the civilian wage in categories I, II, and IIIB but not in IIIA. These services took more non-HSDGs as military pay rose, other things being equal. The Navy increased the share of non-HSDGs in categories I and II but not IIIA or IIIB. The Air Force decreased the share of non-HSDGs in category I and increased the share in categories IIIA and IIIB.

Geography Matters Less for Service Members at Lower Levels of Education and More for Service Members with Higher Levels of Education

Confirming trends noted by Autor (2019), we find that civilian wages do not differ much across geographies in the United States for workers with less than a high school degree, a high school degree, or some college, but that they differ substantially for workers with a bachelor's degree or higher. Thus, unlike in the past when civilian wages for both highly skilled and less-skilled workers were higher in urban than less-urban areas, civilian wages are more equal across geographic areas, at least for those with a high school degree or some college. We find that RMC percentiles of the civilian wage distribution for enlisted personnel with lower levels of education are similar across the most urban and the least urban states. However, RMC percentiles of the civilian wage distribution for Army officers with higher levels of education are much lower in the most urban states compared with the least urban states. As automation and outsourcing have changed the labor market and replaced many jobs that required specialized training but lower levels of formal education (such as factory jobs), alternatives for less edu-

cated workers have changed (Acemoglu and Autor, 2011; Acemoglu and Restrepo, 2017, 2018; Alabdulkareem et al., 2018; Autor, 2015, 2019; Autor and Dorn, 2013; Autor, Katz, and Kearney, 2006; Autor, Levy, and Murnane, 2003). Whereas previously many less-educated workers worked in these "middle-skill" jobs as well as less skill-intensive jobs, they are increasingly taking less skill-intensive jobs as the middle-skill jobs have disappeared. Additional research should be conducted to further examine how RMC compares with civilian wages in different parts of the country for workers with different levels of education and the implications for recruiting and retention of military personnel.

Acknowledgments

We would like to thank Thomas K. Emswiler, Director, 13th Quadrennial Review of Military Compensation, for sponsoring this study. We especially appreciate the guidance offered by Jeri Busch, Director for Military Compensation, and Don Svendsen of the Office of Compensation, as well as Don's comments. We are grateful to Mike DiNicolantonio and his team at the Research, Surveys, and Statistics Center of the Office of People Analytics in the Defense Human Resources Activity for tabulations on educational attainment of those in the military. At RAND, Christine DeMartini helped process the military pay and Current Population Survey files, and we are thankful for her assistance. We appreciate the input and comments from the two reviewers, John Warner, Professor Emeritus from Clemson University, and Melanie Zaber at RAND.

Abbreviations

AFQT	Armed Forces Qualification Test
ASVAB	Armed Services Vocational Aptitude Battery
BAH	basic allowance for housing
BAS	basic allowance for subsistence
CPS	Current Population Survey
DMDC	Defense Manpower Data Center
DoD	U.S. Department of Defense
ECI	Employment Cost Index
FY	fiscal year
GED	General Education Development
HSDG	high school diploma graduate
MEPS	military enlistment processing station
NCES	National Center for Education Statistics
NLSY	National Longitudinal Survey of Youth
NPS	non–prior service

NR	not reported
QRMC	Quadrennial Review of Military Compensation
RMC	regular military compensation
YOS	years of service

CHAPTER ONE

Introduction

A common theme of past Quadrennial Reviews of Military Compensation (QRMCs), as far back at the first one in 1969, is whether military compensation is set high enough to attract and retain the number and quality of personnel required by the armed services. Basic pay is the foundation of military compensation. Every service member on active duty is entitled to basic pay, though the particular amount depends on the member's pay grade and length of service. Every member is also entitled to receive two other elements of military compensation, the basic allowance for housing (BAH) (or quarters in kind) and basic allowance for subsistence (BAS) (or subsistence in kind). The entitlement to these three elements—basic pay, BAH, and BAS—led the Gorham Commission in 1962 to develop the construct of "regular military compensation," or RMC, as a benchmark for comparing military compensation with civilian compensation. Later, the definition of RMC was expanded to include the federal tax advantage associated with receiving BAH and BAS tax-free.

Subsequent QRMCs and commissions also considered the competitiveness, effectiveness, and efficiency of military compensation, focusing on various elements of compensation to include not only RMC but also BAH, military retirement reserve compensation, and the structure of the pay table.[1] It was the 9th QRMC that made the level of RMC the focal point of its study. In its 2002 report, the 9th

[1] A history of studies considering major structural changes to military compensation is provided in Appendix III of Office of the Under Secretary of Defense for Personnel and Readiness (2018).

QRMC concluded, "Pay at around the 70th percentile of comparably educated civilians has been necessary to enable the military to recruit and retain the quantity and quality of personnel it requires" (Office of the Under Secretary of Defense for Personnel and Readiness, 2002, p. xxiii). Further, it found that comparing enlisted personnel with civilians with a high school diploma no longer reflected the education level of the force because an increasing fraction of the enlisted force had some college education and the military actively recruited from the college-bound youth market. Thus, the 9th QRMC argued that comparative pay analyses should look at military pay for enlisted personnel relative to the 70th percentile of pay of civilians with some college. Similarly, the comparison group for officers should be civilians with a bachelor's degree or higher (rather than those with only a bachelor's degree).

Using data from 2009, a decade after the data used by the 9th QRMC, the 11th QRMC found that military pay exceeded the 70th percentile. Specifically, it found that RMC was at about the 90th percentile for enlisted members and at the 83rd percentile for officers. Thus, over the course of the 2000s, military pay increased substantially relative to civilian pay.

In a recent study, Hosek et al. (2018) found that military pay continued to exceed the 70th percentile and that the percentiles for 2016 were in fact virtually the same as what the 11th QRMC found for 2009. The Hosek et al. (2018) study also analyzed the extent to which readiness, as measured by the quality of the enlisted force, improved as military pay relative to civilian pay increased since 2000. The study found that recruit quality rose as relative military pay increased since 2000 for each service, except for the Army. The reason for the Army difference was unclear. Some proposed explanations include Army recruiting becoming more difficult than other services' recruiting over this period, the Army reduced other recruiting resources such as bonuses, or the Army chose to focus its recruiting efforts on nontraditional metrics of quality.

The director of the 13th QRMC requested that RAND update the Hosek et al. (2018) study to consider how military pay compares with the pay of similar civilians through 2017 rather than 2016. He

also requested that we update the regression analysis in that study to examine how recruit quality changes with increases in relative military pay. In the spirit of the 9th QRMC, we first consider the educational attainment of the enlisted and officer forces and how attainment has changed since the 9th QRMC considered this question using data from 1999 and since the 11th QRMC considered this question using data from 2009. For this analysis we use input from the Office of People Analytics within the Office of the Under Secretary of Defense for Personnel and Readiness. Given the shift in the educational attainment of the enlisted and officer force, we then address three main questions:

1. How does military pay for active-component personnel in 2017 compare with the pay of comparably educated civilians? Similarly, are our results for 2017 different from the results in Hosek et al. (2018) for 2016?
2. Has the comparability of military pay changed since 2009, when the 11th QRMC compared military and civilian pay?
3. What has happened to recruit quality given the relative changes in military and civilian pay since 2000?

We address these questions using data from the U.S. Department of Defense's (DoD's) *Selected Military Compensation Tables* (Directorate of Compensation, 2017), also known as the Greenbook, and from Active Duty Pay Files provided by the Defense Manpower Data Center (DMDC). We also use data from the March supplements to the Current Population Survey (CPS; U.S. Census Bureau, 2018) and from *2015 Demographics: Profile of the Military Community* (Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy, 2016) on the gender mix in the military and from DMDC's August 2009 and September 2017 Status of Forces Surveys on the education distribution of enlisted personnel and officers (Office of People Analytics, 2017, 2018). To analyze how recruit quality changes as civilian and military pay varies, we estimated regression models for each service, controlling for other variables that change over time (such as unemployment rate and recruiting goals).

Chapter Two shows how educational attainment for military personnel has changed over time and then addresses the first two questions above. We compare RMC with civilian wages both over a career and over calendar time for specific age and education groups. Chapter Three summarizes our analysis for the third question regarding the relationship between recruit quality and relative military pay. Because our methodology for both Chapters Two and Three closely follows the methodology used in Hosek et al. (2018), we provide only a broad overview of our methods and focus more on results. Interested readers are referred to the Hosek et al. (2018) document. In Chapter Four, we explore how geography affects the competitiveness of military pay and how this varies by education level. We offer concluding thoughts in Chapter Five.

CHAPTER TWO

Comparisons of Military and Civilian Pay

In this chapter we examine how RMC compares with civilian pay. RMC includes basic pay, BAH, BAS, and the federal tax advantage resulting from the allowances not being taxed. RMC accounts for approximately 90 percent of current cash compensation (Office of the Under Secretary of Defense for Personnel and Readiness, 2012a, 2012b).

We note that throughout the report we are comparing the pay of individuals and not households and that we will not provide any evidence on the adequacy of military pay for military families. Previous work has documented that military spouses have significantly lower rates of employment and earnings than comparable civilians and that they tend to be underemployed when employed (Asch, Hosek, and Warner, 2007). Spousal employment and earnings have increased as a share of family employment and earnings over time, and this may affect military and civilian families differently. We are conducting ongoing work that will more fully examine the adequacy of military pay.

We first examine how educational attainment for military personnel has changed over time and use these data to adjust our measures of RMC. We compare RMC with civilian wages both over a career and through time for specific age and education groups.

Educational Attainment

To compare military personnel with similar civilians, we used the education distribution of officers and enlisted personnel from the August 2009 and September 2017 Status of Forces Surveys of Active

Duty Members, provided by the DoD Office of People Analytics.[1] We considered five education levels for enlisted personnel—high school, some college (more than high school but no degree), associate's degree, bachelor's degree, and master's degree or higher—and two levels for officers—bachelor's degree and master's degree or higher.

In Table 2.1 we show the education attainment for enlisted members in 2017 and in 2009 when the 11th QRMC compared military and civilian pay. We find that enlisted personnel in 2017 and 2009 show a similar education profile, although those in 2017 have more years of formal education than those in 2009. The 9th QRMC identified the trend of increasing educational attainment while members were in service, and we find evidence that this trend continued beyond 1999.

Table 2.1
Educational Attainment of Enlisted Personnel, by Pay Grade, 2009 and 2017, as Percentages

Pay Grade	Non–High School Graduate		High School Graduate		Less Than One Year of College		One or More Years of College, No Degree		Associate Degree		Bachelor's Degree		Advanced Degree	
	2009	2017	2009	2017	2009	2017	2009	2017	2009	2017	2009	2017	2009	2017
E-2	1	1	70	66	20	20	8	13	NR	0	1	0	NR	0
E-3	1	1	48	51	23	16	21	22	4	5	3	4	0	0
E-4	0	0	39	40	25	18	22	23	7	9	6	8	1	1
E-5	1	1	25	23	22	18	32	30	13	18	6	9	0	1
E-6	1	0	17	13	23	15	30	32	20	26	8	12	1	2
E-7	1	0	10	9	15	10	30	22	28	32	14	22	2	5
E-8	0	0	9	4	13	7	30	25	24	24	20	28	4	11
E-9	NR	0	7	6	10	4	17	14	22	22	30	37	14	18

SOURCES: Office of the Under Secretary of Defense for Personnel and Readiness, 2002, Figure 2.5; Office of People Analytics, 2017, 2018.

NOTE: NR = not reported. The percentages in each row add to 100 with rounding. There is no row for E-1s because their education distribution was not reported in the survey. In this table, *high school graduate* includes traditional diploma and alternative diploma (e.g., home school, equivalency test, distance learning). The survey responses are weighted to be representative of the force.

[1] These data were provided to RAND by the Office of People Analytics in 2017 and 2018, respectively.

In Table 2.2 we show how the educational attainment of enlisted personnel has changed from 1999 to 2017. Unfortunately, we do not have detailed information on all education categories for 1999, and so we present tabulations for the two groups we do have: those with some college or an associate's degree and those with a bachelor's degree or higher. The year 1999 is when the 9th QRMC compared military and civilian pay. In 1999 18 percent of E-2s had some college or higher education; for E-9s the figure was 84 percent. For 2009, when the 11th QRMC compared military and civilian pay, the percentages were 29 percent and 93 percent, respectively, and for 2017 they were 33 percent and 95 percent respectively. Many military members increase their educational attainment while in service, and this changes the mix of nonmilitary jobs that they can get. For this reason, it is important to

Table 2.2
Enlisted Personnel with Post–High School Education, by Pay Grade, 1999, 2009, and 2017, as Percentages

Pay Grade	Some College or Associate's Degree			Bachelor's Degree or Higher		
	1999	2009	2017	1999	2009	2017
E-1	7	NR	NR	1	NR	NR
E-2	18	28	33	0	1	0
E-3	22	48	43	2	3	4
E-4	31	54	50	5	7	9
E-5	47	67	66	6	6	10
E-6	57	73	73	10	9	14
E-7	60	73	64	18	16	27
E-8	56	67	56	22	24	39
E-9	57	49	40	27	44	55

SOURCES: Office of the Under Secretary of Defense for Personnel and Readiness, 2002, Figure 2.4; Office of People Analytics, 2017, 2018.

NOTE: NR = not reported. There is no data for E-1s after 1999 because their education distribution was not reported in the survey. The survey responses are weighted to be representative of the force. The 9th QRMC report presents the combined percentage of enlisted with bachelor's degrees or higher; it does not present the percentage with only a bachelor's degree. For 2009 and 2017, Table 2.1 shows separate percentages for bachelor's degrees and master's degrees or higher, and this table adds those percentages to obtain bachelor's degrees or higher.

Table 2.3
Educational Attainment of Officer Personnel, by Pay Grade, 1999, 2009, and 2017, as Percentages

Pay Grade	College Degree			Advanced Degree		
	1999	2009	2017	1999	2009	2017
O-1	97	93	91	3	6	8
O-2	91	87	87	9	11	12
O-3	59	60	57	39	39	42
O-4	31	30	20	69	69	79
O-5	15	13	7	85	85	93
O-6	8	4	2	92	96	98

SOURCES: Office of the Under Secretary of Defense for Personnel and Readiness, 2002, Figure 2.14; Office of People Analytics, 2017, 2018.

NOTE: *College degree* includes bachelor's and associate's degrees. *Advanced degree* includes master's, doctoral, and professional school degrees.

compare military RMC with the pay of civilians with more years of formal education as enlisted progress through their careers.

As with their enlisted counterparts, the percentage of officers with bachelor's degree or higher increases with rank and has trended upward over time. Table 2.3 shows the percentage of officers with college degrees and advanced degrees for 1999, 2009, and 2017. The percentage of O-1s with an advanced degree increased from 3 percent in 1999 to 8 percent in 2017, and the percentage of O-6 with an advanced degree increased from 92 percent to 98 percent over the time period.

Regular Military Compensation Percentiles in 2017

In this section we consider how RMC compares with the pay of similar civilians over a career and overall, averaged across all personnel. For this analysis, we use RMC from the Directorate of Compensation's *Selected Military Compensation Tables*, or Greenbook (Directorate of Compensation, 2017). In it, RMC is an average across pay grade and dependency status at each year of service. Data on weekly wages and characteristics for civilians come from the Current Population Survey

(CPS) Annual Social and Economic Supplement, also known as the March CPS. The CPS, administered by the Bureau of Labor Statistics, uses a representative random sample of the population.

Following the 11th QRMC, we used data on full-time, full-year workers and weight civilian-wage data by the percentages of men and women in the military.[2] In 2015, the percentages were 85 percent men and 15 percent women for enlisted and 83 percent men and 17 percent women for officers (Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy, 2016, pp. 18–19).

While the Greenbook provides RMC by years of service (YOS), the CPS does not have data on civilian years of labor-force experience. To compare military and civilian wages adjusted for experience, we used assumptions to map age and years of education to years of labor-force experience for civilians. Specifically, for high school graduates we subtracted 18 from the person's age in years, for those with some college and associate's degrees we subtracted 20, for college graduates we subtracted 22, and for those with advanced degrees we subtracted 24. For those who started school at a later age or who interrupted their schooling for any reason, these assumptions overstate their experience.[3] However, most students initially enrolling in two- and four-year institutions are 19 years or younger (National Center for Education Statistics [NCES], 2017).[4]

Regular Military Compensation Percentiles over a Career in 2017

Figures 2.1a, 2.1b, and 2.2 show enlisted and officer RMC in 2017 for a given year of service and compare RMC with civilian wages for a comparable year of experience at the 50th (median) and 70th percentiles, for the levels of education noted in the figure notes. As shown in Table

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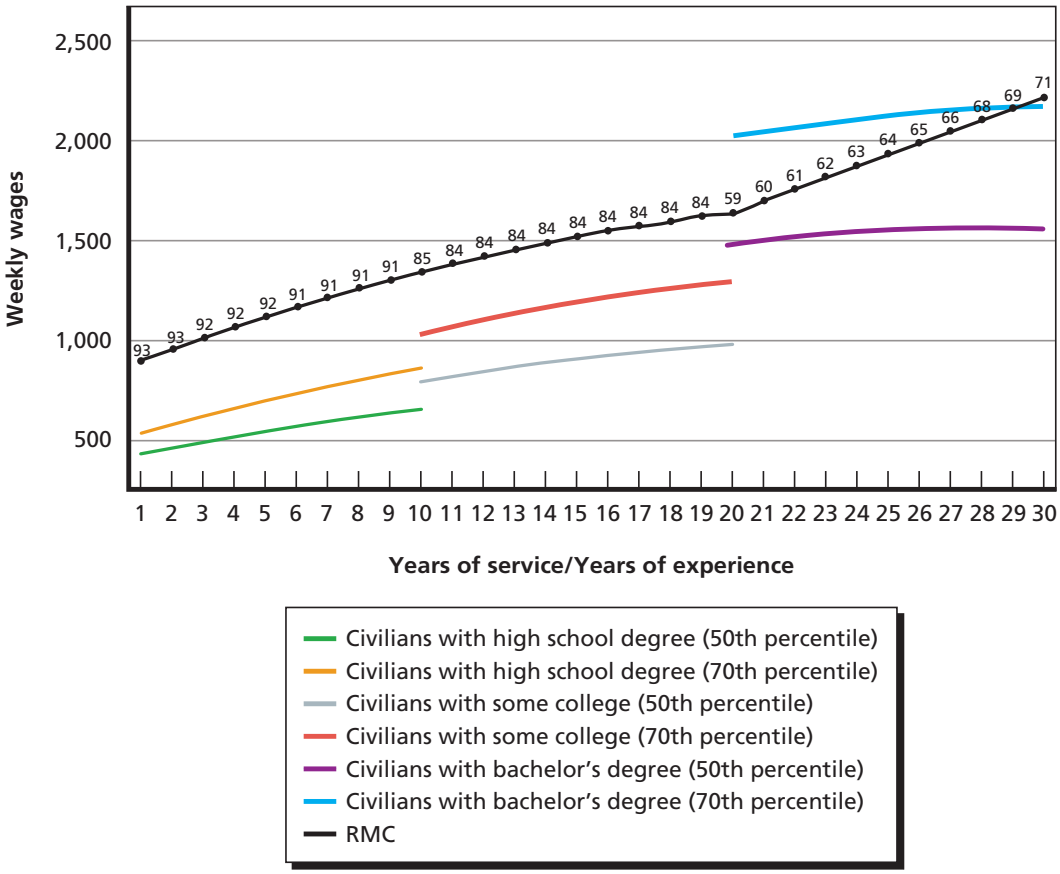
[2] These are workers with a usual workweek of more than 35 hours and who worked more than 35 weeks in the year.

[3] Since we are treating "some college" as two years, we may also be underestimating work experience for some individuals. However, for those who start school late, take a gap year, complete extended religious mission service, or take more than four years for college or more than two years for graduate school, we are assigning them more experience than they have.

[4] For more information on how these assumptions impact our estimates as well as details about top coding in the CPS and how this approach compares with that of the 11th QRMC, see Hosek et al. (2018, p 17).

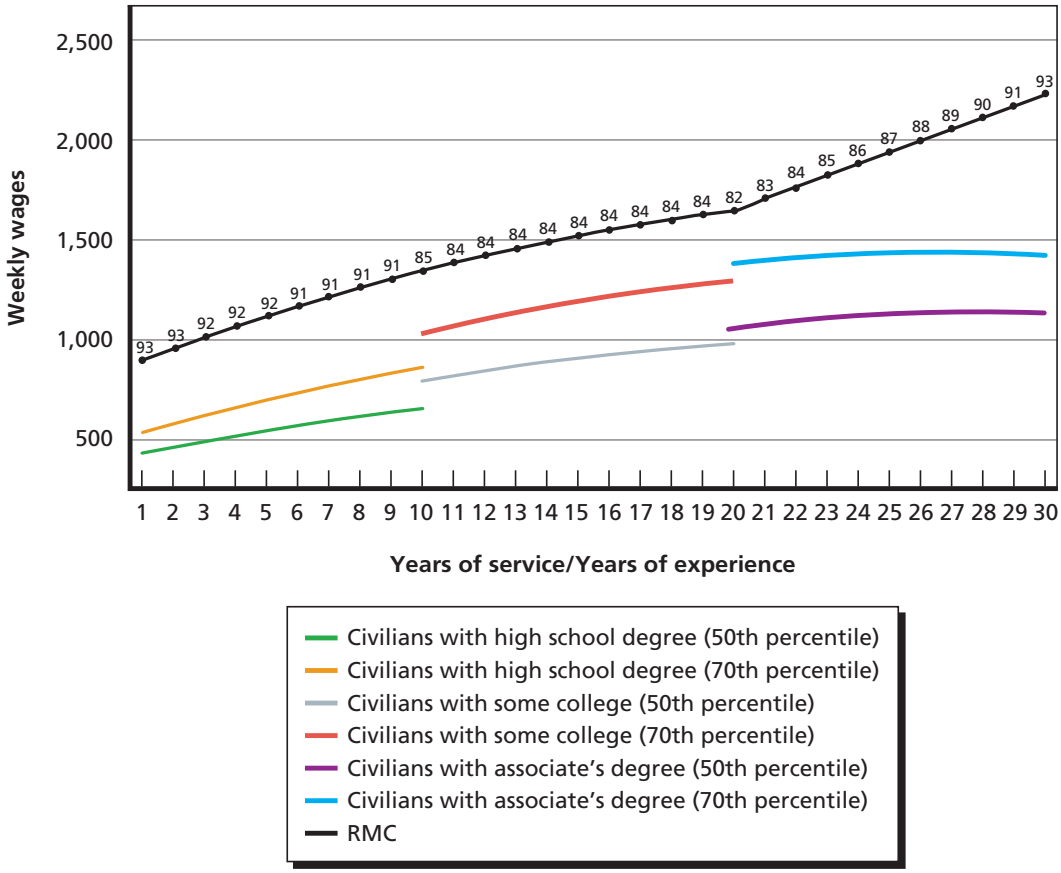
Figure 2.1a
Enlisted Regular Military Compensation, Civilian Wages, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with High School, Some College, or Bachelor's Degree, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = high school, 10–19 = some college, and 20–30 = a bachelor's degree). We weighted civilian-wage data by enlisted military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC, and the number above the black line is the percentile in the wage distribution for high school, some college, and bachelor's degree.

2.2, 39 percent of E8s and 55 percent of E9s had a bachelor's degree or higher in 2017. In Figure 2.1a we compare enlisted RMC for YOS 20–30 to civilian wages for civilians who have a bachelor's degree or higher. In Figure 2.1b we compare enlisted RMC for YOS 20–30 to civilian wages for civilians who have an associate's degree. In Table 2.4 we estimate the education distribution for each YOS to provide a more precise picture of overall RMC. The civilian-wage and RMC lines in Figures 2.1a, 2.1b, and 2.2 have been smoothed with quadratic regressions on the raw data.

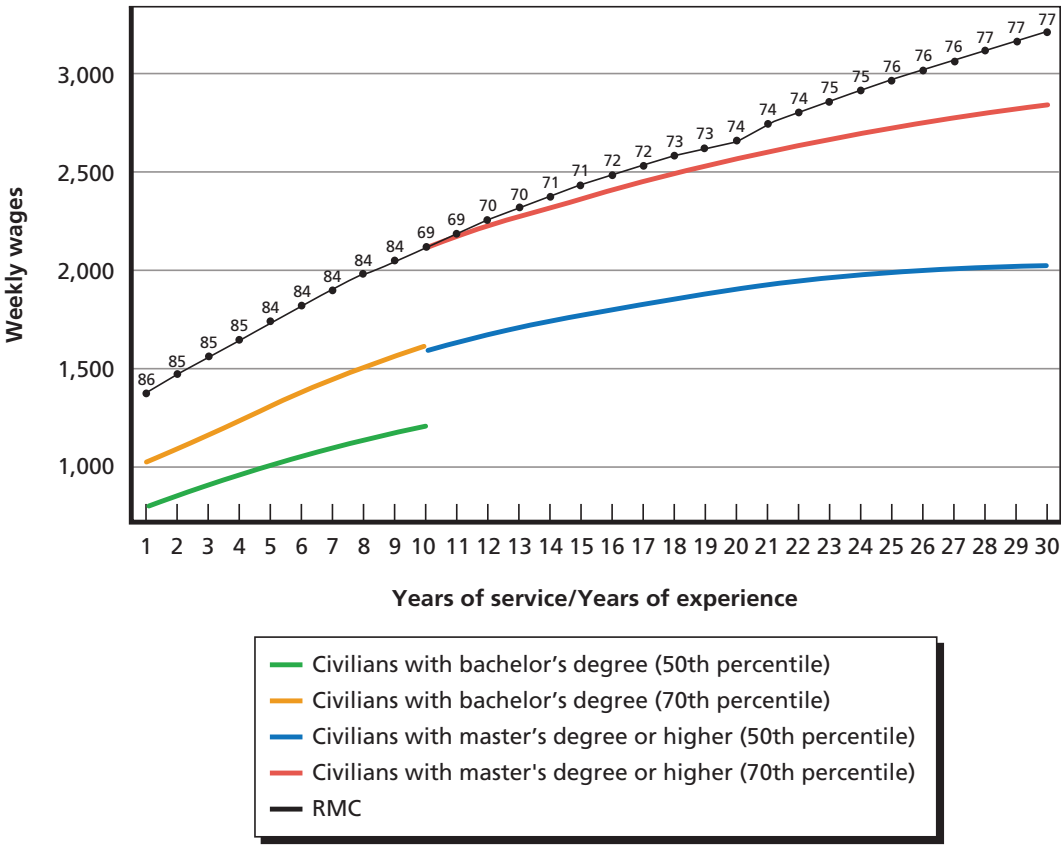
Figure 2.1b
Enlisted Regular Military Compensation, Civilian Wages, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with High School, Some College, or Associate's Degree, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = high school, 10–19 = some college, and 20–30 = a associate's degree). We weighted civilian-wage data by enlisted military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC, and the number above the black line is the percentile in the wage distribution for high school, some college, and associate's degree.

Compared with civilians with a high school degree, enlisted pay is around the 90th percentile of the civilian pay distribution in the first part of the career (1–9 YOS). When we compare RMC with civilians with some college for years 10–19, enlisted pay is at around the 84th percentile. RMC then rises from the 59th percentile to the 71st percentile for YOS 20–30 when compared with the pay of civilians with a bachelor's degree (Figure 2.1a). When we compare to civilians with an

Figure 2.2
Officer Regular Military Compensation, Civilian Wages, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with Bachelor's Degree or with Master's Degree or Higher, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = bachelor's degree, 10–30 = master's degree or higher). We weighted civilian-wage data by officer gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC, and the numbers above the black line are the percentile in the wage distribution for a bachelor's degree and a master's degree or higher.

associate's degree (Figure 2.1b), pay goes from the 82nd percentile in YOS 20 to the 93rd percentile in YOS 30. It is not surprising that the percentiles are lower for 20–30 YOS than for the YOS earlier in the career because personnel policies become more selective in terms of which personnel are allowed to be retained after 20 YOS—that is, the point at which military personnel are eligible for an immediate annuity under the military retirement system. As shown in the figures, RMC sharply increases after 20 YOS, reflecting the higher qual-

ity and higher pay of those permitted to stay on. For 20–30 YOS in Figure 2.1a, we are comparing RMC with the wages of civilians with a bachelor's degree, and this results in lower RMC percentiles of the civilian wage distribution. When compared to civilians with an associate's degree, RMC percentiles remain relatively high through YOS 30.

Officer RMC is at about the 85th percentile of the civilian wage distribution when compared with civilians with a bachelor's degree in the early career (years 1–9) and rises from the 69th percentile to the 77th percentile from years 10–30 when compared with civilians with a master's degree or higher.

Weighted Average of Regular Military Compensation Percentiles for 2017

It is also of interest to have an overall summary measure of how RMC compares with civilian pay, so we computed an overall weighted average of the RMC percentiles. The procedure for estimating the overall average is provided in Hosek et al. (2018, pp. 26–28), but in short, we computed the RMC percentiles for 2017 by YOS for each education level. This way, we could examine the RMC percentile in detail by education level. In addition, we estimated the percentage of education distribution at each year of service, used this to compute the average RMC percentile by YOS, and then used the number of personnel by YOS to compute an overall weighted average of the RMC percentile.[5] To compute percentiles, civilian pay by formal education level and age

[5] To compute the weighted averages, we first translated the education distribution by rank (Tables 2.1 and 2.3) to a distribution at each year of service, by interpolation. We did this in several steps. First, we obtained the joint distribution of personnel by pay grade and YOS from the Greenbook. This allowed us to compute the percentage of personnel at each pay grade, by YOS. Second, we used these percentages to obtain a weighted average of the education distribution at each year of service (i.e., the percentage with high school, some college, associate's degrees, bachelor's degrees, and master's degrees or higher). Third, for each level of education (e.g., high school, some college), we fitted a polynomial curve to its percentages by YOS and then used the fitted curves to predict the percentage, in effect smoothing the percentages. The set of curves for the different levels of education gave us the predicted education distribution by YOS. The predicted education distribution is shown in Tables 2.4 and 2.5 for enlisted and officers, respectively. To check for sensitivity, we perturbed the education percentages by YOS and found little change in the predicted overall RMC percentile.

Table 2.4
Regular Military Compensation as a Percentile of Civilian Wages, by Level of Education and Year of Service, for Enlisted Personnel, 2017

	Predicted Education Distribution, by YOS					RMC Percentile						
YOS	High School	Some College	Associate's	Bachelor's	Master's Plus	High School	Some College	Associate's	Bachelor's	Master's Plus	Weighted Average	Enlisted Count
1	0.56	0.37	0.04	0.04	0.00	92	88	79	65	32	88.9	175,468
2	0.46	0.40	0.08	0.06	0.00	92	90	84	53	33	88.1	133,761
3	0.38	0.43	0.11	0.07	0.01	92	91	84	59	38	87.9	124,916
4	0.32	0.45	0.14	0.08	0.01	88	95	85	57	38	87.7	124,147
5	0.27	0.46	0.16	0.09	0.01	95	83	88	61	37	84.5	103,467
6	0.24	0.47	0.18	0.10	0.01	92	91	81	61	49	85.9	71,618
7	0.21	0.47	0.20	0.10	0.02	93	88	87	57	39	84.9	56,219
8	0.19	0.47	0.21	0.11	0.02	89	91	77	63	32	83.6	46,891
9	0.17	0.46	0.23	0.12	0.02	92	88	77	55	39	81.5	39,891
10	0.16	0.46	0.24	0.12	0.02	90	81	83	55	40	78.9	33,298
11	0.15	0.45	0.25	0.13	0.02	92	82	78	60	35	78.6	28,268
12	0.14	0.44	0.26	0.14	0.02	93	83	82	57	34	79.3	28,359
13	0.13	0.42	0.27	0.15	0.03	86	88	79	56	37	79.1	22,956
14	0.12	0.41	0.28	0.16	0.03	92	82	82	61	41	78.6	24,819
15	0.11	0.40	0.28	0.17	0.04	94	79	74	52	32	73.0	23,884
16	0.11	0.38	0.29	0.18	0.04	91	80	85	61	36	77.3	22,299
17	0.10	0.37	0.29	0.19	0.05	89	84	83	55	41	76.5	21,128
18	0.09	0.36	0.29	0.21	0.06	91	81	79	55	38	73.6	20,980

Table 2.4—Continued

YOS	Predicted Education Distribution, by YOS					RMC Percentile						
	High School	Some College	Associate's	Bachelor's	Master's Plus	High School	Some College	Associate's	Bachelor's	Master's Plus	Weighted Average	Enlisted Count
19	0.08	0.35	0.28	0.22	0.06	91	82	81	51	38	72.9	19,181
20	0.08	0.34	0.28	0.23	0.07	86	87	87	65	41	78.4	19,093
21	0.07	0.32	0.27	0.24	0.08	89	87	79	55	42	73.4	19,052
22	0.07	0.31	0.27	0.26	0.09	92	87	80	60	43	74.4	10,559
23	0.07	0.30	0.26	0.27	0.10	93	86	83	60	47	74.6	7,756
24	0.07	0.28	0.25	0.29	0.11	94	87	86	61	47	75.2	6,492
25	0.06	0.27	0.25	0.30	0.12	92	84	81	62	48	72.7	5,412
26	0.06	0.25	0.24	0.31	0.13	92	91	92	68	55	79.3	3,943
27	0.06	0.24	0.24	0.32	0.14	96	90	95	69	48	78.8	2,730
28	0.06	0.22	0.23	0.33	0.15	97	89	89	70	58	78.6	2,117
29	0.06	0.22	0.23	0.33	0.15	97	91	91	71	55	79.2	1,971
30	0.06	0.22	0.24	0.33	0.15	95	90	92	69	54	78.3	1,471
0–20											**84.6**	
0–30											**84.1**	

SOURCES: Directorate of Compensation, 2017; DMDC data from 2017; U.S. Census Bureau, 2018.

NOTE: We computed the RMC percentile at each level of education, by YOS, as median RMC relative to the civilian wages of full-time, full-year male and female workers, weighted by their proportion in the military. We computed median RMC from the Greenbooks with weights based on the fraction of personnel count, by YOS (the "Enlisted Count" column), which comes from the active-duty pay files. Weighted average RMC percentile at each year of service is the sum of the product of the RMC percentile at a given level of education and the fraction of personnel with that level of education, shown in the left pane of the table. We estimated the education fractions using the educational attainment distribution for 2017 (see Table 2.1) and the joint distribution of personnel by pay grade and YOS from the Greenbook for 2017. The overall RMC percentiles for YOS 0–20 and YOS 0–30 are weighted averages of the average RMC percentile at each year of service, with weights based on the fraction of personnel count by YOS (the "Enlisted Count" column).

Table 2.5
Regular Military Compensation as a Percentile of Civilian Wages, by Level of Education and Year of Service, for Officers, 2017

	Predicted Education Distribution[a]		RMC Percentile			
YOS	Bachelor's	Master's Plus	Bachelor's	Master's Plus	Weighted Average	Officer Count
1	0.92	0.08	81	55	78.9	10,242
2	0.84	0.16	85	51	79.5	9,299
3	0.76	0.24	86	68	81.7	9,244
4	0.69	0.31	87	74	83.0	9,132
5	0.63	0.37	86	72	80.8	9,829
6	0.56	0.44	82	73	78.1	9,077
7	0.51	0.49	85	68	76.6	8,794
8	0.45	0.55	88	64	74.9	8,464
9	0.41	0.59	81	70	74.5	8,034
10	0.36	0.64	85	77	79.9	7,842
11	0.32	0.68	85	75	78.2	7,569
12	0.28	0.72	81	67	71.0	6,909
13	0.25	0.75	86	75	77.7	6,302
14	0.22	0.78	84	74	76.2	6,556
15	0.19	0.81	82	68	70.7	6,340
16	0.17	0.83	87	67	70.4	6,280
17	0.15	0.85	84	70	72.1	6,252
18	0.13	0.87	83	73	74.3	6,261
19	0.11	0.89	78	71	71.8	5,882
20	0.10	0.90	89	71	72.8	6,088
21	0.09	0.91	85	65	66.8	6,138
22	0.08	0.92	83	74	74.7	4,657
23	0.08	0.92	85	75	75.8	4,316
24	0.07	0.93	87	77	77.7	4,054
25	0.07	0.93	89	78	78.8	3,810
26	0.07	0.93	87	74	74.9	3,526
27	0.07	0.93	88	71	72.2	2,959
28	0.07	0.93	87	78	78.7	2,606

Table 2.5—Continued

	Predicted Education Distribution[a]		RMC Percentile			
YOS	Bachelor's	Master's Plus	Bachelor's	Master's Plus	Weighted Average	Officer Count
29	0.08	0.92	89	81	81.6	2,507
30	0.08	0.92	90	82	82.7	1,996
0–20					**76.7**	
0–30					**76.4**	

SOURCES: Directorate of Compensation, 2017; DMDC data from 2017; U.S. Census Bureau, 2018.

NOTE: We computed the RMC percentile at each level of education, by YOS, as median RMC relative to the civilian wages of full-time, full-year male and female workers, weighted by their proportion in the military. We computed median RMC from the Greenbooks with weights based on the fraction of personnel count, by YOS (the "Officer Count" column), which comes from the active-duty pay files. Weighted average RMC percentile at each year of service is the sum of the product of the RMC percentile at a given level of education and the fraction of personnel with that level of education, shown in the left pane of the table. We estimated the education fractions using the educational attainment distribution for 2017 (see Table 2.1) and the joint distribution of personnel by pay grade and YOS from the Greenbook for 2017. The overall RMC percentiles for 0–20 YOS and 0–30 YOS are weighted averages of the average RMC percentile at each year of service, with weights based on the fraction of personnel count by YOS (the "Officer Count" column).

[a] This is the fraction of officers, by education level, at each year of service.

was drawn from the CPS, and military pay for each year of service was drawn from the Greenbooks. Table 2.4 presents the results for enlisted, and Table 2.5 presents the results for officers.

For enlisted personnel we estimate RMC to be at the 85th percentile of civilian wages for 0–20 YOS and at the 84th percentile of civilian wages for 0–30 YOS. The 11th QRMC reported their results averaged over 0–20 YOS, so we show results for both 0–20 and 0–30 YOS. Both calculations show that RMC is well above the 70th percentile of civilian pay even when accounting for the higher educational attainment of enlisted personnel since 1999.

For officers we estimate RMC to be at the 77th percentile of civilian wages when examining 0–20 YOS and at the 76th percentile of civilian wages for 0–30 YOS. Officers start their careers around the 79th percentile before dropping to around the 70th percentile around year 20 before

climbing back to around the 80th percentile near year 30.[6] Again, the results show that RMC for officers exceeds the 70th percentile.

How do these results compare with those found by the 11th QRMC for 2009? That is, did military pay worsen or improve relative to civilian pay between 2009 and 2017?

Our weighted average estimates, which place RMC at the 85th percentile for enlisted and the 77th percentile for officers, are lower than the estimates of the 11th QRMC, which placed RMC at the 90th percentile of civilian pay for enlisted and the 83rd for officers. However, our methodology was also different, as we used additional education categories and computed civilian years of experience differently.[7] The issue is that we have a measure of years of service for military personnel, but the CPS does not provide a comparable measure of years of labor-force experience. So, assumptions using data on age are required to impute years of experience in the CPS data. Our assumptions differ from that of the 11th QRMC, which used a conservative estimate, with the result that it potentially missed wage growth in civilian pay, thereby causing percentiles to appear larger. Our approach is less conservative, resulting in somewhat lower percentiles. Neither approach is perfect; both yield qualitatively similar results. When we computed percentiles in 2009 using a method comparable with the one we used in 2017 and included the additional education categories, we found that enlisted RMC is at around the 84th percentile in 2009, which is similar to our estimate for 2017. Put differently, enlisted RMC relative to civilian pay has remained unchanged between 2009 and 2017, and the differences reported here versus the 11th QRMC are attributable to differences in methodology. For officers we find that the weighted average of the RMC percentile for 2009 is the 78th for years 0–20. Again, this is virtually the same as the 77th percentile we find for 2017 using the same methodology and the same education categories.

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[6] As mentioned, these figures are weighted averages that reflect the distribution of educational attainment among officers. The percentages shown by YOS in Figure 2.2 assume a given level of education at different YOS. Consequently, we would not expect the percentiles at any given YOS in Figure 2.2 to equal the weighted average across YOS.

[7] For an in-depth discussion of the differences in the two approaches, see Hosek et al. (2018, pp. 10–16, 28–30).

In summary, we find little change in average RMC percentiles between 2009 and 2017 when calculated using a consistent methodology.

Trends in the Regular Military Compensation Percentile for Selected Age and Education Groups, 2000–2017

To see whether and to what extent RMC percentiles evolved over time rather than a point in time, we also computed the RMC percentile for 2000 through 2017 for specific groups defined by education level and age. We conducted this analysis for each service, but we present only the results for Army men because results were similar across services. In these graphs we use cross-section data on males from the given age group and rank (officer or enlisted) from the Defense Manpower Data Center Active Duty Pay Files to compute RMC.[8] Figures 2.3 through 2.6 show results for Army men in the following groups:

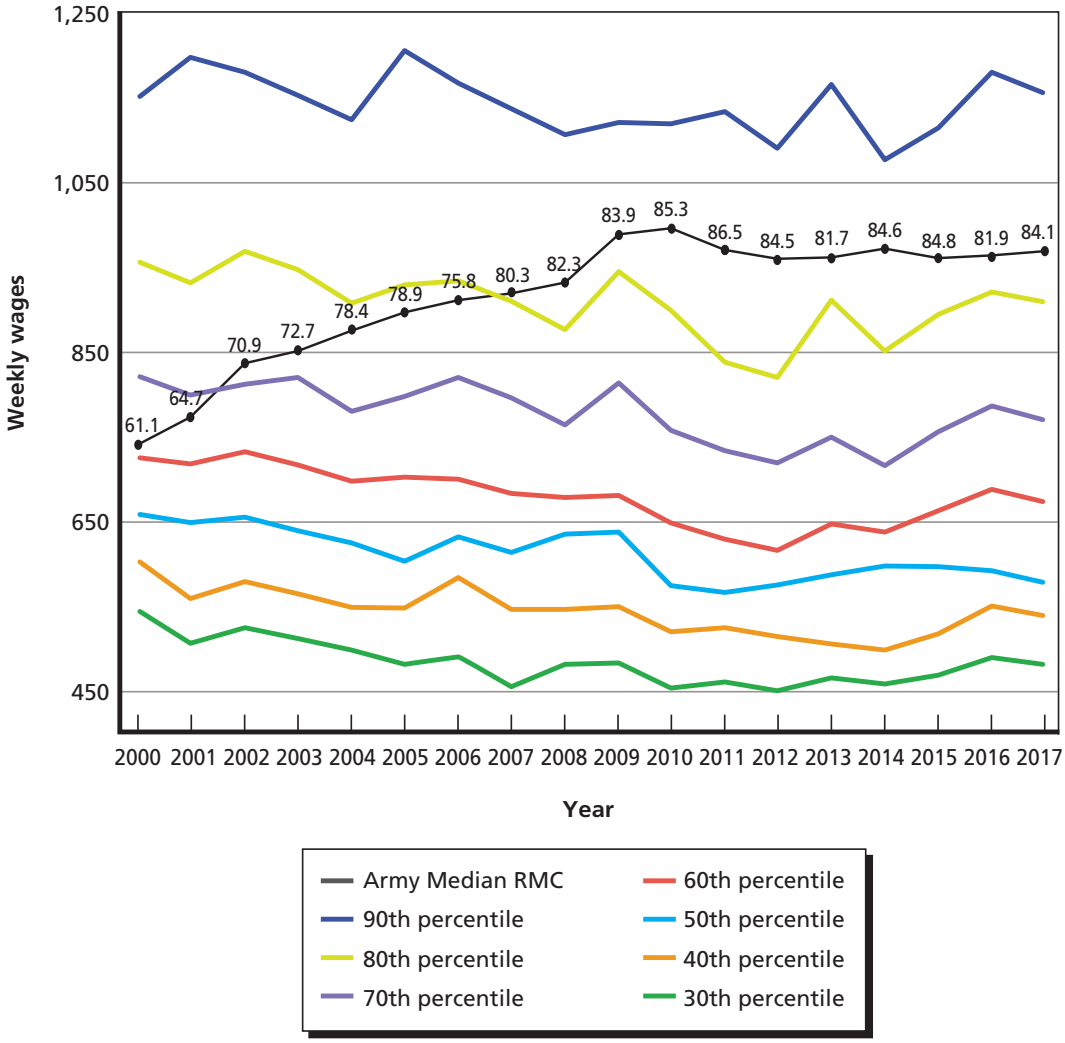
- enlisted members ages 23–27 compared to civilian high school graduates
- enlisted members ages 28–32 compared to civilians with some college
- officers ages 28–32 compared to civilians with bachelor's degrees
- officers ages 33–37 compared to civilians with master's degrees or higher.

Unlike in Figures 2.1 and 2.2, we did not smooth the wage percentiles in Figures 2.3 through 2.6. These comparisons also differ from the YOS comparisons in the earlier figures because some individuals enter service at older ages and have fewer years of service than one would expect based on their ages.

Overall, we find that RMC for these groups increased from 2000 to 2010 and then stayed roughly constant through 2017. The increase

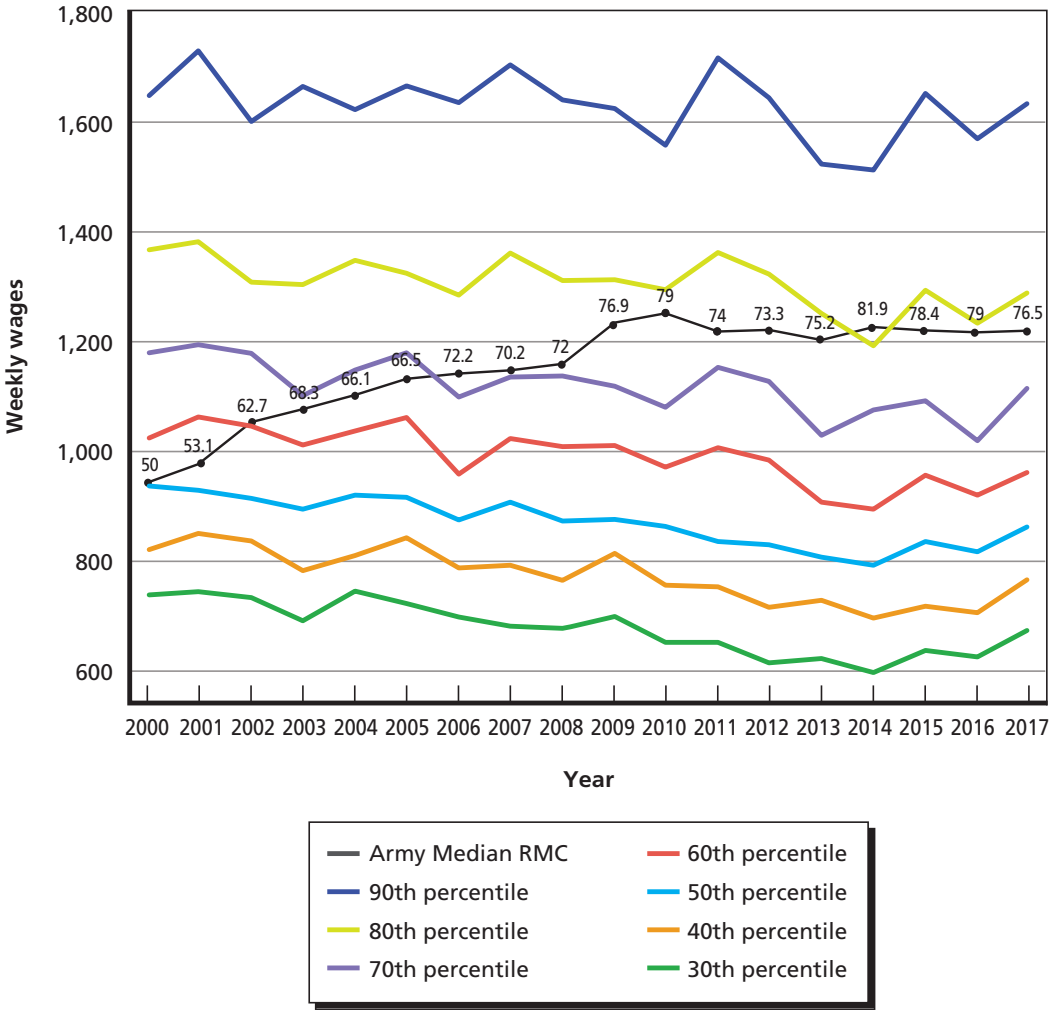
[8] Computing RMC with the military-pay files required that we compute the tax advantage. It is based on taxable (basic-pay) and nontaxable (BAS and BAH) income, number of dependents, and marital status. Additional details can be found in Hosek et al (2018, pp. 4–8).

Figure 2.3
Civilian Wages for High School Graduate Men and Median Regular Military Compensation for Army Enlisted, Ages 23–27, Calendar Years 2000–2017, in 2017 Dollars



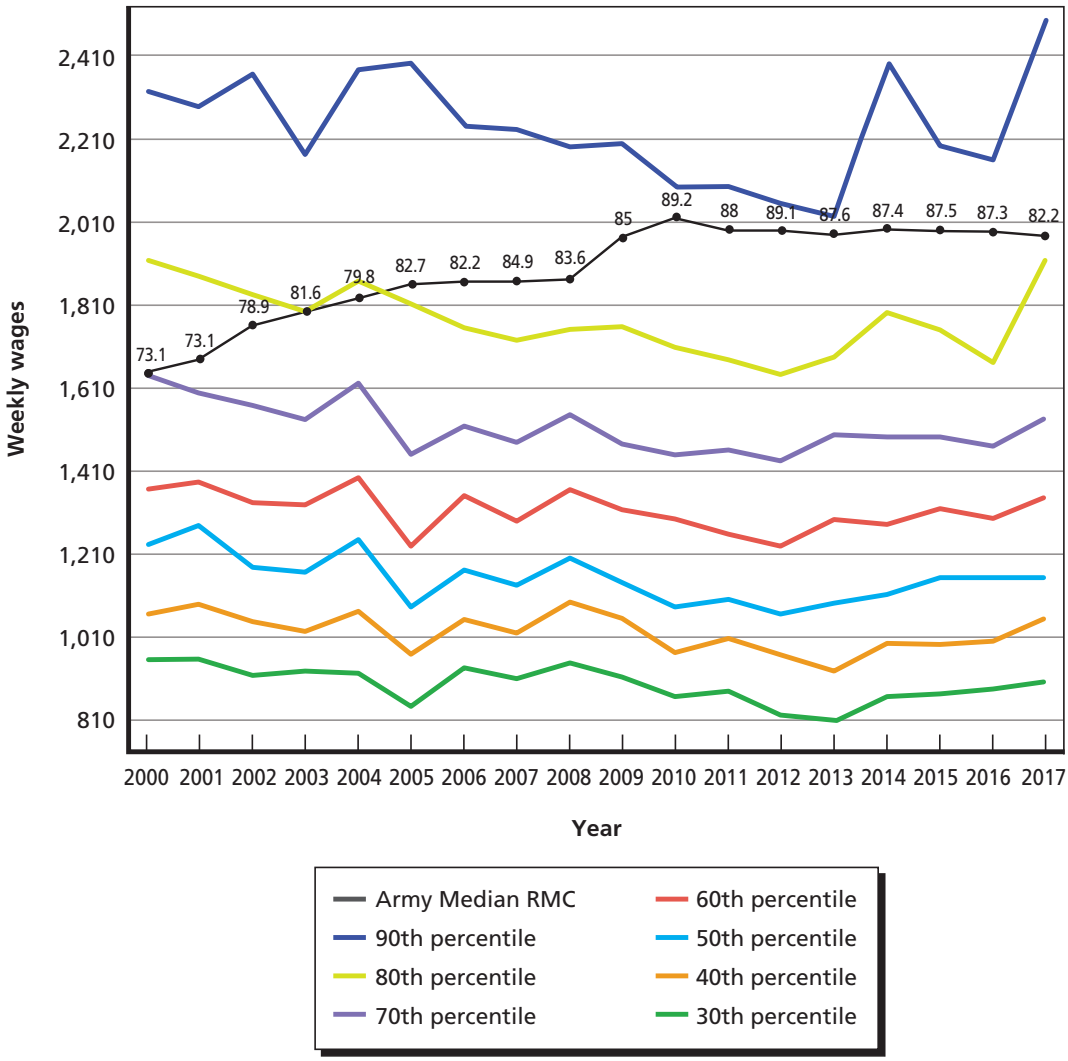
SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: The reference population is men ages 23–27 who reported high school completion as their highest level of education, worked more than 35 weeks in the year, and usually worked more than 35 hours per week. We computed the weekly wage by dividing annual earnings by annual weeks worked. The colored lines depict the wages at the indicated percentiles of the wage distribution for this population. For instance, at the 70th percentile, 30 percent of the population had higher wages and 70 percent had lower wages. The black line depicts median RMC for Army enlisted between ages 23 and 27. The numbers above the RMC line are the percentiles at which RMC stood in the population's wage distribution.

Figure 2.4
Civilian Wages for Men with Some College and Median Regular Military Compensation for Army Enlisted, Ages 28–32, Calendar Years 2000–2017, in 2017 Dollars



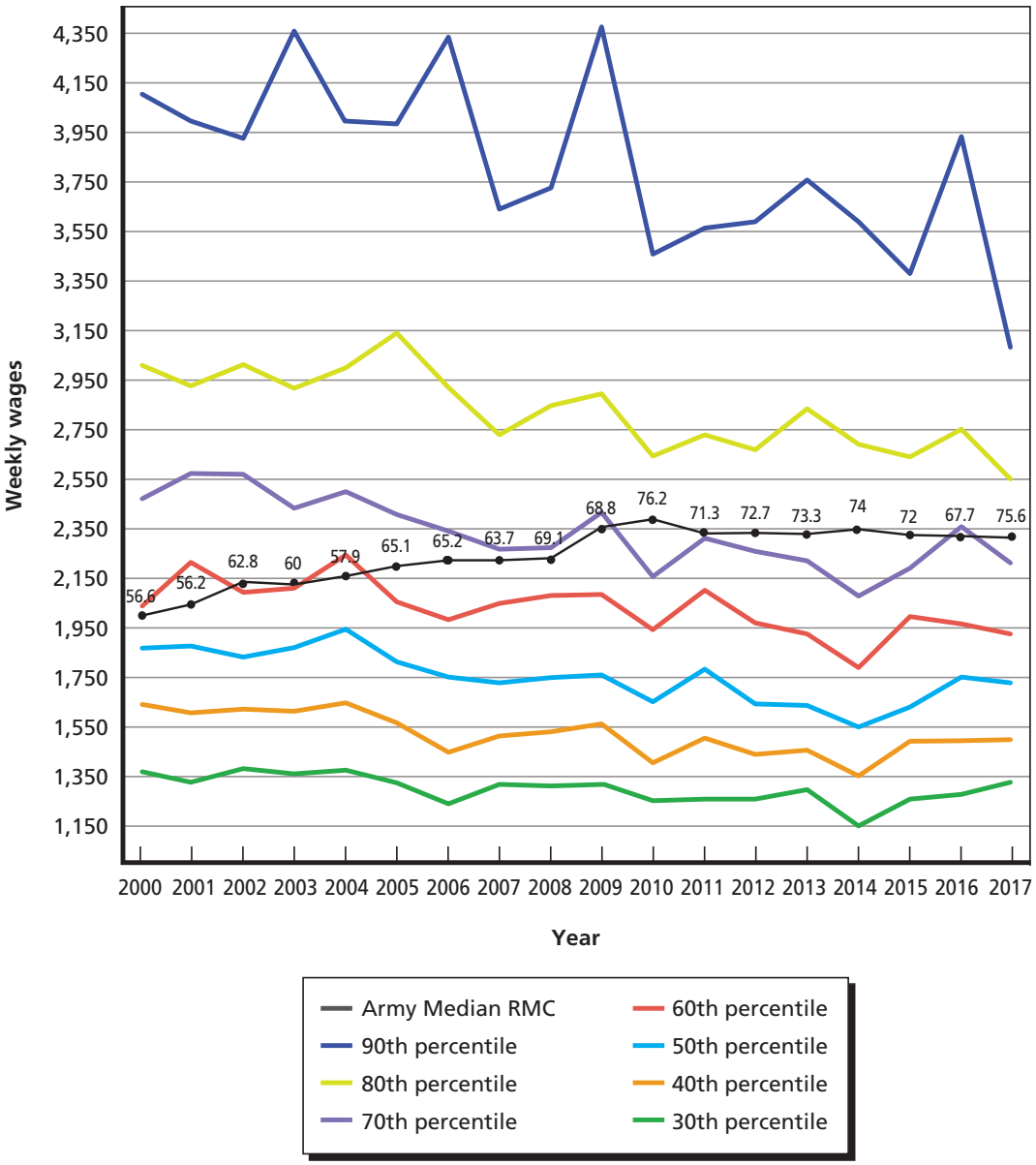
SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: The reference population is men ages 28–32 who reported some college as their highest level of education, worked more than 35 weeks in the year, and usually worked more than 35 hours per week. We computed the weekly wage by dividing annual earnings by annual weeks worked. The colored lines depict the wages at the indicated percentiles of the wage distribution for this population. For instance, at the 70th percentile, 30 percent of the population had higher wages and 70 percent had lower wages. The black line depicts median RMC for Army officers between ages 28 and 32. The numbers above the RMC line are the percentiles at which RMC stood in the population's wage distribution.

Figure 2.5
Civilian Wages for Men with Four-Year College Degrees and Median Regular Military Compensation for Army Officers, Ages 28–32, Calendar Years 2000–2017, in 2017 Dollars



SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: The reference population is men ages 28–32 who reported bachelor's degrees as their highest levels of education, worked more than 35 weeks in the year, and usually worked more than 35 hours per week. We computed the weekly wage by dividing annual earnings by annual weeks worked. The colored lines depict the wages at the indicated percentiles of the wage distribution for this population. For instance, at the 70th percentile, 30 percent of the population had higher wages and 70 percent had lower wages. The black line depicts median RMC for Army officers between ages 28 and 32. The numbers above the RMC line are the percentiles at which RMC stood in the population's wage distribution.

Figure 2.6
Civilian Wages for Men with Master's Degrees or Higher and Median Regular Military Compensation for Army Officers, Ages 33–37, Calendar Years 2000–2017, in 2017 Dollars



SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: The reference population is men ages 33–37 who reported master's degrees or higher as their highest levels of education, worked more than 35 weeks in the year, and usually worked more than 35 hours per week. We computed the weekly wage by dividing annual earnings by annual weeks worked. The colored lines depict the wages at the indicated percentiles of the wage distribution for this population. For instance, at the 70th percentile, 30 percent of the population had higher wages, and 70 percent had lower wages. The black line depicts median RMC for Army officers between ages 33 and 37. The numbers above the RMC line are the percentiles at which RMC stood in the population's wage distribution.

was driven by several factors including a restructuring of the basic-pay table from 2001 through 2003, higher-than-usual basic-pay increases from (fiscal year) FY 2000 to FY 2010, increases in BAH implemented in the first part of the decade to cover the full cost of housing, increases in housing cost that resulted in further BAH increases, and a downward trend in civilian wages that leveled off around 2012 and tended to increase after 2013.[9]

From 2010 onward, the figures indicate that RMC was between

- the 81st and 87th percentiles for enlisted members ages 23–27 compared to civilian high school graduates
- the 73rd and 82nd percentiles for enlisted members ages 28–32 compared to civilians with some college
- the 82nd and 89th percentiles for officers ages 28–32 compared to civilians who were four-year college graduates
- the 68th and 76th percentiles for officers ages 33–37 compared to civilians with master's degrees or higher.

Summary

We computed RMC percentiles for enlisted and officers adjusting for the education distribution of military personnel. We estimated RMC for enlisted to be at the 85th percentile of the civilian wage distribution and RMC for officers to be at the 77th percentile of the civilian wage distribution. We also computed RMC percentiles for 2009. Our RMC percentiles are similar but somewhat lower than those of the 11th QRMC, and we attribute this to methodological differences. That is, accounting for these differences, we find little change between RMC percentile estimates for both enlisted and officers between 2009 and 2017. Trend analysis shows an increase in RMC percentile from 2000 to 2017 for various age and education groups. This reflects the relatively fast military pay growth from 2000 to 2010, as well as a downward trend in real civilian wages.

[9] For more details on each of these factors, see Hosek et al. (2018, pp. 30–35).

CHAPTER THREE

Recruit Quality and Military and Civilian Pay

Military compensation is one of the primary tools used by the services to get the quantity and quality of personnel they need. Both RMC and the RMC percentile have increased substantially since 1999. Consequently, it is natural to wonder if this has resulted in an increase in the quality of recruits over time. That is, did readiness as measured by the quality of enlisted recruits increase as relative pay increased?

Military recruits are deemed high quality if they are high school degree graduates (HSDGs) and score in the upper half of the Armed Forces Qualification Test (AFQT) score distribution.[1] AFQT scores are normed to the general population using the distribution of AFQT scores from representative Bureau of Labor Statistics surveys so that they range from 0 to 99 and are subdivided into categories:

- Category I: 93–99
- Category II: 65–92
- Category IIIA: 50–64
- Category: IIIB: 31–49
- Category: IV: 16–30
- Category V: 0–15.

Thus, a recruit is in the upper half of the AFQT score distribution if he or she is in categories I–IIIA.

To examine the relationship between RMC and recruit quality, we estimated reduced-form regression models of two recruiting outcomes:

[1] AFQT is comprised of four sections from the Armed Services Vocational Aptitude Battery (ASVAB), which all enlisted take.

the recruiting rate for HSDGs and the non-HSDG share of accessions. We defined the outcomes separately for each of the AFQT score categories I–IIIB. We also only consider those recruits who have no prior service, that is, non–prior service (NPS) accessions.

We construct the recruiting rate as the ratio of HSDG accessions in a given AFQT category to the population of youth who have completed high school in that AFQT category, net of those who went on to complete four or more years of college. We use DMDC's Military Entrance Processing Command data for information on HSDG accession in a given AFQT category. The population of youth high school completers within a given AFQT category is estimated using a methodology described in Appendix B of Hosek et al. (2018). The methodology involves using National Center of Education Statistics (NCES) information on the population of high school completers and adjusting for AFQT category using data from the 1997 National Longitudinal Survey of Youth. Recruiting rates by service, category, and gender can be found in Appendix B Tables B.2–B.5.

The second outcome we consider is the share of non-HSDG accessions, which is computed as the ratio of non-HSDG accessions in a given AFQT category to the total number of accessions in that category (HSDG and non-HSDG). We compute this outcome using DMDC's Military Entrance Processing Command data.

We use data from 2000 through 2017. The most recent March CPS available for this analysis is for March 2018, which reports earnings for 2017, so the last year we include is 2017. Before presenting our regression results, we first show trends in recruit quality and the explanatory variables or factors that we posit are related to recruit quality and included in the regression models. We then discuss the models and results.

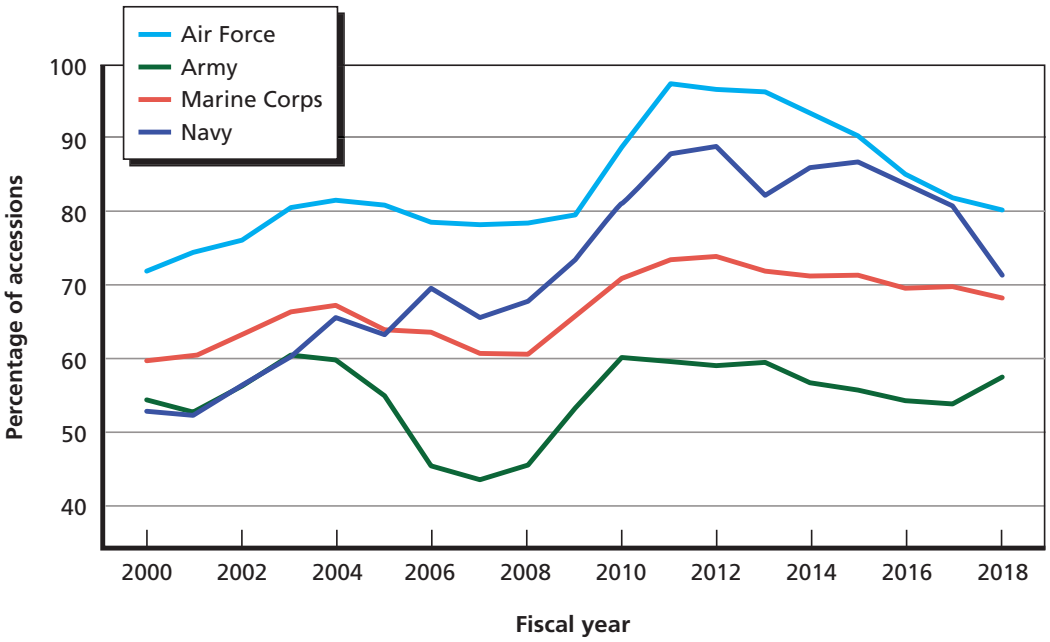
Trends in Recruit Quality and Factors Related to Recruit Quality

NPS recruit quality changed between 2000 and 2018. Figure 3.1 shows the percentage of accessions who are high quality, by service, defined here as HSDGs in AFQT categories I through IIIA. Figure 3.2 shows

the percentages who are HSDGs, while Figure 3.3 shows the percentages who are in AFQT categories I through IIIA.

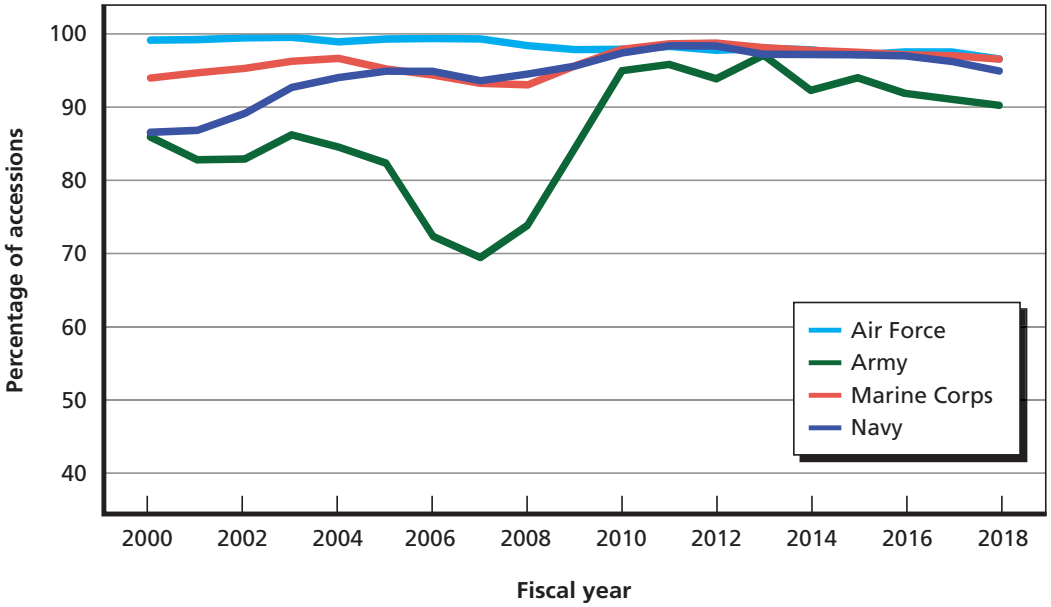
Recruit quality increased between 2000 and 2017 for the Air Force, Navy, and Marine Corps, but not the Army. The Air Force, Navy, and Marine Corps increased their percentages of accessions who were high quality (Figure 3.1) and had, or reached, a very high percentage of accessions who were NPS HSDGs (Figure 3.2). The Army's percentage of accessions who were high quality fell after 2004, then rebounded to its initial level by 2010, and then stayed there. Its HSDG percentage bottomed out in 2007 and then rose to a stable level closer that of the other services by 2010. Its percentage of accessions in categories I through IIIA in the active component declined fairly steadily after 2004 (Figure 3.2) but showed an uptick in 2018. This percentage

Figure 3.1
Percentage of Active-Component Non–Prior Service Accessions Who Were Category I–IIIA High School Diploma Graduates, by Service, FY 2000–2018



SOURCE: Office of People Analytics, undated.
NOTE: An HSDG is someone with at least a high school diploma and not exclusively a GED, associate's degree, professional nursing diploma, bachelor's degree, master's degree, post–master's degree, first professional degree, doctoral degree, post-doctorate work, or one semester of college completed. Category I–IIIA personnel are those who scored in the upper half of the AFQT score distribution.

Figure 3.2
Percentage of Active-Component Non–Prior Service Accessions Who Were High School Diploma Graduates, by Service, FY 2000–2018



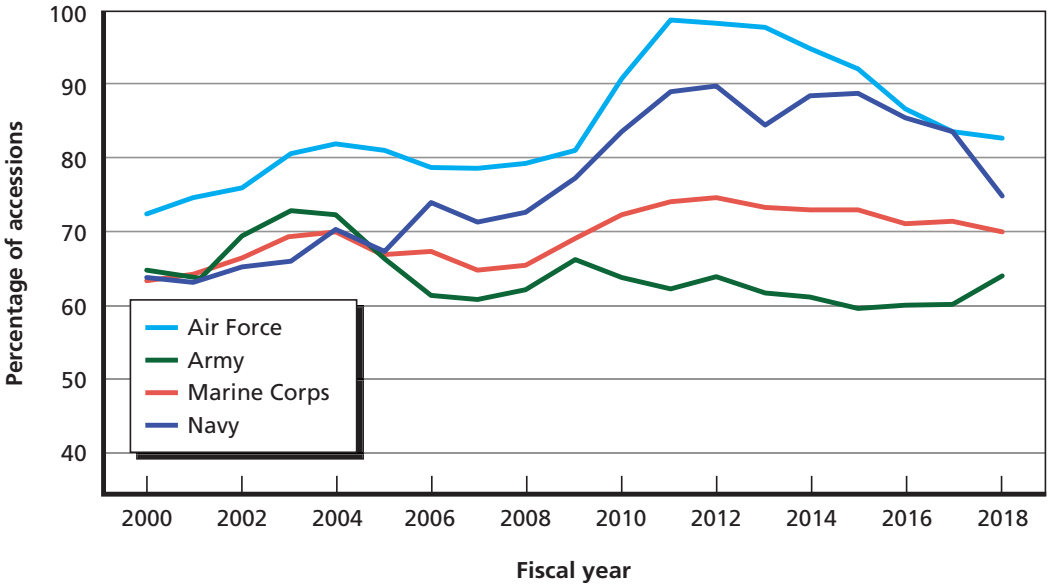
SOURCE: Office of People Analytics, undated.
NOTE: An HSDG is someone with a high school diploma and not exclusively a GED, associate's degree, professional nursing diploma, bachelor's degree, master's degree, post–master's degree, first professional degree, doctoral degree, post-doctorate work, or one semester of college completed.

increased in the other services.[2] Note that the fall in quality among Army accessions was driven by both a reduction in HSDGs and a smaller decrease in the percentage of overall recruits who scored in category IIIA or above (as shown in Figure 3.3).

Raw trends in quality of recruits over time do not account for other factors that were also changing over this time period such as the outside job options. We used the following explanatory variables in the reduced form regressions described below to isolate the effect of pay and better control for these other factors: military and civilian pay, recruiting goal, deployment, unemployment, gender, and a post-2009 indicator (that is, an indicator being after 2009) to control for changes in educational benefits policy. We describe the purpose of the latter variable in greater detail later in this section.

[2] For some ideas about why the Army failed to increase its quality at a time of increasing RMC, see Hosek et al. (2018, pp. 71–73).

Figure 3.3
Percentage of Active-Component Non–Prior Service Accessions Who Were in Categories I–IIIA, by Service, FY 2000–2018



SOURCE: Office of People Analytics, undated.
NOTE: Category I–IIIA personnel are those who scored in the upper half of the AFQT score distribution.

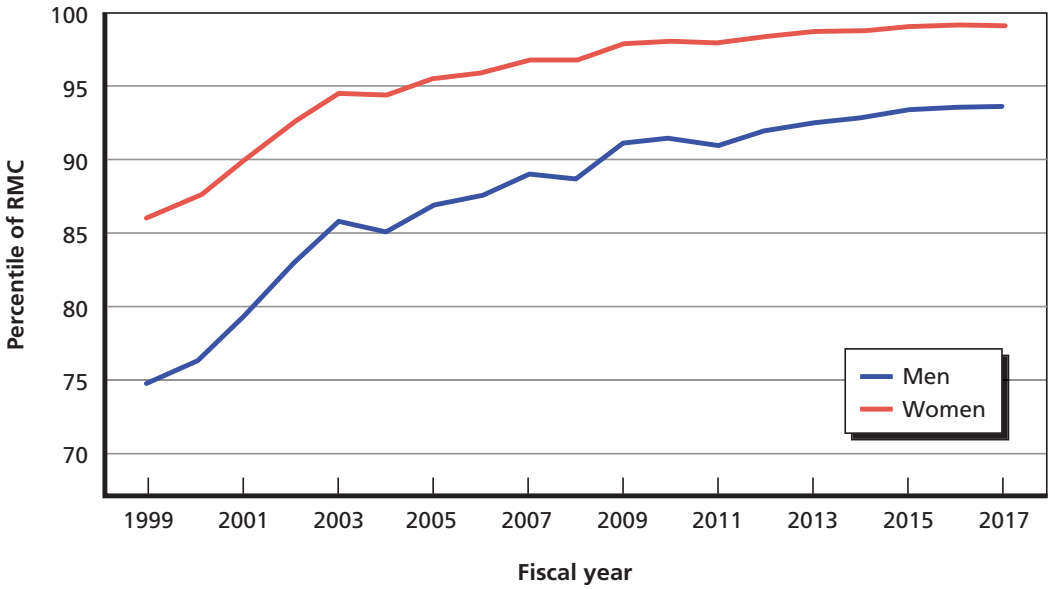
To construct a variable for military and civilian pay, we used RMC for an E-4 with four YOS and the median civilian wages of 18- to 22-year-old male and female workers with high school education (and not more; including a General Education Development [GED] certificate). As a measure of pay we used the military/civilian wage ratio. This was constructed from data from the Greenbook and from the March CPS. We considered two pay measures—the RMC percentile and the military/civilian wage ratio—and chose the latter, which is consistent with the approach used in past studies (e.g., Simon and Warner, 2007; Asch et al., 2010). The former approach has the disadvantage that pay must increase by a larger absolute amount to move from, say, the 85th to the 90th percentile than from, say, the 70th to the 75th, while the pay ratio has the same interpretation throughout its range. That said, the regression results using the RMC percentile were nearly the same as the pay ratio results and had similar statistical significance. RMC is from the Greenbook, and the civilian wage is from

the March CPS. We chose RMC of an E-4 at four YOS to approximate pay at the end of the first enlistment term.

In Figures 3.4 and 3.5 we show the RMC percentile, smoothed to adjust for variation resulting from sample size and the RMC/wage ratio.[3] Since females in the civilian sector make less on average than their male counterparts, the RMC percentile is higher for women than for men. Figure 3.5 shows the raw ratio and a linear curve fitted to it.

Figure 3.6 shows the recruiting goals for each service over the same time period. The Army had the largest recruiting goal, roughly double that of each of the other services in the middle of the decade. The recruiting goals decreased on net during this period, but the timing of the decrease differed by service. Recruiting goals have generally increased in recent years.

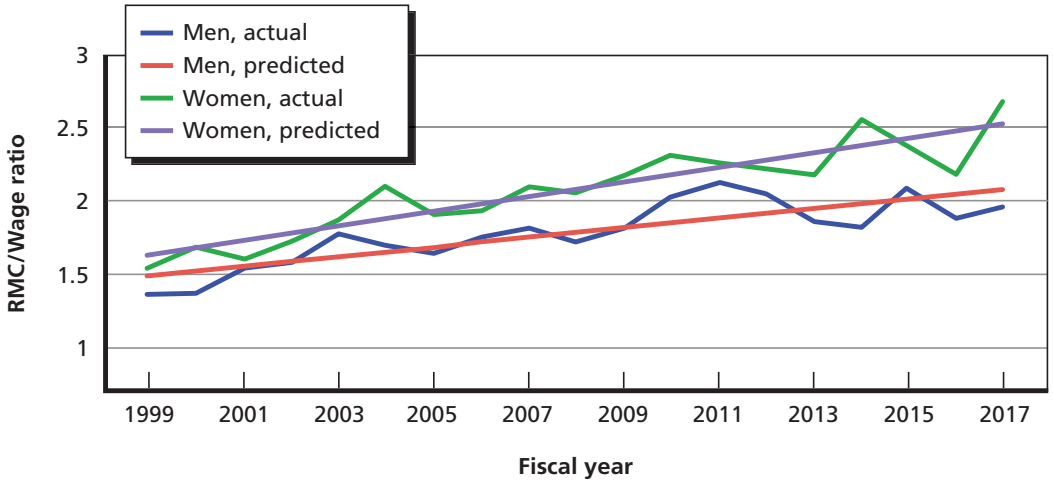
Figure 3.4
Smoothed Regular Military Compensation Percentiles: Male and Female High School Graduates, Ages 18–22, FY 1999–2017



SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: We estimated the curves as described in Appendix A. The data used in the regressions were based on our tabulations of RMC as a percentile of the civilian wages of male and female high school graduates ages 18–22. RMC is for an E-4 with four YOS. The RMC percentile is relative to the wage distribution for 18- to 22-year-old workers with high school (and not additional) education who had more than 35 hours of work in the year and more than 35 usual weekly hours of work.

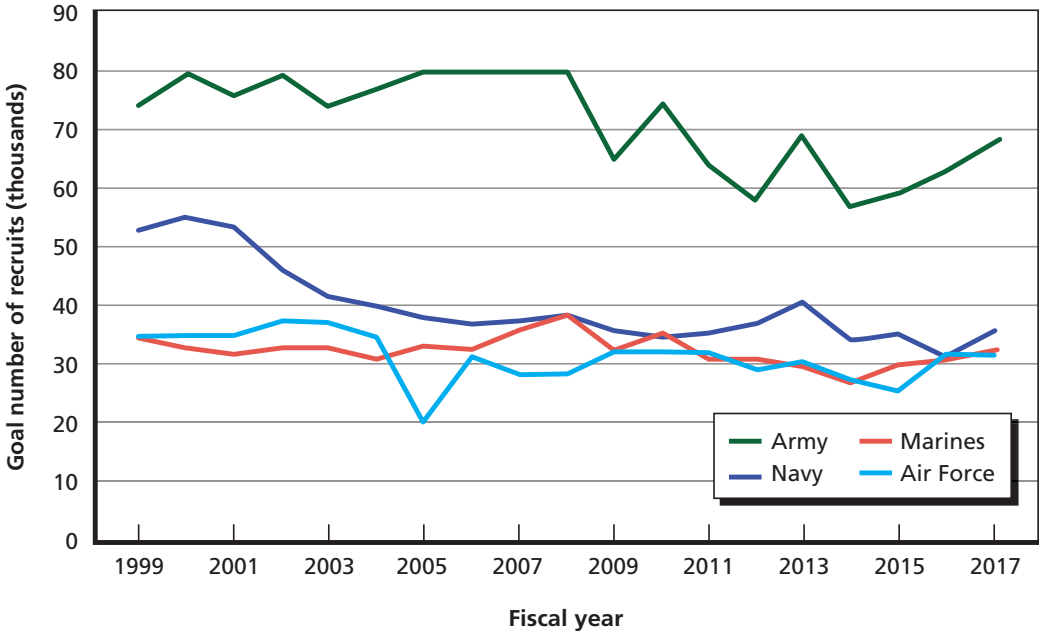
[3] Appendix A describes the smoothing method and contains the raw and smoothed values.

Figure 3.5
Regular Military Compensation/Median Wage Ratio: Male and Female High School Graduates, Ages 18–22, FY 1999–2017



SOURCES: Active-duty pay files from DMDC; U.S. Census Bureau, 2018.
NOTE: We estimated the curves as described in Appendix A. The data used in the regressions were based on our tabulations of RMC as a percentile of the civilian wages of male and female high school graduates ages 18–22. RMC is for an E-4 with four YOS. The RMC percentile is relative to the wage distribution for 18- to 22-year-old workers with high school (and not additional) education who had more than 35 hours of work in the year and more than 35 usual weekly hours of work.

Figure 3.6
Recruiting Goals, by Service, FY 1999–2017



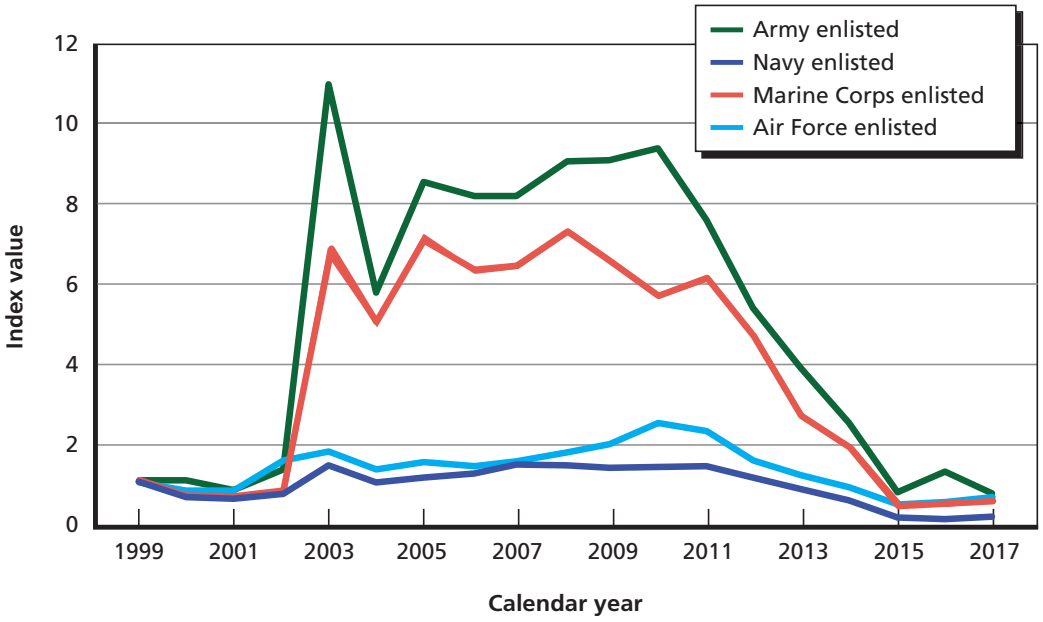
SOURCE: Accession Policy Directorate, 2017.

To get a measure of deployment, we use the number of personnel receiving imminent-danger or hostile-fire pay. With 1999 normalized to one for each service, the Army and Marine Corps had 5 to 11 times more deployed personnel between 2003 and 2010 than in 1999 (Figure 3.7). Navy and Air Force deployed personnel were .9 to 2.5 times their 1999 level.

Extensive deployments between 2002 and 2009 might have made it more difficult for the Army to enlist high-quality recruits. The percentage of Army accessions who were HSDGs dropped in the middle of the decade (Figure 2.2), which also meant a drop in high-quality accessions (Figure 2.1). Marine Corps deployment also rose, but the service's HSDG and high-quality recruiting rose as well.

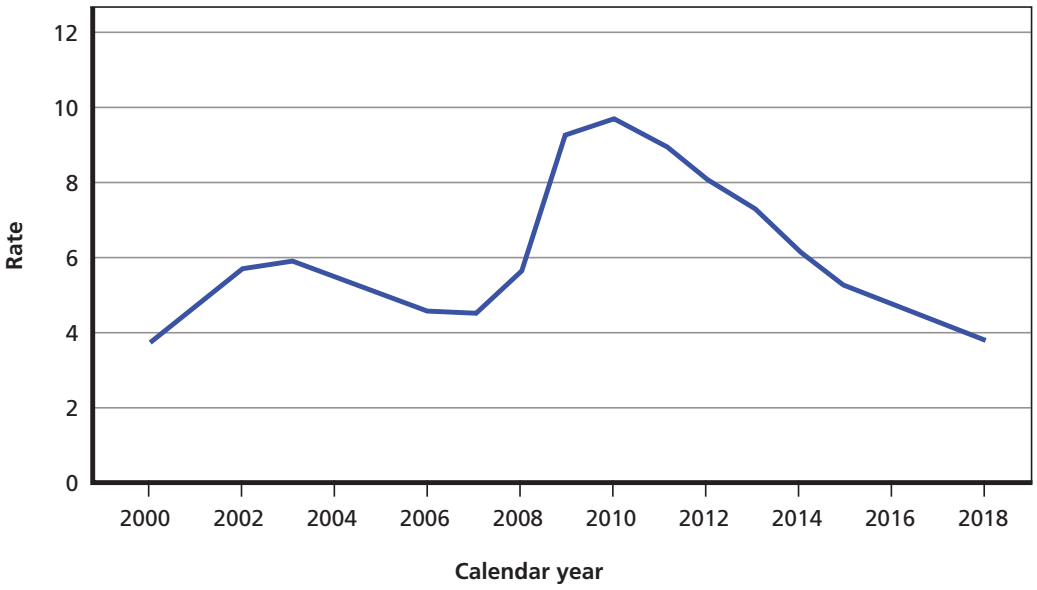
Figure 3.8 shows changes in unemployment during this time period. When the economy worsens, workers have fewer outside options and may be more likely to be enticed to join the military, which provides relatively high and stable pay. The percentage of high-quality recruits who were in categories I through IIIA rose rapidly from 2009

Figure 3.7
Enlisted Personnel Receiving Imminent-Danger or Hostile-Fire Pay, Calendar Years 1999–2017



SOURCES: Author's calculations based on Defense Manpower Data Center Active-Duty Pay files.
NOTE: 1999 = 1.00.

Figure 3.8
Civilian Unemployment Rate, Calendar Years 2000–2018



SOURCE: Bureau of Labor Statistics, undated.

to 2012, a period when the unemployment rate was high relative to 2000–2008 and 2013–2018. Researchers in past studies have found that the number of high-quality enlistments in each service, including the Army, is positively associated with the civilian unemployment rate (for reviews of past studies, see, e.g., Asch, Hosek, and Warner [2007]; Asch et al. [2010]).

We also include a post-2009 indicator variable to capture the changing nature of educational benefits for service members in different branches. The Post-9/11 Veterans Educational Assistance Act of 2008 (also known as the Post-9/11 GI Bill) for education benefits took effect in August 2009 (Pub. L. 110-252, Title V, 2008). This bill covered tuition at a level equal to the tuition of a service member's home-state four-year public university, plus offering BAH while attending school. Prior to that point, while the services had the same base education benefit, the Army offered a supplement, the Army College Fund, for high-quality recruits in critical occupations. The Post-9/11 GI Bill made benefits available to recruits of all services on equal terms, regardless of quality, and, given the generosity of the benefits, the Army lost the recruiting advantage it had.

Modeling the Relationship Between Recruiting Rate and Regular Military Compensation/Wage Ratio

Recruiting is determined both by the willingness of an individual to enlist and by the service's willingness to accept the recruit. The model we estimated is a reduced-form model that reflects supply-and-demand influences but does not identify the effects of the supply-and-demand variables separately.

We view willingness to enlist as a variant of the random utility model (McFadden, 1983). An individual's willingness to join a service depends on military pay relative to civilian pay, job opportunities as measured by the unemployment rate, job and school opportunities related to AFQT, the chance of being deployed in hostile operations, and possible differences in preferences and opportunities related to gender. It also depends on factors not observed in our data, including the military occupational specialties that are offered, bonuses, educational benefits, ship date, information from advertising or service websites, the influence of family and friends, and aspects of military service, such as its roles, missions, tradition, and values (see, e.g., Eighmey, 2006).

On the demand side, the recruiting command wants to meet a quantity goal and meet or exceed a quality goal. The service goals must comply with DoD guidance that calls for at least 60 percent of accessions to be in categories I through IIIA and at least 90 percent to be tier 1 (Kapp, 2013; Sellman, 2004). A tier 1 recruit is one with a high school diploma or at least 15 college credits; tier 1 recruits are predominantly HSDGs. Category I–IIIA HSDG recruits count toward the quantity and quality goals, while category IIIB HSDG and category IV HSDG recruits count only toward the quantity goal. This suggests that the probability of an HSDG's recruitment conditional on the person being willing to enlist relates to a preference ordering:

$$Pr(accept|willingCatsIthroughIIIA) = 1$$
$$Pr(accept|willingCatIIIB) \leq 1$$
$$Pr(accept|willingCatIV) \ll 1$$

The "equal" part of "less than or equal" for IIIB allows for the possibility that meeting the quantity goal might require accepting

all willing IIIBs. It also reflects the possibility of identifying high-potential IIIB prospects through nontraditional methods. Thus, the AFQT can affect a service's willingness to accept someone who is willing to join, especially if the person is at IIIB or less. Also, a person's willingness can depend on AFQT results, because, as mentioned, these can be related to job prospects, college expectations, and college opportunities. For these demand-and-supply reasons, our analysis allowed for possible differences by AFQT category in the recruiting rate's responsiveness to the RMC/wage ratio.

Our model is a reduced-form model because it does not identify structural equations for the demand-and-supply sides. For instance, unemployment can increase willingness to enlist, and in response the services can decrease their recruiting resources, such as recruiters, advertising, and bonuses, and tighten eligibility. Our reduced-form unemployment coefficient is the net effect of these responses. The direct effect of unemployment on supply is positive, but if unemployment triggers a large enough decrease in recruiting resources at the same time, the coefficient on unemployment in the reduced-form model could be negative. Similarly, deployment might have a positive or negative effect on supply, and if the supply effect is negative, the service might take the option of increasing its enlistment bonuses (as mentioned above) to nullify the negative effect.

It would be ideal to identify structural (causal) effects of recruiting resources, which are endogenous to the recruiting process, but doing so requires exogenous variation in explanatory variables, such as through enlistment bonus, recruiter, or advertising experiments, or through the use of instrumental variables. Our data are not from experiments, and we did not have instruments or enough data to estimate instrumental variable models. Instead, the variables we included in the reduced-form model were outside the control of the recruiting command and, as suggested, are external to its resourcing decisions. These variables are military and civilian pay, recruiting goal, deployment, unemployment, and eligibility. Although the reduced-form model does not identify causal effects, such as the causal effect of pay, it avoids issues of bias that would have arisen if we had included observed bonuses, recruiters, and advertising.

Still, poor recruiting and retention conditions in one year might result in a higher-than-expected military-pay raise and a higher recruiting goal in the next. These conditions—autocorrelated errors and policy actions affecting pay and retention—could bias downward the RMC/wage and recruiting goal coefficients and produce low standard errors (and thus high t-statistics). A downward bias would imply that the coefficients are conservative estimates of the true effect.

We ran separate models for each service. The dependent variable is the logit of the recruiting rate. There is a recruiting-rate observation for each AFQT category for men and another for women. The RMC/wage coefficient is allowed to differ by category. Also, the intercepts are allowed to differ by AFQT category interacted with gender. The coefficients for recruiting goal, deployment, unemployment, and the post-2009 indicator are the same across AFQT categories. In the logit specification, the *percentage* change in the recruiting rate with respect to a continuous variable equals the coefficient times one minus the recruiting rate (i.e., $\beta[1 - p]$).[4] The recruiting rates are low percentages, so $1 - p \approx 1$, and the percentage change is roughly equal to the coefficient itself, β.[5]

---

[4] In the logit regression specification, the marginal change in p with respect to a continuous explanatory variable x is

$$\left(\frac{\partial p}{\partial x}\right) = \beta(1 - p)p.$$

Therefore, the percentage change in p with respect to a one-unit change in x is

$$\left(\frac{\partial p}{\partial x}\right)\left(\frac{1}{p}\right) = \beta(1 - p).$$

We also ran regressions in which the dependent variable was the log of the recruiting rate. In that specification, the coefficients represent the percentage change in the dependent variable for a one-unit change in the explanatory variable. The results were virtually the same as $\beta(1 - p)$ from the logit.

[5] For indicator variables, the impact on the recruiting rate required evaluating

$$\frac{e^{\beta x}}{1 + e^{\beta x}}$$

for the variable at 1 versus 0, with other explanatory variables held at some level (e.g., their means).

A final point is that one might expect the results to differ for the Army and the other services because the Army's recruiting goal is the largest, being roughly twice that of each of the other services. However, the extent to which the magnitude of the recruiting goal makes a difference depends on resourcing decisions that the services made and the quality they required. The marginal cost of a recruit of a given quality might be higher for the Army if it must go deeper into the population of prospective recruits; yet, by programming enough resources to recruiting, the Army might attain the same quality as the other services. But resources have other uses, and the same quality might not be needed. The issue, then, turns on the expected benefit from higher-quality recruits relative to their cost and, further, whether the positions in the Army need to be manned by the same quality of recruit, on average, as needed in the other services. In short, service differences in recruiting cost and required quality could give rise to differences in recruit quality and—relevant to this research—differential responses in recruit quality by service when the rise in RMC is the same across services.

Modeling the Relationship Between Share of Non–High School Diploma Graduate Accessions and Regular Military Compensation/Wage Ratio

Here, we focus on the share of accessions who are non-HSDGs, again by AFQT category. The intuition is that the service will prefer an HSDG recruit to a non-HSDG recruit, other things being equal. Yet, if recruiting conditions are more difficult than expected, recruiting outcomes are below goal, goals have unexpectedly increased, or recruiting stations become short-staffed, recruiting a non-HSDG might be more attractive. This would be the case if, given the adverse recruiting conditions, the marginal benefit from meeting the quantity goal relative to the marginal cost of doing so were greater for a non-HSDG than an HSDG recruit. This intuition extends beyond unexpected, difficult recruiting conditions, though. Judging by recruiting outcomes (Figures 3.1 through 3.3), non-HSDG accessions are a

regular part of the recruiting mix that the services program resources to obtain, although the actual outcomes will depend on conditions realized during the recruiting year. In 1999, more than 10 percent of Army and Navy accessions were non-HSDG, and, although the percentage in recent years has been well below 10 percent for all services, in 2006 and 2007, more than 35 percent of male Army accessions were non-HSDGs. Overall, the cost of an all high-quality or all-HSDG accession cohort might be too high relative to the expected value to the service.

To capture the idea that non-HSDG accessions serve as an outlet, we estimated models of the share of accessions who were non-HSDGs. The models include the same explanatory variables as the recruiting rate models, and the dependent variable is the logit of the share of accessions who were non-HSDGs.

Regression Results

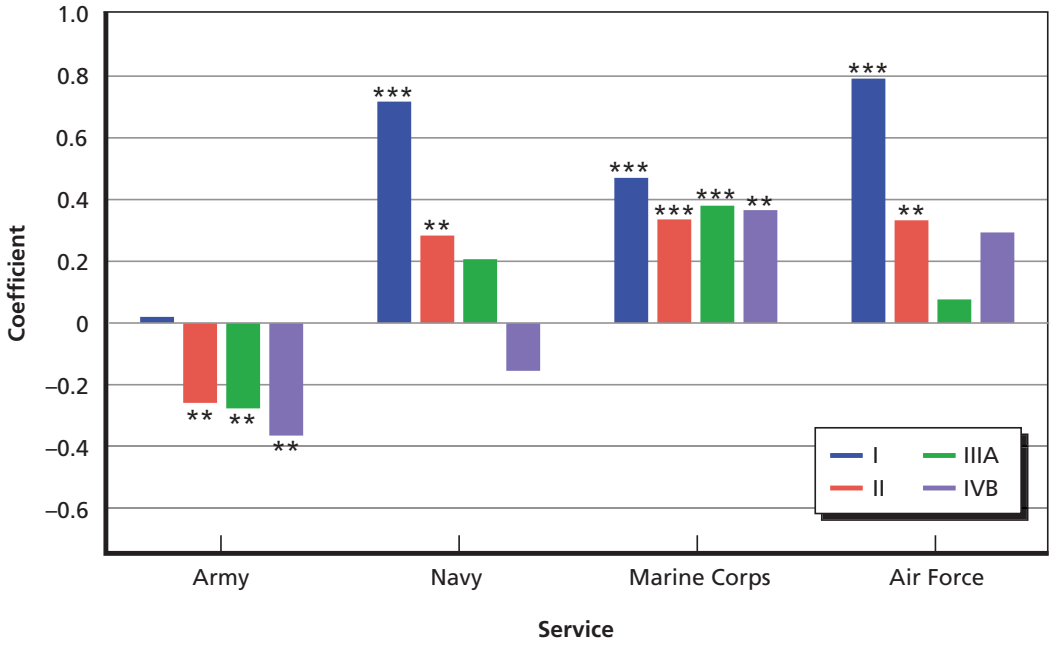
The regression estimates are reported in Tables B.6 through B.9 in Appendix B. We summarize our findings in Figures 3.9 and 3.10. These figures depict the estimated coefficient for the ratio of RMC to civilian wage, by AFQT category for each service for the two models, respectively. Thus, the figures show the estimated relationship between the RMC/wage ratio and the recruiting outcome variable by AFQT category for each service.

Recruiting Rate

As shown in Figure 3.9, an increase in the RMC/wage ratio was associated with

- no change in the recruiting rate for category I for the Army but decreases in the rates for II, IIIA, and IIIB
- an increase for the Navy in recruiting rates for categories I and II
- increases in all categories—I, II, IIIA, and IIIB—for the Marine Corps

Figure 3.9
Regular Military Compensation/Wage Coefficients from Logit Regressions of Recruiting Rate for Armed Forces Qualification Test Categories I–IIIB, by Service

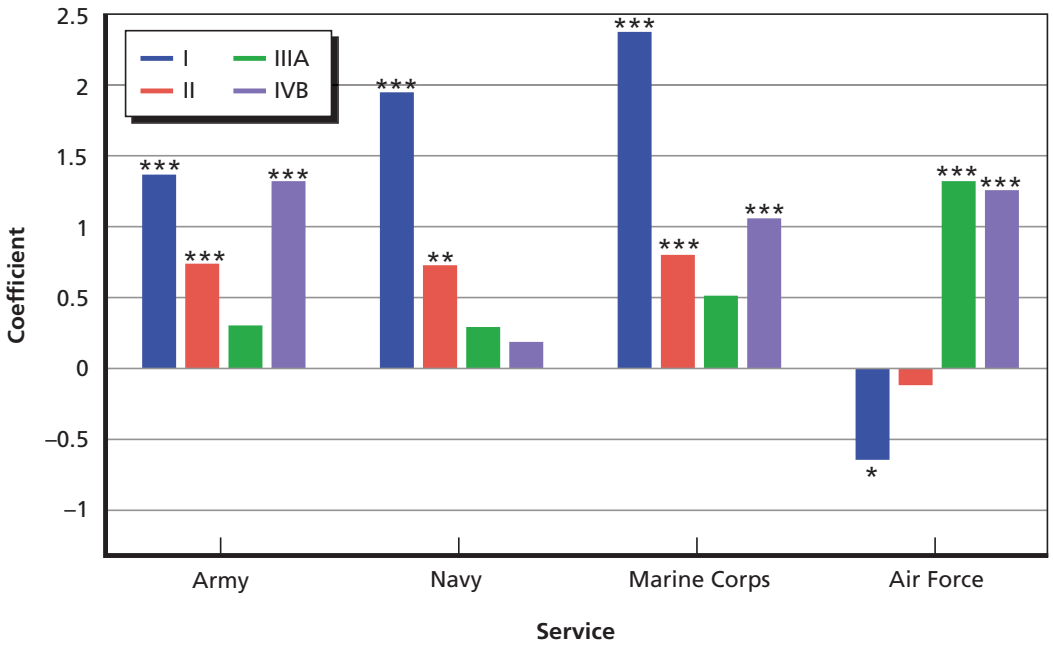


NOTE: The bars in the figure show the overall RMC percentile coefficient for each AFQT category. For example, the overall RMC percentile coefficient for category I is RMC's effect on the logit recruiting rate for AFQT category I. It equals the sum of the RMC coefficient for IIIA, the reference group, and RMC × category I coefficient in Tables B.6–B.7.
*** = statistically significant at the 1-percent level; ** = statistically significant at the 5-percent level; * = statistically significant at the 10-percent level.

- an increase for the Air Force in recruiting rates for categories I and II.

Thus, the Navy and Air Force increased their quality mix through higher category I and II recruiting rates over the time period. The Marine Corps also increased recruiting rates for categories I, II, and IIIA (as well as IIIB). Like Hosek et al. (2018, pp. 52–63), we find that an increase in the RMC/wage ratio for the Army was associated with no change in the category I recruiting rate and, contrary to what one might expect, lower recruiting rates in II and IIIA, as well as IIIB.

Figure 3.10
Regular Military Compensation/Wage Coefficients from Logit Regressions of the Non–High School Diploma Graduate Share of Accessions for Armed Forces Qualification Test Categories I–IIIB, by Service



NOTE: The bars in the figure show the overall RMC percentile coefficient for each AFQT category. For example, the overall RMC percentile coefficient for category I is RMC's effect on the share of non-HSDG accessions for AFQT category I. It equals the sum of the RMC coefficient for IIIA, the reference group, and RMC × category I coefficient in Tables B.7–B.9.
*** = statistically significant at the 1-percent level; ** = statistically significant at the 5-percent level; * = statistically significant at the 10-percent level.

In short, increasing RMC relative to civilian wages was associated with an increase in the recruiting rate, especially in categories I and II for all services except the Army. Hosek et al. (2018, pp. 71–73) discuss in depth why the results for the Army might be different than for the other services. It could be that Army recruiting became more difficult for reasons not captured in our models. Another possibility is that the Army set quality goals and programmed recruiting resources to sustain, but not increase, accession quality or that higher RMC affected recruiter effort. Yet another explanation is that Army recruiters were allowed to reduce effort as the recruiting market expanded as RMC increased, so recruiting rates in II and IIIA were lower. Hosek et al. (2018) explicitly model a trade-off between RMC and a service's

recruiting resources, including recruiter effort, and show that such a model could explain these results.

Non–High School Diploma Graduate Share

As shown in Figure 3.10, an increase in the RMC/wage ratio was associated with

- an increase for the Army in the share of non-HSDG in categories I, II, and IIIB
- an increase in the share of non-HSDG in categories I and II for the Navy
- an increase for the Marine Corps in the share of non-HSDG in categories I, II, and IIIB
- an increase in the RMC/wage ratio associated with a decrease in the share of non-HSDGs in category I and an increase in the share in categories IIIA and IIIB for the Air Force.

Controlling for the factors discussed above, we found that an increase in the RMC/wage ratio was associated with a higher share of non-HSDGs across all services and with a higher share of non-HSDGs in categories I, II, and IIIB for the Army and Marine Corps and in categories I and II in the Navy.[6] Thus, in the Army, Navy, and Marine Corps, the RMC/wage ratio was associated with an increase in the quality of non-HSDGs. Still, the non-HSDG share in IIIB also increased in the Army and Marine Corps. The findings for the Air Force were mixed, with a decrease in this share for category I but an increase in the share in IIIA and IIIB.

Conclusion

This chapter has analyzed the relationship between military pay and recruit quality. While the RMC/wage ratio for an E-4 with four YOS

[6] With no controls, the relationship between share of non-HSDG and RMC/wage ratio is negative for all branches except the Air Force.

rose significantly during this period, recruit quality varied by service. We used a reduced form regression analysis to control for several factors and shed further light on the association between RMC and recruit quality.

As the regressions indicate, recruit quality increased for all services except the Army as the RMC/wage ratio increased. The Navy and Air Force increased their category I and II recruiting rates; and the Marine Corps increased its category I, II, and IIIA recruits (as well as IIIB recruits). In contrast, the association between the RMC/wage ratio and the Army recruiting rate for II, IIIA, and IIIB was negative.

We also found that a higher RMC/wage ratio was associated with a higher share of non-HSDG accessions in categories I, II, and IIIB for the Army and Marine Corps, categories I and II for the Navy, and categories IIIA and IIIB for the Air Force. A higher RMC/wage ratio was correlated with a decrease in share of non-HSDG accessions in category I for the Air Force.

Our regression models are reduced form and did not identify the causal effect that military or civilian pay has on recruiting outcomes. Ideally, each of our explanatory variables would be varied experimentally in order to avoid endogeneity. However, the military does not have direct control over many of our explanatory variables, and in the past, it has been reluctant to vary policy levers that it does control (such as bonuses, advertising, and recruiting locations), because the importance of meeting recruiting missions has often taken precedence over experimentation.

CHAPTER FOUR

Geographic Differences in Regular Military Compensation Percentiles

Pay comparisons in past QRMC reports as well as in the comparisons shown in previous chapters in this report are based on national data. That is, RMC is compared with the pay of civilians throughout the United States, without regard to where individuals live. Such national comparisons are useful because they provide a summary measure of the overall status of military pay relative to civilian pay and because basic pay, the foundation of RMC, is set at the national, not the regional, level. Further, personnel rotate frequently and are not attached to a specific location over their entire career, so from the standpoint of the retention decisions of military personnel, comparison of military pay with pay across the national external market seems relevant. The relevance of the national market is less clear for the initial recruiting decision since potential recruits are likely to put more weight on how military pay compares with pay in their hometown region than with pay at the national level. In general, more research is needed to better understand the extent to which pay comparisons at the local rather than the national level influence both recruiting and retention decisions and the extent to which pay supplements such as BAH help to make pay competitive in different areas.

Insofar as local pay comparisons are important for these decisions, it is useful to consider geographic differences in RMC percentiles, especially because the structure of wages in urban versus nonurban regions of the country has shifted in recent years and thereby affected how RMC compares with civilian pay in urban versus nonurban areas. In this chapter, we highlight these comparisons.

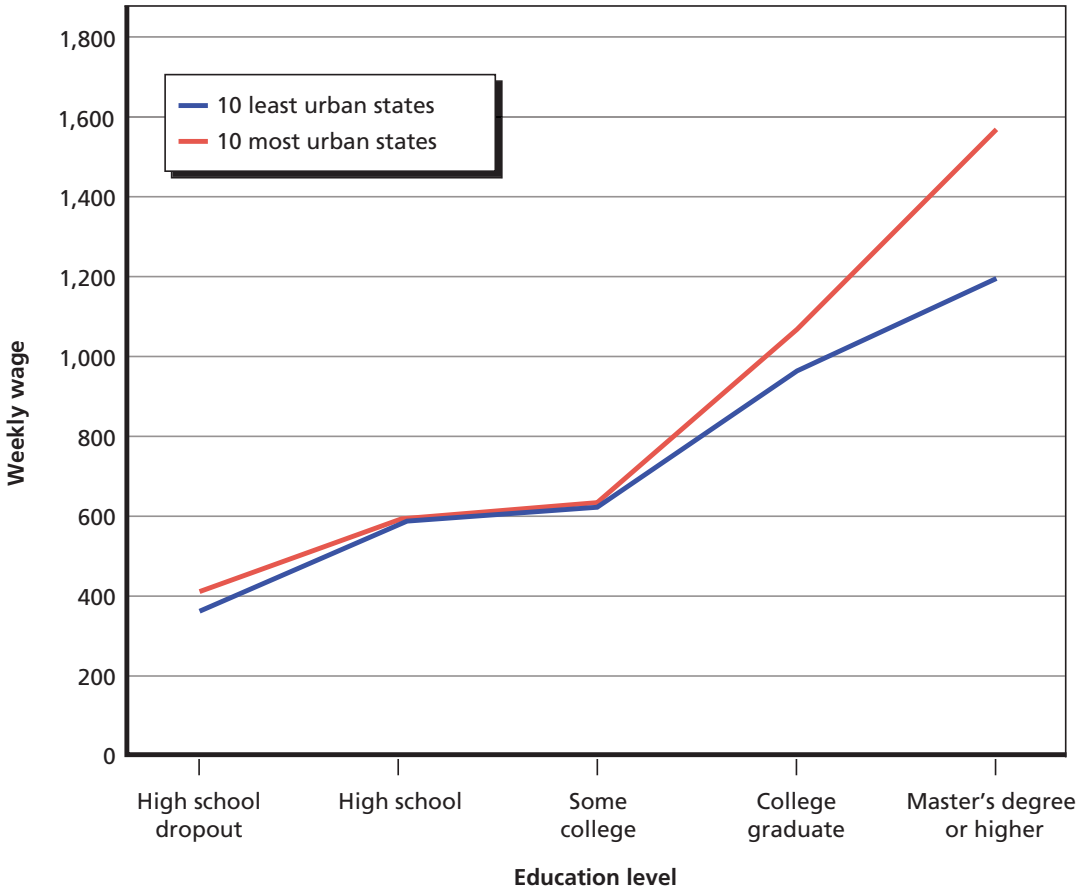
Researchers are becoming increasingly aware of the important ways in which location influences life outcomes. Several studies have examined the influence of neighborhoods on wages and social mobility (Chetty and Hendren, 2018a, 2018b; Chetty, Hendren, and Katz, 2016), the importance of state laws for promoting economic growth or access to healthcare (Clarke, 2004; Currie and MacLeod, 2008; Holmes, 1998; Kleiner, 2016), and the differences in economic opportunities between cities and more rural areas (Glaeser, 2010, 2011). However, recent research has also documented changes in the complex interactions between educational attainment, economic opportunities, and geography (Autor, 2019; Austin, Glaeser, and Summers, 2018). In previous decades, cities offered wage premiums to both highly skilled and less-skilled individuals. That is, pay was higher in cities than outside cities for both highly skilled and less-skilled workers. Urban areas had dynamic labor markets supporting large manufacturing facilities as well as specialized high-skilled innovation. For example, Detroit became known for large car manufacturing plants. Relatively high-paying jobs attracted workers who then specialized in the skills necessary for their work. In turn, firms in adjacent industries had an incentive to locate to Detroit to take advantage of this large pool of skilled workers. After gaining experience in the industry, workers were also more likely to start new firms, which further attracted additional workers to the area. These benefits of geographic concentration are called *agglomeration effects*.

In previous decades, the higher productivity and higher wages from agglomeration effects encouraged more people to move to cities. However, in the last several years many of the relatively high-paying jobs that were previously done by individuals with less formal education have been automated or outsourced, and many of these workers have moved into lower-paying service-sector jobs (Acemoglu and Autor, 2011; Acemoglu and Restrepo, 2017, 2018; Alabdulkareem et al., 2018; Autor, 2015, 2019; Autor and Dorn, 2013; Autor, Katz, and Kearney, 2006; Autor, Levy, and Murnane, 2003). The result is that wages are now no higher in more urban areas for individuals with less formal education than they are in less urban areas. For highly educated workers,

there is still a large wage premium for moving to cities. At the same time, other policies (such as limitations on new construction, increases in local taxes, and licensing requirements) have increased the costs of living in many cities even as the premium for workers with less formal education has disappeared (Ganong and Shoag, 2017).

Figure 4.1 illustrates the result of this trend. It shows median weekly wages from the CPS for 2014–2017 for those who have different levels of education and who live in the ten least urban states and in

Figure 4.1
Weekly Wages by Education Level for Those in the Ten Least Urban States and Those in the Ten Most Urban States, 2014–2017



SOURCES: U.S. Census Bureau, 2010, 2018.
NOTE: Median weekly wages are in 2017 dollars.

the ten most urban states.[1] As can be seen, workers with lower levels of education make around the same amount whether they live in more or less urban areas. Those with higher levels of education make significantly more in more urban states.

To the extent that pay at the local level is relevant to recruiting and retention decisions, the implication of this trend in the civilian labor market is that military service was less competitive in urban than in less urban areas in the past because pay was higher in urban areas for both higher- and lower-skilled workers. Because of the shifts in the urban labor markets for lower-skilled workers over the last few decades, it seems likely that military service may now be just as competitive for lower-skilled workers in urban as in less urban areas, all else being equal. The lower-skilled workers include those with high school and some college, as shown in Figure 4.1, and are a prime market for the enlisted force, especially the junior enlisted force.

Geographic Differences in Regular Military Compensation Percentiles for Enlisted and Officers

To some extent RMC includes a geographic component. As an element of RMC, BAH provides an adjustment to pay based on the cost of housing in different areas. Also, the services offer enlistment and reenlistment bonuses to eligible individuals, and such bonuses help make military service more competitive to the extent that RMC does not compare as favorably in a specific area. Still, it is useful to consider

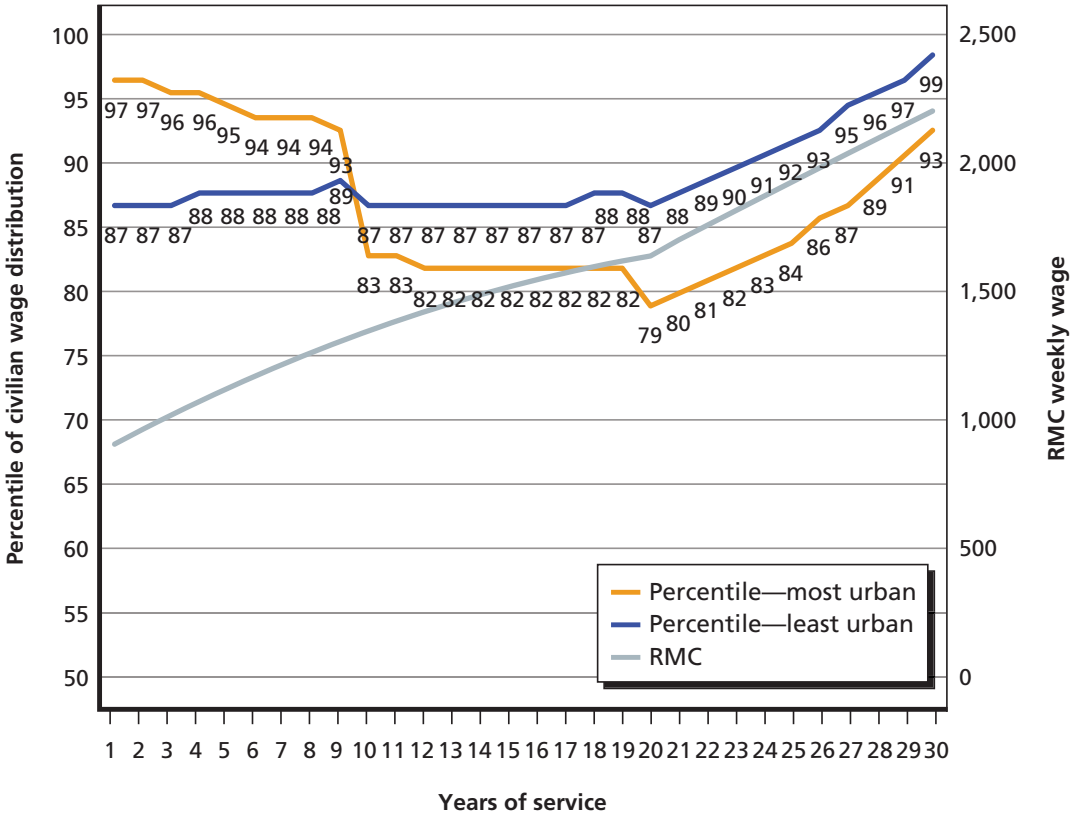
[1] States are categorized based on the percentage of the total population in urban areas from the 2010 Decennial Census. The District of Columbia, although not a state, is included in the measure since more people live there than many states. Note that the definition is the percentage of the population who lives in urban areas and not the percent of the total land mass filled by people. Thus, states that we do not often think of as urban because they have lots of empty land are surprisingly dense because most of the population lives in a small geographic area. This is the case with states such as Utah, Nevada, and Arizona. The ten densest states are District of Columbia, California, New Jersey, Nevada, Massachusetts, Hawaii, Florida, Rhode Island, Utah, and Arizona. The ten least urban states are North Dakota, Alabama, Kentucky, South Dakota, Arkansas, Montana, Mississippi, West Virginia, Vermont, and Maine.

how the changing dynamics of civilian wages by geography affect how RMC compares with civilian wages in urban and less urban areas.

Figures 4.2 and 4.3 summarize the regional comparisons shown in Appendix C by showing RMC for enlisted and officers, respectively, as the gray line graphed relative to the right axis. On the left axis, the figures show the percentile values along the RMC line, by year of service/age. The figures show how RMC wages compare with civilian wages over a career in the most urban and the least urban states.

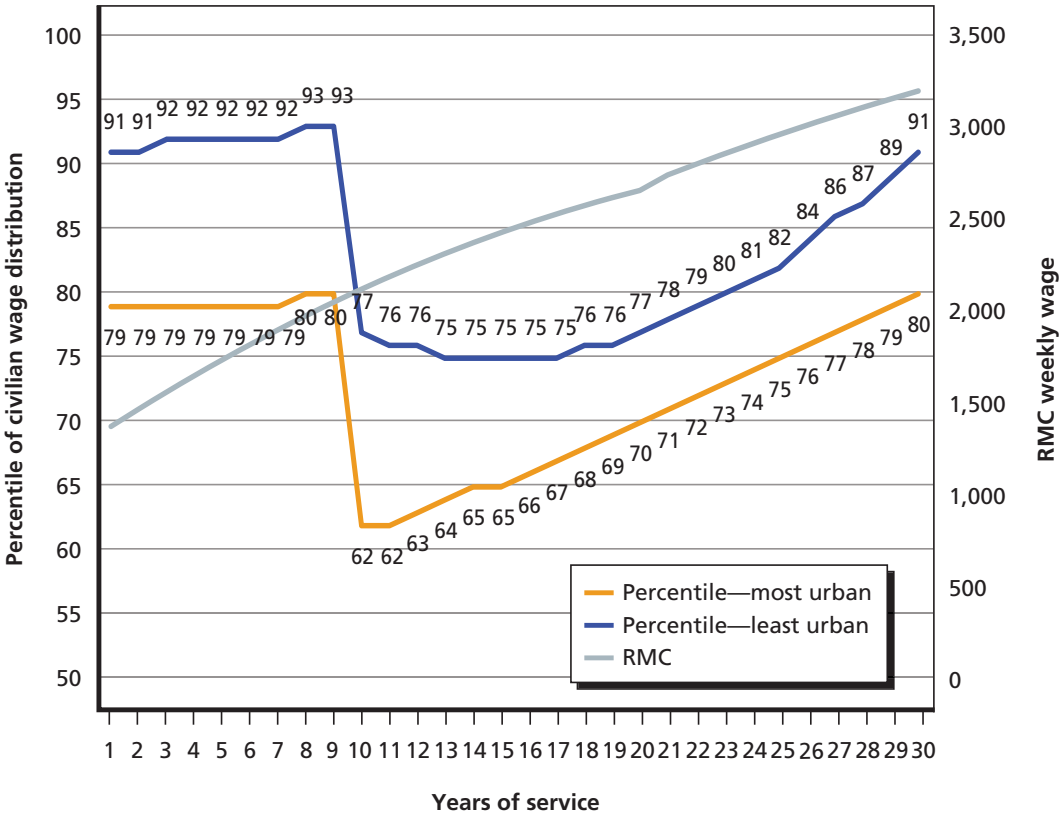
For enlisted personnel in Figure 4.2, RMC is a higher percentile of civilian wages compared with civilians who live in the most urban

Figure 4.2
Enlisted Regular Military Compensation and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with High School Diploma, Some College, and Associate's Degree in the Most and Least Urban States, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = high school, 10–19 = some college, and 20–30 = associate's degree). We weighted civilian-wage data by enlisted military gender mix. The gray line is enlisted RMC. Data are smoothed.

Figure 4.3
Officer Regular Military Compensation and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with Bachelor's Degree or with Master's Degree or Higher in the Most and Least Urban States, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = bachelor's degree, 10–30 = master's degree or higher). We weighted civilian-wage data by officer military gender mix. The gray line is enlisted RMC. Data are smoothed.

versus the least urban states for one through nine YOS. That is, for enlisted personnel early in their career, RMC compares more favorably with civilian pay in urban areas than in nonurban areas. This pattern flips as we compare RMC with the pay for civilians with more years of formal education as years of service increase. However, the difference between the percentiles in the least and most urban states is about 5 percentiles (e.g., 87th percentile for less urban workers and 82nd percentile for more urban workers for 12–19 YOS) and grows to about 8 percentage points at 20 YOS. That is, for enlisted personnel in their later career, RMC compares somewhat less favor-

ably with civilian pay in urban areas than in non-urban areas. But, notably, the 5 to 8 percentile differences after ten YOS are smaller than the differences for officers, which are shown in Figure 4.3

In Figure 4.3 we compare RMC for officers from the Greenbooks with civilians with bachelor's degrees (1–9 YOS) and master's degrees or more (10–30 YOS). While exhibiting a similar overall pattern to that found in Figure 2.2, officer RMC is at a persistently and substantially higher percentage of civilian pay in the least urban states than in the most urban states; in most cases the difference is more than ten percentiles. That is, because of the higher wages of urban civilian workers, RMC percentiles are lower in urban areas than in less urban areas by more than ten percentiles.

Traditionally, wages have been lower in less urban areas so we would expect RMC to be a higher percentile of civilian wages in these areas. This is still true for workers with more years of formal education; RMC compares more favorably with what workers with more years of formal education in less urban states could get in their local labor market. However, for less-educated workers, the difference between wages in more and less urban areas is much smaller; and for those with only a high school degree, wages may now be higher in less urban areas, thereby making RMC a higher percentile of civilian wages in more urban areas.

Conclusion

There appear to be differences in RMC percentiles across geographies for individuals of different education levels. Due to trends for less-educated workers across the economy, enlisted military members with a high school degree are more likely to find RMC equally competitive no matter where they live (and perhaps even more competitive in urban areas). However, officers and those with more education in general are likely to find military pay more competitive if they live in less urban areas than if they live in more urban areas.

While these patterns are briefly noted here, further research is necessary to explore their implications for military recruiting and retention.

CHAPTER FIVE

Closing Thoughts

Our findings are relevant to the following questions. How does military pay for active-component personnel compare with civilian pay? Has the position of military pay improved or worsened since 2009, when the 11th QRMC last benchmarked military pay? Given that military pay has increased since 1999, when the 9th QRMC first benchmarked military pay, was that increase associated with an increase in recruit quality? We summarize our findings and offer some final thoughts.

Findings in Brief

At What Percentile Did Regular Military Compensation Stand in 2017?

We find that RMC in 2017 was at the 85th percentile of comparably educated civilian wages for active-component enlisted personnel and at the 77th percentile for active-component officers. The 9th QRMC noted that many enlisted members have some college and recommended that military pay be at around the 70th percentile for that level of education. In 2017, we find that RMC was at the 84th percentile for enlisted with some college and the 93rd percentile for those with high school. For officers, RMC was at the 86th percentile for officers with a bachelor's degree and the 70th percentile for officers with a master's degree or higher. We also compared RMC with civilian wages over time from 2000 to 2017 for selected age and education groups. These comparisons showed a steady increase in RMC relative to civilian pay from 2000 to 2010 and a leveling off afterward.

At What Percentile Did Regular Military Compensation Stand in 2009?

RMC in 2009 was at the 84th percentile of civilians comparable with enlisted members and at the 77th percentile of civilians comparable with officers—the same as 2017. RMC was at the 85th percentile for enlisted with some college and the 91st percentile for those with high school. RMC was at the 87th percentile for officers with a bachelor's degree and the 69th percentile for those with a master's degree or higher. Our RMC percentiles for 2009 are somewhat below those of the 11th QRMC estimates—90th percentile for enlisted personnel and 83rd for officers—and we attribute the difference to methodological considerations described in Hosek et al. (2018, pp. 10–16, 28–30).

Our finding that the RMC percentile was nearly the same in 2017 as 2009 might be surprising because there were years when basic-pay raises were below the Employment Cost Index (ECI)—namely, 2014–2016—though in our view the ECI is not a reliable guide for military and civilian pay comparisons for various reasons, including that it is not adjusted for the military education distribution.

How Did Recruit Quality Change as Regular Military Compensation Rose?

We used regression models to isolate the relationship between the RMC/wage ratio and recruiting outcomes. We found that as the RMC/wage ratio increased, recruit quality increased in the Navy, Marine Corps, and Air Force but not in the Army.

The regressions controlled for recruiting goal, deployment, unemployment, and gender and were estimated separately by service. As the RMC/wage ratio rose, the Navy, Marine Corps, and Air Force increased their AFQT category I and II recruiting rates, and the Marine Corps also increased its category IIIA rate. But the Army decreased its category II and IIIA recruiting rates. The Army, Navy, and Marine Corps increased the percentage of non-HSDG accessions in category I and II while the Air Force reduced the percentages of non-HSDG accessions in category I. These results suggest that the Army, Navy, and Marine Corps increased the quality of their non-HSDG recruits.

The reason for the Army's different result is an open question. It is possible that Army recruiting became more difficult during the 2000s because of extensive deployments in support of operations in Iraq and Afghanistan, and the Army did not program enough recruiting resources to match the increased difficulty. It may also be that the Army set its recruiting quality goals to hold recruit quality constant as RMC increased, thereby holding its recruit quality near the DoD quality benchmarks of at least 90 percent HSDG recruits and at least 60 percent from categories I through IIIA, rather than allocating more resources such as bonuses and recruiters to recruiting.

How Does the Regular Military Compensation Percentile Vary Across Geographies Within the United States?

There appear to be large differences in how RMC compares with civilian pay across geographies for individuals of different education levels. Due to trends for less-educated workers across the economy, enlisted military members with a high school degree are likely to find military pay relative to civilian pay as attractive in urban as in nonurban areas—a change from earlier years when military pay was relatively less attractive. However, officers and those with more education in general are likely to find military pay higher relative to civilian pay if they live in less urban areas than if they live in more urban areas.

Wrap-Up

In short, our results indicate that RMC continues to exceed the 70th percentile of the distribution of pay of civilians with similar characteristics, found by the 11th QRMC and more recently in Hosek et al. (2018). This result is reached even when accounting for an increase in the educational attainment of both the enlisted force and officers. Our analysis indicates that since 2000, increases in RMC relative to civilian pay have been associated with increases in recruit quality, with the exception of the Army.

These results raise some additional questions. First, the defense capability gained from recruiting more high-quality recruits must be

weighed against the added cost of higher RMC, which increases the entire personnel budget. Our analysis has shown where and to what extent recruit quality increased as military pay increased, but it cannot place a value on the increased quality. Valuing quality is the services' domain.

Second, the increase in recruit quality for three of the four services between 1999 and 2017 raises the question of whether achieving that quality could have been accomplished in a more cost-effective manner than increasing RMC relative to civilian pay. Though estimates differ on the marginal cost of pay and recruiting resources, virtually every study finds that military pay is the costliest approach for enlisting high-quality recruits (Asch et al., 2010; Orvis et al., 2016; Simon and Warner, 2007). RMC is a blunt instrument that is not targeted to occupational specialties in which recruiting or retention shortfalls occur. An increase in RMC affects the cost of all personnel budget in every service, while an increase in a service's recruiting resources such as recruiters, enlistment bonuses, advertising, and recruiting stations and equipment is specific to its recruiting budget, and resources such as bonuses can be targeted.

These questions should be addressed when considering the setting of RMC in the future. The analysis in this report indicates that in the recent past, and since the 11th QRMC, RMC continues to support readiness and lies above the benchmark of the 70th percentile set by the 9th QRMC.

APPENDIX A

Regular Military Compensation Percentile and Regular Military Compensation/Wage Ratio

This appendix describes how we smoothed the RMC percentile for an E-4 with four YOS relative to the civilian-wage distribution for high school graduates ages 18 to 22 who worked more than 35 weeks in the year and had more than 35 usual hours of work. The smoothed values are shown in Figure 3.5 in Chapter Three. This appendix also describes the ratio of RMC to the median civilian wage. RMC is based on Greenbook data, and civilian wages come from March CPSs.

Smoothing the Regular Military Compensation Percentile

Raw RMC percentiles vary considerably from year to year. Some variation comes from annual increases in RMC resulting from increases in basic pay and BAH, but much of the variation comes from the smallness of CPS samples. For high school graduates ages 18 to 22, sample sizes for each year of data range from 150 to 250 observations for men and the same for women. These sample sizes do not provide dense enough coverage for a precise estimate of the wage distribution or the RMC percentile. We used a smoothing method to adjust for the variation.

There are different approaches to smoothing. One approach is a kernel density estimator to smooth the wage distribution each year. But that approach does not use data from adjacent years and cannot be relied on to provide year-to-year continuity. Instead, we estimated a log

wage model to identify the mean and variance of the wage distribution, allowing for a common trend in real wages. The estimation used the tabulated wages at the 30th, 40th, 50th, 60th, 70th, 80th, and 90th percentiles. Then, using the estimated wage distribution parameters, we inferred the RMC percentile. The approach smooths the RMC percentile and provides year-to-year continuity in the wage distribution as real wages change over time.

Using Wage Percentiles to Estimate the Log Wage Distribution

Let p be the percentile (e.g., $p = 0.6$ at the 60th percentile), and let F be the standard normal distribution with mean 0 and standard deviation σ. Assume that the wage is log-normally distributed, so

$$p = F\left[\frac{ln\ w_p - \mu}{\sigma}\right]. \tag{A.1}$$

Taking the inverse normal, the log wage at percentile p is
$ln\ w_p = \mu + \sigma F^{-1}[p]$.

We tabulated CPS wage data to find wages at the 30th through 90th percentiles for each year, 1999 through 2017. These wages are the observations on $ln\ w_p$. Thus, for a given group (e.g., 18- to 22-year-old high school graduates), the log wage at percentile p in year t is

$$ln\ w_{pt} = \mu_t + \sigma F^{-1}[p]. \tag{A.2}$$

At the 50th percentile, $F^{-1}[0.5] = 0$, and it follows that the mean of the log wage distribution, μ_t, equals the log of the wage at the 50th percentile. We computed the wage at the 50th percentile and used it to obtain an estimate of the mean of the log wage distribution: $\mu_t = ln\ w_{0.5t}$ at each year and, in particular, for the base year of our data, 1999. We refer to 1999 as period 0.

For small changes, we approximated the year-to-year wage change as a percentage change from the wage in period 0:

$$w_{pt} = e^{\mu_0 + \sigma F^{-1}[p]} e^{\hat{\delta} t}. \tag{A.3}$$

Taking logs, we have

$$ln\ w_{pt} = \mu_0 + \sigma F^{-1}[p] + \delta t. \tag{A.4}$$

We can replace μ_0 with $ln\ w_{0.5t} + \varepsilon_{pt}$ given that $w_{0.5,0}$ is computed from the data and its log is an estimate of the mean. Subtract $ln\ w_{0.5t}$ from both sides to obtain

$$ln\ w_{pt} - ln\ w_{0.5,0} = \sigma F^{-1}[p] + \delta t + \varepsilon_{pt}. \tag{A.5}$$

In the usual regression format, this can be thought of as

$$ln\ w_{pt} - ln\ w_{0.5,0} = \beta_1 F^{-1}[p] + \beta_2 t + \varepsilon_{pt}, \tag{A.6}$$

where β_1 is an estimate of σ, the standard deviation of the log wage, β_2 is an estimate of δ, the annual percentage change in the wage, and there is no intercept. Values for $F^{-1}[p]$ at each percentile came from the inverse normal function evaluated at the given percentile. The variable t is the year. This approach assumes that the standard deviation does not change during the observation period and that the mean evolves according to the time trend. For each group, there are wages for seven percentiles in each of 19 years, 1999 through 2017, for a total of 133 observations. There are two parameters to estimate.

Using the estimated parameters, the predicted wage in period t at percentile p is

$$w_{pt} = e^{ln\ w_{0.5,0} + \hat{\sigma} F^{-1}[p] + \hat{\delta} t}. \tag{A.7}$$

Also, for a given value of the wage, the corresponding percentile is derived as follows:

$$ln\ w_t - ln\ w_{0.5,0} = \hat{\sigma} F^{-1}[p] + \hat{\delta} t. \tag{A.8}$$

$$F^{-1}[p] = \left[\frac{ln\ w_t - ln\ w_{0.5,0} - \hat{\delta} t}{\hat{\sigma}} \right]. \tag{A.9}$$

$$p = F\left[\frac{ln\ w_t - ln\ w_{0.5,0} - \hat{\delta} t}{\hat{\sigma}} \right]. \tag{A.10}$$

Letting RMC_t stand in for wage, its percentile is

$$p = F\left[\frac{ln\ RMC_t - ln\ w_{0.5,0} - \hat{\delta}t}{\hat{\sigma}}\right]. \quad \text{(A.11)}$$

Parameter Estimates and Goodness of Fit

Table A.1 reports the regression results. The standard deviation of the log wage distribution is 0.457 for men and 0.398 for women, both of which are highly significant. Also, for interpretability, the estimates for δ are reported as the annual percentage change (i.e., as 100 times the estimated coefficient). For example, the δ estimate of –0.500 for male high school graduates reported in the table means that wages trended down by 0.500 percent per year from 1999 to 2017. Similarly, the reported standard error of δ is 100 times the estimated standard error. The wage data are in 2017 dollars. The trend estimate is statistically significant for men and women. The models fit the data well, with an R^2 of 0.93 for men and 0.88 for women.

Table A.1
Regression Results for High School Graduates, Ages 18–22

Group	Coefficient	Robust Standard Error	*t*	P>|*t*|
Male				
Standard deviation of log wage distribution	0.457	0.015	30.78	0.000
Time trend	–0.500	0.059	–8.42	0.000
R^2	0.929			
Female				
Standard deviation of log wage distribution	0.398	0.016	25.75	0.000
Time trend	–1.046	0.085	–12.28	0.000
R^2	0.883			

Raw and Smoothed Regular Military Compensation Percentiles

Table A.2 contains the raw and smoothed (predicted) RMC percentiles. In making predictions, we used the coefficients in Table A.1 and the median weekly wage for 1999, which was $565.89 for men and $500.25 for women.

Table A.2
Regular Military Compensation Percentiles for High School Graduate Civilian Wages, Ages 18–22, as Percentages

	Males		Females	
Year	%Raw	%Smoothed	%Raw	%Smoothed
1999	79	75	94	86
2000	76	77	88	88
2001	81	79	86	90
2002	80	83	90	92
2003	89	86	96	94
2004	88	85	91	94
2005	88	87	95	95
2006	87	88	91	96
2007	92	89	99	97
2008	94	89	91	97
2009	90	91	94	98
2010	96	91	100	98
2011	94	91	100	98
2012	89	92	100	98
2013	82	92	88	98
2014	86	93	98	99
2015	90	93	99	99
2016	97	93	97	99
2017	87	93	99	99

SOURCES: Directorate of Compensation, 1999–2017; U.S. Census Bureau, 2018.

NOTE: RMC is for an E-4 with four YOS. Civilian wages are for 18- to 22-year-old workers with high school (and not additional) education who worked more than 35 weeks in the year and had more than 35 usual weekly hours of work.

The Regular Military Compensation/Wage Ratio

We again used RMC for an E-4 with four YOS and wages for civilians ages 18 to 22 who worked more than 35 weeks in the year and had usual weekly hours of more than 35. The wage ratio is RMC divided by the median wage (the wage at the 50th percentile of the wage distribution). Table A.3 shows the raw ratio, as well as the ratio predicted by fitting a line to the raw values. In our regression analysis, we used the raw values.

Table A.3
Regular Military Compensation/Wage Ratio for High School Graduates, Ages 18–22

	Males		Females	
Year	Raw	Predicted	Raw	Predicted
1999	1.36	1.49	1.54	1.62
2000	1.38	1.52	1.68	1.67
2001	1.53	1.55	1.61	1.72
2002	1.58	1.59	1.72	1.77
2003	1.76	1.62	1.86	1.82
2004	1.70	1.65	2.10	1.87
2005	1.64	1.68	1.90	1.92
2006	1.76	1.71	1.93	1.97
2007	1.82	1.75	2.09	2.02
2008	1.72	1.78	2.04	2.07
2009	1.81	1.81	2.15	2.12
2010	2.02	1.84	2.31	2.17
2011	2.13	1.88	2.25	2.22
2012	2.03	1.91	2.22	2.27
2013	1.85	1.94	2.17	2.32
2014	1.82	1.97	2.55	2.36
2015	2.07	2.00	2.36	2.41
2016	1.88	2.04	2.15	2.46
2017	1.95	2.07	2.68	2.51

SOURCES: Directorate of Compensation, 1999–2017; U.S. Census Bureau, 2018.

NOTE: RMC is for an E-4 with four YOS. The wage ratio is RMC divided by the median wage for 18- to 22-year-old workers with high school (and not additional) education who worked more than 35 weeks in the year and had more than 35 usual weekly hours of work.

APPENDIX B

Recruiting Rates for Armed Forces Qualification Test Categories I–IIIB and Regression Estimates

Recruiting Rates

The recruiting rate is the ratio of NPS HSDG enlisted accessions to the population of high school completers, net those who went on to complete four or more years of college. Accession data are from the military enlistment processing station (MEPS) file. Data on high school completers and on the percentage of high school completers who had completed four or more years of college by ages 25 to 29 are from NCES. We calculated recruiting rates by AFQT category. The category is given directly in MEPS data, but it is not present in NCES data. To allocate our adjusted high school completer population by AFQT category, we used the 1997 National Longitudinal Survey of Youth (NLSY), which administered the AFQT to a representative sample of young adults.

NCES provides data on recent high school completers, by gender, for 1960 through 2017 (NCES, 2018a). We also drew on NCES data to calculate the percentage of 25- to 29-year-olds who completed bachelor's degrees or higher conditional on completing high school or higher (NCES, 2018b). We assumed a modal age of 18 for high school completers and a modal age of 27 for the 25- to 29-year-olds who completed bachelor's degrees or higher (i.e., nine years later: age 27 minus age 18). The completion-rate data were available through 2017. We fitted linear trend models to the higher-degree (bachelor's or higher) completion data and used the estimated trend models to predict the higher-degree completion rates for high school completers for the span covered by our data, 1999 to 2017. We deducted these percentages

from the population of completers. What remained was the number of high school completers not expected to later complete four-year degrees or higher. We assumed that this was the population to be recruited into the military.

The 1997 NLSY is the most recent renorming of the ASVAB (from which the AFQT score is calculated). NLSY provides information on the AFQT score distribution for 18- to 23-year-old men and women. We used the percentage of the population in each category to estimate the percentage of our net high school completer population by category. This did not account for the possibility that the AFQT distribution conditional on high school completion differs from that of the unconditional population. The high school completion rate in 2000 was 87 percent for men and 89 percent for women (NCES, 2018b), suggesting that the AFQT distribution for high school completers is likely to be close to that for the 18- to 23-year-old population overall.

Table B.1 shows the total number of male and female high school completers, the percentage of completers expected to complete four or more years of college, and the number of high school completers net of the latter. Tables B.2 through B.5 show the recruiting rates by service and gender for AFQT categories I, II, IIIA, and IIIB.

Table B.1
High School Completers, 1999–2018, Net Those Predicted to Complete Four or More Years of College

Calendar Year	High School Completers, in Thousands		Percentage Predicted to Complete Bachelor's or Higher		High School Completers Net of Predicted Bachelor's or Higher Completers, in Thousands	
	Male	Female	Male	Female	Male	Female
1999	1,474	1,423	31.1	38.1	1,015	881
2000	1,251	1,505	31.7	38.6	855	924
2001	1,277	1,273	32.2	39.1	866	774
2002	1,412	1,384	32.7	39.7	950	835
2003	1,306	1,372	33.2	40.2	872	820
2004	1,327	1,425	33.8	40.8	879	844
2005	1,262	1,414	34.3	41.3	829	830
2006	1,328	1,363	34.8	41.8	866	793
2007	1,511	1,444	35.4	42.4	977	832
2008	1,640	1,511	35.9	42.9	1,052	862
2009	1,407	1,531	36.4	43.5	894	865
2010	1,679	1,482	36.9	44.0	1,059	830
2011	1,611	1,468	37.5	44.5	1,007	814
2012	1,622	1,581	38.0	45.1	1,006	868
2013	1,524	1,453	38.5	45.6	937	790
2014	1,423	1,445	39.0	46.1	867	778
2015	1,448	1,516	39.6	46.7	875	808
2016	1,517	1,620	40.1	47.2	908	855
2017	1,345	1,525	40.6	47.8	799	796
2018[a]	1,548	1,555	41.2	48.3	911	804

SOURCE: NCES, 2018.

NOTE: We fitted a linear trend to the percentage of 25- to 29-year-olds who completed bachelor's degrees or higher, conditional on completing high school or more, for 2005 through 2018. We assumed a median age of 27 for the 25- to 29-year-olds and a median age of 18 for high school completers, a nine-year difference, then used the linear trend to predict the percentage of high school completers in 1999 through 2018 who would complete bachelor's degrees or higher by nine years later.

[a] The number of high school completers in 2018 was predicted from a linear trend model fitted to high school completers in 1999 through 2017.

Table B.2
Army Recruiting Rates, 2000–2018: Armed Forces Qualification Test Categories I, II, IIIA, and IIIB, as Percentages

	I		II		IIIA		IIIB	
Year	%Men	%Women	%Men	%Women	%Men	%Women	%Men	%Women
2000	2.7	0.4	5.3	1.3	8.1	2.2	8.3	2.6
2001	2.8	0.5	5.3	1.5	7.9	2.6	7.8	3.0
2002	3.5	0.5	5.3	1.4	7.1	2.2	6.6	2.3
2003	4.2	0.6	5.7	1.3	7.5	2.1	6.4	2.3
2004	5.5	0.7	7.2	1.5	9.4	2.3	7.9	2.4
2005	4.8	0.6	5.9	1.2	7.5	1.9	7.0	2.1
2006	4.0	0.5	5.1	1.1	5.9	1.6	6.6	2.1
2007	3.1	0.4	3.9	1.0	4.6	1.3	5.1	1.7
2008	3.1	0.4	4.1	1.0	4.9	1.3	5.7	1.9
2009	4.1	0.4	5.1	1.0	6.4	1.3	7.7	1.9
2010	4.4	0.6	5.5	1.2	6.7	1.7	8.5	2.5
2011	4.1	0.5	5.1	1.0	6.1	1.5	8.1	2.5
2012	3.3	0.4	4.9	0.9	6.4	1.3	7.9	2.0
2013	3.8	0.5	5.8	1.1	8.1	1.9	10.4	2.8
2014	3.0	0.4	4.8	0.9	7.1	1.7	8.7	2.3
2015	3.1	0.4	4.9	0.9	7.1	1.7	9.4	2.6
2016	3.0	0.4	4.7	0.9	6.5	1.5	8.9	2.5
2017	3.8	0.4	5.8	1.0	8.2	1.7	10.7	2.8
2018[a]	3.9	0.5	5.6	1.2	7.4	1.8	8.2	2.6

[a] Denominator is imputed.

Table B.3
Navy Recruiting Rates, 2000–2018: Armed Forces Qualification Test Categories I, II, IIIA, and IIIB, as Percentages

	I		II		IIIA		IIIB	
Year	%Men	%Women	%Men	%Women	%Men	%Women	%Men	%Women
2000	2.2	0.3	4.2	0.9	5.4	1.5	7.4	1.7
2001	1.9	0.3	3.9	1.1	5.2	1.8	7.3	1.9
2002	2.1	0.3	3.4	0.9	4.4	1.4	5.7	1.4
2003	2.2	0.3	3.5	0.8	4.3	1.4	5.5	1.1
2004	3.1	0.4	4.4	1.0	5.1	1.5	5.5	1.1
2005	2.9	0.4	4.5	0.9	5.9	1.4	6.6	1.3
2006	2.8	0.4	4.1	1.0	4.8	1.4	3.9	1.3
2007	2.2	0.3	3.2	0.8	3.8	1.2	3.8	1.2
2008	2.3	0.4	3.3	0.9	3.8	1.2	3.4	1.3
2009	2.9	0.5	3.9	1.1	4.3	1.4	3.2	1.0
2010	2.8	0.5	3.5	1.2	3.8	1.8	1.9	0.8
2011	3.2	0.6	3.8	1.3	4.2	1.9	1.1	0.7
2012	3.4	0.6	4.2	1.3	4.7	2.0	1.1	0.7
2013	3.7	0.6	4.5	1.5	5.3	2.3	2.2	1.2
2014	3.6	0.5	4.3	1.3	5.1	2.1	1.4	0.8
2015	3.5	0.6	4.5	1.4	5.4	2.3	1.2	0.9
2016	3.0	0.4	3.5	1.0	4.2	1.7	1.3	0.9
2017	3.8	0.5	4.5	1.3	5.4	2.3	2.2	1.2
2018[a]	3.3	0.5	4.1	1.2	4.5	1.9	3.3	1.9

[a] Denominator is imputed.

Table B.4
Marine Corps Recruiting Rates, 2000–2018: Armed Forces Qualification Test Categories I, II, IIIA, and IIIB, as Percentages

	I		II		IIIA		IIIB	
Year	%Men	%Women	%Men	%Women	%Men	%Women	%Men	%Women
2000	1.1	0.1	3.1	0.2	4.7	0.4	5.2	0.3
2001	1.1	0.1	3.1	0.3	4.8	0.5	5.2	0.4
2002	1.2	0.1	3.1	0.3	4.6	0.5	4.6	0.3
2003	1.5	0.1	3.5	0.3	4.7	0.5	4.5	0.3
2004	1.9	0.1	3.9	0.3	5.2	0.5	4.8	0.3
2005	2.0	0.1	4.2	0.3	5.7	0.5	5.8	0.5
2006	1.8	0.1	3.6	0.3	4.7	0.4	4.8	0.5
2007	1.7	0.1	3.4	0.3	4.3	0.4	4.6	0.5
2008	1.6	0.1	3.4	0.3	4.5	0.4	4.6	0.4
2009	1.7	0.1	3.5	0.3	4.6	0.5	4.4	0.4
2010	1.5	0.1	2.8	0.3	3.7	0.5	3.1	0.4
2011	1.6	0.1	3.3	0.3	4.4	0.5	3.2	0.4
2012	1.6	0.1	3.4	0.3	4.7	0.5	3.3	0.4
2013	1.7	0.2	3.7	0.4	5.2	0.6	3.9	0.5
2014	1.4	0.1	3.1	0.4	4.6	0.7	3.4	0.5
2015	1.5	0.1	3.5	0.4	5.4	0.7	3.9	0.4
2016	1.3	0.1	3.2	0.4	5.0	0.7	4.0	0.4
2017	1.8	0.2	4.1	0.4	6.1	0.8	4.9	0.5
2018[a]	1.6	0.2	3.5	0.5	4.9	0.7	4.3	0.6

[a] Denominator is imputed.

Table B.5
Air Force Recruiting Rates, 2000–2018: Armed Forces Qualification Test Categories I, II, IIIA, and IIIB, as Percentages

	I		II		IIIA		IIIB	
Year	%Men	%Women	%Men	%Women	%Men	%Women	%Men	%Women
2000	1.5	0.2	3.6	1.0	4.7	1.7	3.5	1.4
2001	1.6	0.3	3.7	1.2	4.7	1.9	3.2	1.4
2002	1.8	0.3	3.7	1.2	4.6	1.9	3.0	1.4
2003	2.2	0.4	4.1	1.2	4.8	1.9	2.5	1.0
2004	2.9	0.5	4.8	1.4	5.4	2.0	2.7	1.1
2005	1.8	0.3	2.7	0.8	3.3	1.1	1.7	0.6
2006	2.3	0.4	3.8	1.2	4.2	1.7	2.5	1.2
2007	1.8	0.3	3.1	1.0	3.3	1.4	2.1	1.0
2008	1.8	0.3	2.9	0.9	3.1	1.3	1.9	0.9
2009	2.7	0.4	4.0	1.0	4.1	1.4	2.3	0.9
2010	2.4	0.4	3.4	1.0	3.4	1.2	0.9	0.4
2011	2.5	0.4	3.9	1.1	4.2	1.5	0.1	0.1
2012	2.6	0.4	3.9	1.0	4.2	1.4	0.2	0.1
2013	2.4	0.4	3.8	1.1	4.0	1.3	0.2	0.1
2014	2.4	0.4	3.6	1.0	3.8	1.4	0.5	0.2
2015	2.3	0.3	3.5	1.0	3.5	1.3	0.8	0.3
2016	2.7	0.4	4.0	1.2	4.1	1.6	1.6	0.6
2017	3.0	0.4	4.3	1.2	4.5	1.7	2.1	0.9
2018[a]	2.6	0.5	3.6	1.2	3.7	1.5	1.8	0.9

[a] Denominator is imputed.

Regression Estimates

Table B.6
Logit Regression of Recruiting Rate for Armed Forces Qualification Test Categories I–IIIB, Army and Navy

	Army			Navy		
Variable	Coefficient	Standard error	*t*	Coefficient	Standard error	*t*
Pay ratio	–0.2750	(0.153)	–1.801	0.2060	(0.153)	1.345
Pay ratio × Cat I	0.280	(0.167)	1.672	0.508	(0.168)	3.029
Pay ratio × Cat II	0.018	(0.126)	0.140	0.076	(0.115)	0.668
Pay ratio × Cat IIIB	–0.087	(0.212)	–0.412	–0.360	(0.388)	–0.928
Recruiting goal	0.006	(0.002)	2.695	0.012	(0.005)	2.356
Deployment	–0.012	(0.007)	–1.880	–0.105	(0.060)	–1.737
Unemployment	0.023	(0.010)	2.167	0.006	(0.014)	0.414
Cat I	–1.181	(0.329)	–3.592	–1.450	(0.315)	–4.607
Cat II	–0.329	(0.242)	–1.358	–0.326	(0.214)	–1.521
Cat IIIB	0.123	(0.348)	0.355	0.558	(0.661)	0.844
Female	–1.351	(0.079)	–16.992	–1.133	(0.063)	–17.998
Female × Cat I	–0.699	(0.097)	–7.220	–0.996	(0.078)	–12.833
Female × Cat II	–0.167	(0.087)	–1.928	–0.279	(0.071)	–3.916
Female × Cat IIIB	0.201	(0.104)	1.930	0.181	(0.144)	1.257
Post-2009	0.015	(0.064)	0.232	0.153	(0.063)	2.412
Post-2009 × Cat IIIB	0.360	(0.093)	3.882	–0.881	(0.156)	–5.633
Constant	–2.643	(0.353)	–7.495	–3.838	(0.428)	–8.977
R-squared	0.972			0.949		
Observations	144			144		
Pay ratio I	0.005	(0.167)	0.030	0.713	(0.202)	3.530
Pay ratio II	–0.257	(0.125)	–2.050	0.282	(0.139)	2.030
Pay ratio IIIA	–0.275	(0.153)	–1.801	0.206	(0.153)	1.345
Pay ratio IIIB	–0.362	(0.178)	–2.040	–0.154	(0.419)	–0.370

NOTE: Table shows the results of regressions of the logit recruiting rate on the given variables. Robust standard errors are shown. The reference category is category IIIA. The final three rows show the estimate for the pay ratio and the given category by combining the coefficient for pay ratio and the relevant interaction term.

Table B.7
Logit Regression of Recruiting Rate for Armed Forces Qualification Test Categories I–IIIB, Marine Corps and Air Force

	Marine Corps			Air Force		
Variable	Coefficient	Standard error	*t*	Coefficient	Standard error	*t*
Pay ratio	0.3780	(0.122)	3.098	0.0760	(0.126)	0.600
Pay ratio × Cat I	0.090	(0.131)	0.685	0.712	(0.221)	3.226
Pay ratio × Cat II	–0.044	(0.113)	–0.391	0.256	(0.135)	1.899
Pay ratio × Cat IIIB	–0.014	(0.208)	–0.068	0.217	(0.655)	0.330
Recruiting goal	–0.010	(0.005)	–1.836	0.032	(0.005)	6.084
Deployment	0.007	(0.007)	1.057	–0.098	(0.099)	–0.987
Unemployment	–0.030	(0.008)	–3.509	–0.044	(0.031)	–1.438
Cat I	–1.340	(0.247)	–5.427	–1.901	(0.412)	–4.617
Cat II	–0.276	(0.202)	–1.362	–0.559	(0.244)	–2.286
Cat IIIB	–0.025	(0.361)	–0.069	–0.875	(1.090)	–0.803
Female	–2.363	(0.054)	–43.408	–1.033	(0.055)	–18.732
Female × Cat I	–0.347	(0.069)	–5.061	–1.022	(0.083)	–12.277
Female × Cat II	–0.103	(0.064)	–1.603	–0.333	(0.064)	–5.211
Female × Cat IIIB	–0.111	(0.094)	–1.186	0.029	(0.277)	0.104
Post-2009	0.003	(0.048)	0.059	–0.002	(0.084)	–0.024
Post-2009 × Cat IIIB	–0.161	(0.083)	–1.938	–1.614	(0.330)	–4.892
Constant	–3.201	(0.292)	–10.973	–3.877	(0.247)	–15.713
R-squared	0.990			0.895		
Observations	144			144		
Pay ratio I	0.468	(0.111)	4.220	0.788	(0.262)	3.010
Pay ratio II	0.334	(0.091)	3.680	0.331	(0.168)	1.980
Pay ratio IIIA	0.378	(0.122)	3.098	0.076	(0.126)	0.600
Pay ratio IIIB	0.364	(0.177)	2.050	0.292	(0.675)	0.430

NOTE: Table shows the results of regressions of the logit recruiting rate on the given variables. Robust standard are errors shown. The reference category is category IIIA. The final three rows show the estimate for the pay ratio and the given category by combining the coefficient for pay ratio and the relevant interaction term.

Table B.8
Logit Regression of Share of Non–High School Diploma Graduate Accessions for Armed Forces Qualification Test Categories I–IIIB, Army and Navy

	Army			Navy		
Variable	Coefficient	Standard error	*t*	Coefficient	Standard error	*t*
Pay ratio	0.3010	(0.232)	1.296	0.2900	(0.311)	0.930
Pay ratio × Cat I	1.043	(0.274)	3.810	1.623	(0.353)	4.597
Pay ratio × Cat II	0.428	(0.200)	2.140	0.428	(0.302)	1.417
Pay ratio × Cat IIIB	0.997	(0.650)	1.533	–0.102	(0.719)	–0.142
Recruiting goal	0.001	(0.008)	0.113	0.047	(0.008)	6.128
Deployment	0.033	(0.017)	1.916	–0.621	(0.137)	–4.523
Unemployment	–0.158	(0.030)	–5.268	–0.015	(0.029)	–0.513
Cat I	–3.480	(0.491)	–7.087	–4.045	(0.603)	–6.705
Cat II	–1.299	(0.371)	–3.501	–1.192	(0.511)	–2.332
Cat IIIB	–2.227	(1.029)	–2.165	–1.392	(1.195)	–1.165
Female	–0.801	(0.110)	–7.276	–0.652	(0.162)	–4.017
Female × Cat I	0.053	(0.154)	0.344	–0.304	(0.234)	–1.296
Female × Cat II	0.001	(0.135)	0.004	–0.013	(0.198)	–0.064
Female × Cat IIIB	–0.202	(0.329)	–0.614	0.227	(0.277)	0.818
Post-2009	–1.107	(0.134)	–8.248	–1.015	(0.140)	–7.262
Post-2009 × Cat IIIB	–0.703	(0.406)	–1.732	0.271	(0.382)	0.710
Constant	–0.773	(0.835)	–0.927	–3.718	(0.718)	–5.178
R-squared	0.849			0.799		
Observations	143			144		
Pay ratio I	1.344	(0.309)	4.340	1.912	(0.349)	5.480
Pay ratio II	0.729	(0.239)	3.050	0.718	(0.304)	2.360
Pay ratio IIIA	0.301	(0.232)	1.296	0.290	(0.311)	0.930
Pay ratio IIIB	1.298	(0.636)	2.040	0.187	(0.723)	0.260

NOTE: Table shows the results of regressions of the logit recruiting rate on the given variables. Robust standard errors are shown. The reference category is category IIIA. The final three rows show the estimate for the pay ratio and the given category by combining the coefficient for pay ratio and the relevant interaction term.

Table B.9
Logit Regression of Share of Non–High School Diploma Graduate Accessions for Armed Forces Qualification Test Categories I–IIIB, Marine Corps and Air Force

	Marine Corps			Air Force		
Variable	Coefficient	Standard error	*t*	Coefficient	Standard error	*t*
Pay ratio	0.5070	(0.367)	1.383	1.2990	(0.319)	4.076
Pay ratio × Cat I	1.823	(0.362)	5.033	–1.927	(0.399)	–4.834
Pay ratio × Cat II	0.282	(0.310)	0.908	–1.410	(0.345)	–4.083
Pay ratio × Cat IIIB	0.535	(0.470)	1.138	–0.062	(0.474)	–0.130
Recruiting goal	0.049	(0.014)	3.492	–0.014	(0.009)	–1.577
Deployment	–0.059	(0.015)	–3.931	–0.619	(0.111)	–5.586
Unemployment	–0.088	(0.025)	–3.439	0.274	(0.040)	6.895
Cat I	–3.787	(0.652)	–5.812	3.616	(0.737)	4.905
Cat II	–0.761	(0.549)	–1.385	2.948	(0.645)	4.570
Cat IIIB	–1.148	(0.776)	–1.480	0.066	(0.773)	0.085
Female	–0.685	(0.132)	–5.178	–0.534	(0.169)	–3.168
Female × Cat I	–0.197	(0.223)	–0.884	0.672	(0.210)	3.196
Female × Cat II	0.083	(0.165)	0.505	0.435	(0.191)	2.282
Female × Cat IIIB	–0.186	(0.213)	–0.871	–0.027	(0.270)	–0.099
Post-2009	–0.776	(0.176)	–4.410	0.244	(0.131)	1.859
Post-2009 × Cat IIIB	–0.535	(0.235)	–2.277	–0.001	(0.261)	–0.004
Constant	–4.388	(0.662)	–6.625	–7.244	(0.640)	–11.312
R-squared	0.708			0.721		
Observations	142			144		
Pay ratio I	2.330	(0.331)	7.040	–0.628	(0.371)	–1.690
Pay ratio II	0.789	(0.279)	2.830	–0.111	(0.317)	–0.350
Pay ratio IIIA	0.507	(0.367)	1.383	1.299	(0.319)	4.076
Pay ratio IIIB	1.042	(0.344)	3.030	1.237	(0.365)	3.390

NOTE: Table shows the results of regressions of the logit recruiting rate on the given variables. Robust standard are errors shown. The reference category is category IIIA. The final three rows show the estimate for the pay ratio and the given category by combining the coefficient for pay ratio and the relevant interaction term.

APPENDIX C

Additional Graphs Comparing Regular Military Compensation Percentiles in Least and Most Urban States

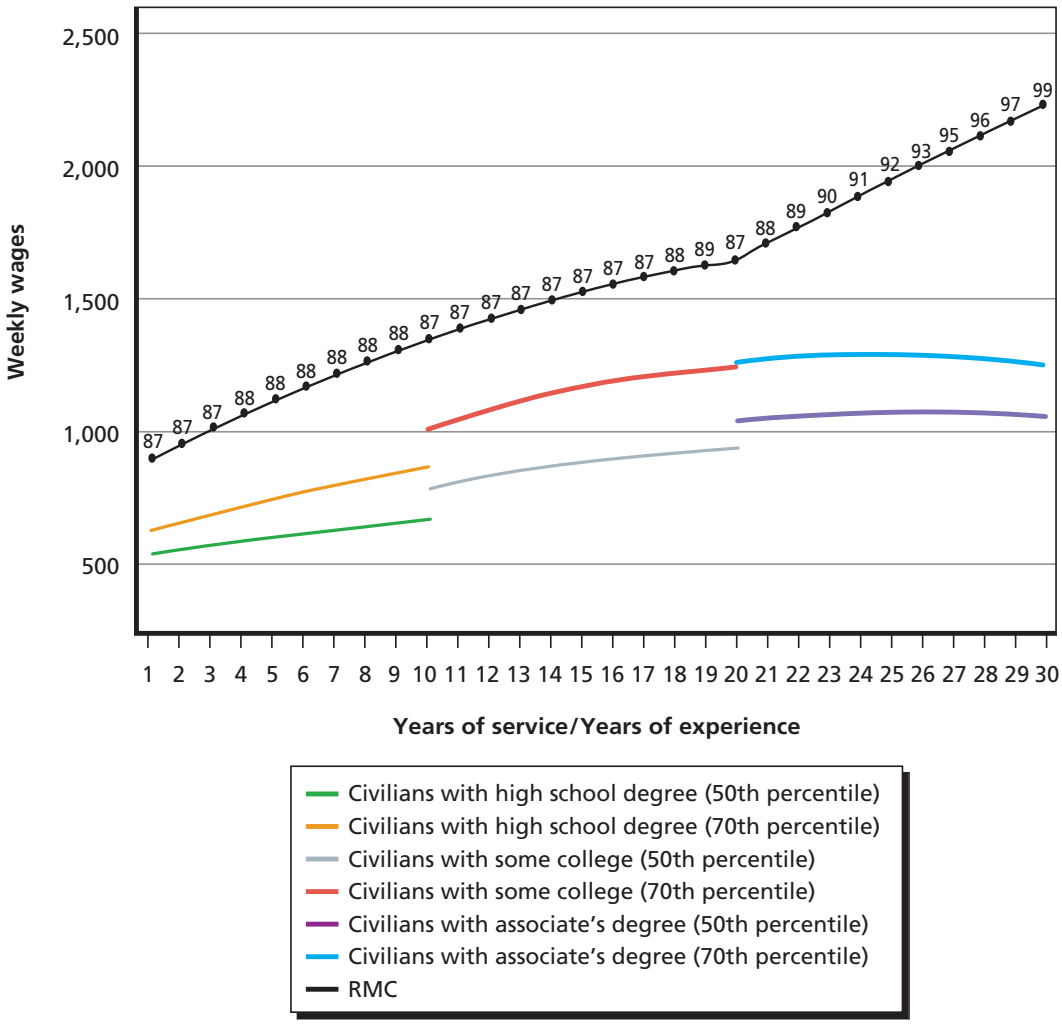
In Figures C.1 through C.4 we repeat versions of Figures 2.1b and 2.2, which show RMC by year of service compared with civilian wages. We use data from the Greenbooks and weight the CPS data based on the military gender mix. Figures C.1 and C.2 examine how enlisted RMC compares with civilian wages using high school graduates as the reference group for the first nine years of a career, those with some college as the reference group for those with 10–19 years of service, and those with an associate's degree for those enlisted with 20–30 years of service. Figure C.1 shows RMC compared with civilian wages for civilians who live in the least urban states. Figure C.2 shows RMC compared with civilian wages for civilians who live in the most urban states. RMC is a higher percentile of civilian wages compared with civilians who live in the most urban versus the least urban states for years one through nine.[1] This pattern flips as we compare RMC with civilians with more years of formal education as years of service increase. However, differences between the percentiles in the least and most urban states are relatively small for less-educated workers.

In Figures C.3 and C.4 we compare RMC for officers from the Greenbooks with civilians with bachelor's degrees (1–9 years of service) and master's degrees or more (10–30 years of service). While exhibiting a similar overall pattern to that found in Figure 2.2, officer RMC is at

[1] This may be due to more competition for low-skilled jobs in these areas, which leads to lower civilian wages; a full analysis is beyond the scope of this report.

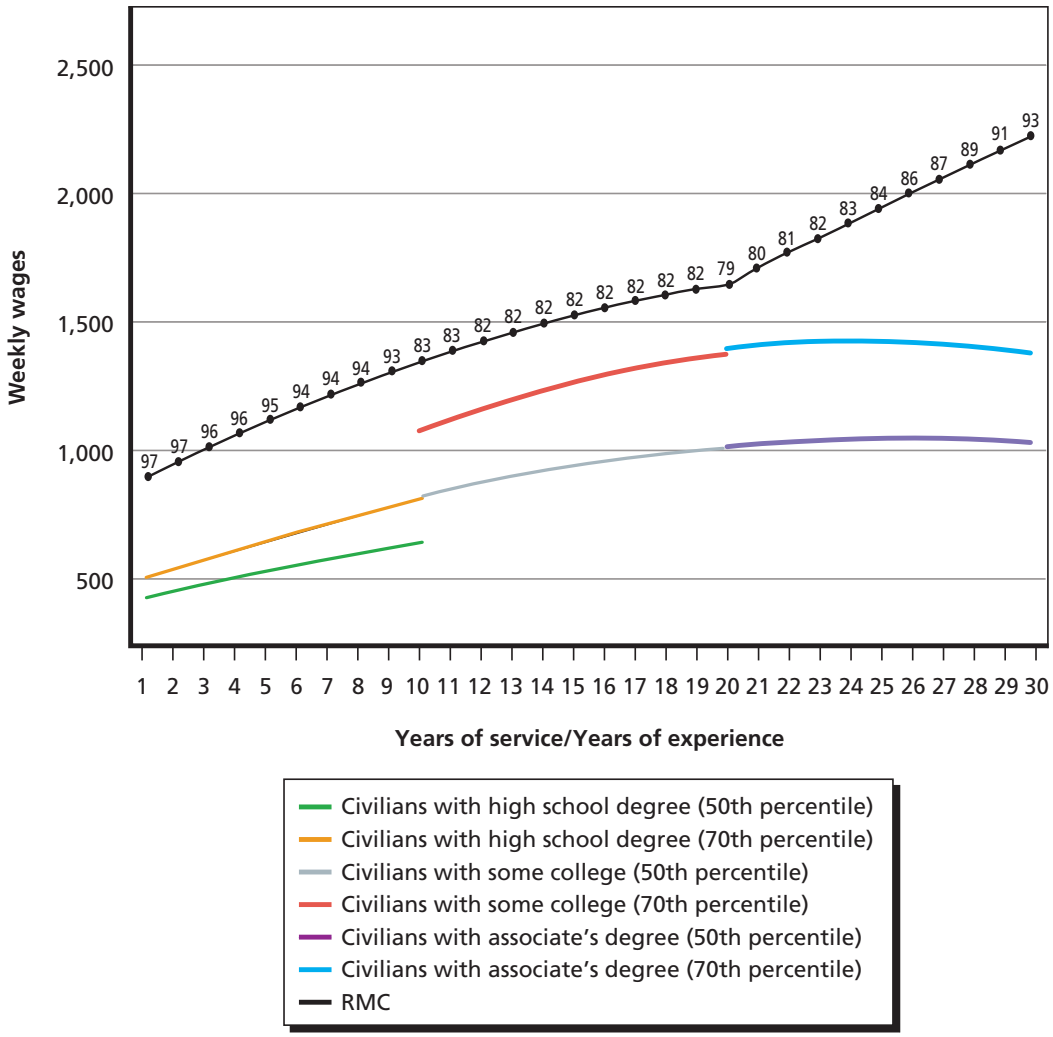
a persistently and substantially higher percentage of civilian pay in the least urban states than in the most urban states; in most cases the difference is more than ten percentiles.

Figure C.1
Enlisted Regular Military Compensation, Civilian Wages for Civilians in the Least Urban States, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with High School, Some College, or Associate's Degree, 2017



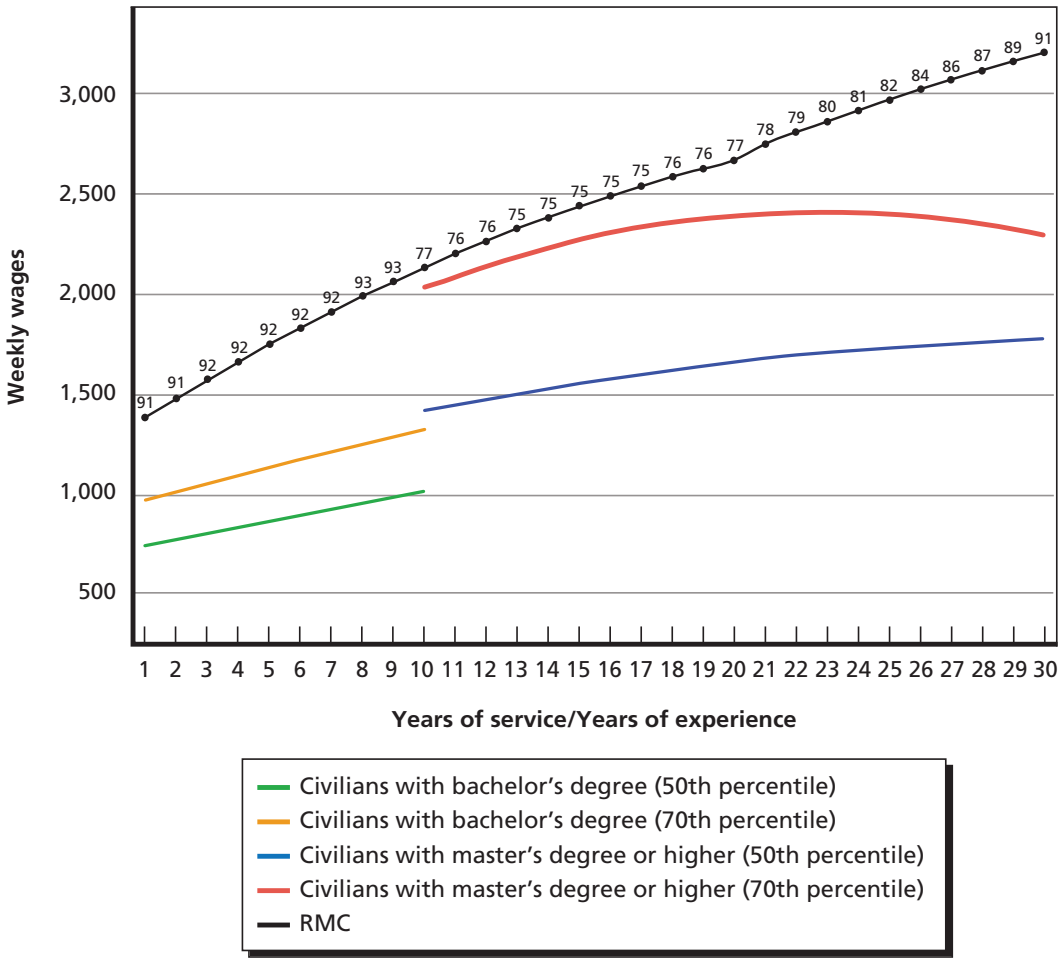
SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = high school, 10–19 = some college, and 20–30 = associate's degree). We weighted civilian-wage data by enlisted military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC; and the number above the black line is the percentile in the wage distribution for high school, some college, and associate's degree. Data are smoothed.

Figure C.2
Enlisted Regular Military Compensation, Civilian Wages for Civilians in the Most Urban States, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with High School, Some College, or Associate's Degree, 2017



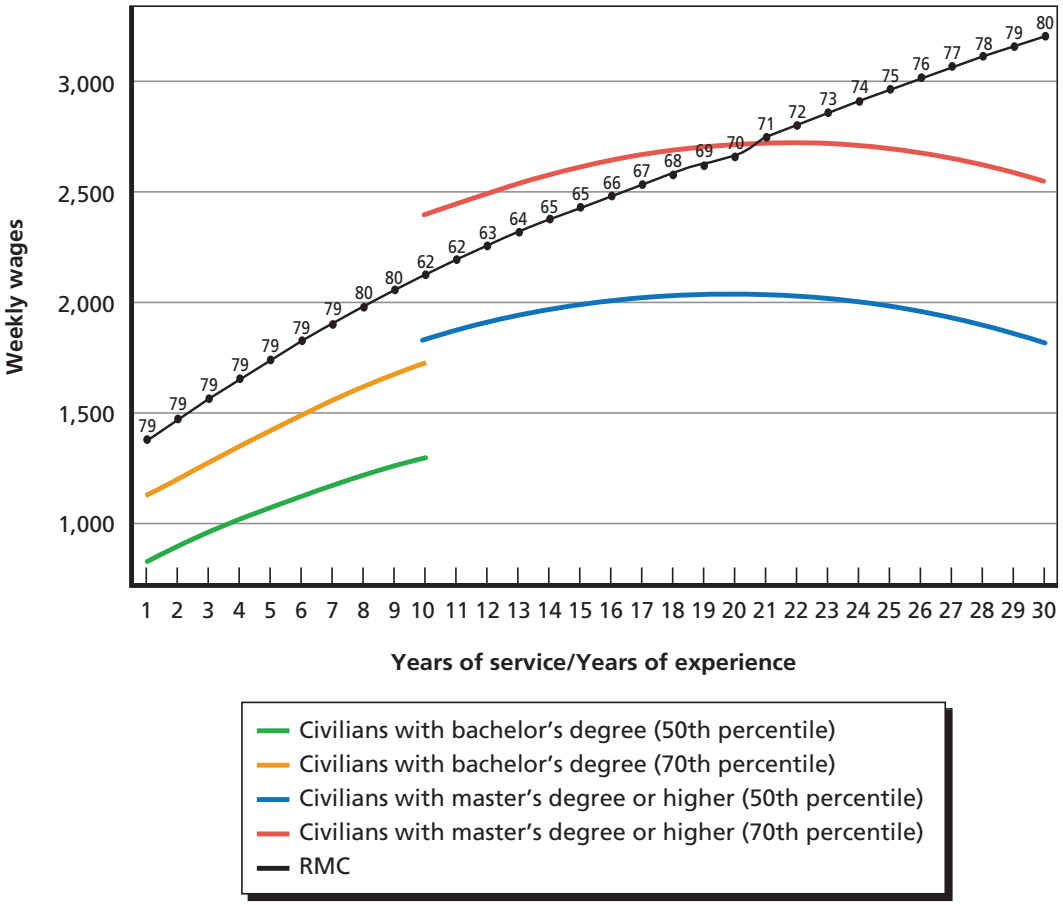
SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = high school, 10–19 = some college, and 20–30 = associate's degree). We weighted civilian-wage data by enlisted military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC; and the number above the black line is the percentile in the wage distribution for high school, some college, and associate's degree. Data are smoothed.

Figure C.3
Officer Regular Military Compensation, Civilian Wages for Civilians in the Least Urban States, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with Bachelor's Degree or with Master's Degree or Higher, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = bachelor's degree, 10–30 = master's degree or higher). We weighted civilian-wage data by military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC, and the numbers above the black line are the percentile in the wage distribution for a bachelor's degree and for a master's degree or higher. Data are smoothed.

Figure C.4
Officer Regular Military Compensation, Civilian Wages for Civilians in the Most Urban States, and Regular Military Compensation Percentiles for Full-Time, Full-Year Workers with Bachelor's Degree or with Master's Degree or Higher, 2017



SOURCES: Directorate of Compensation, 2017; U.S. Census Bureau, 2018.
NOTE: RMC percentile varies by YOS (1–9 = bachelor's degree, 10–30 = master's degree or higher). We weighted civilian-wage data by military gender mix. Colored lines are smoothed wage curves for the 50th and 70th percentiles of the given level of education. The black line is enlisted RMC, and the numbers above the black line are the percentile in the wage distribution for a bachelor's degree and for a master's degree or higher. Data are smoothed.

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Given an all-volunteer force, compensation and benefits are critical for attracting and retaining the quantity and quality of military personnel necessary for the United States to achieve its military goals. The military must set pay high enough to draw quality recruits away from other jobs that they could obtain, while also appropriately managing public funds. Analyzing data from 1999, the Ninth Quadrennial Review of Military Compensation (QRMC) recommended in 2002 that regular military compensation (RMC)—which is the sum of basic pay, basic allowance for housing, basic allowance for subsistence, and the federal tax advantage resulting from allowances not being taxed—be at around the 70th percentile of comparably-educated civilian wages. The authors' analysis indicates that RMC has consistently remained above that benchmark and has thus continued to support readiness. The authors also found that as the RMC/wage ratio increased over time, recruit quality increased in the Navy, Marine Corps, and Air Force, but not in the Army. In addition, they saw large differences in how RMC compares with civilian pay across geographies for individuals of different education levels: Whereas officers and those with more education in general are likely to find military pay higher relative to civilian pay if they live in less urban areas, enlisted military with a high school degree are likely to find military pay as attractive in urban as in nonurban areas. On average, RMC in 2017 was at the 85th percentile for active-component enlisted personnel and at the 77th percentile for active-component officers.

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Thrift Savings Plan Contributions under the Blended Retirement System

Dan Leeds, Josh Horvath, and Chris Gonzales

DRM-2019-U-021622-Final

Abstract

The Blended Retirement System aims to increase Servicemembers' retirement savings by matching contributions to Thrift Savings Plans by up to five percent of basic pay. This new system applies to Servicemembers who entered uniformed service on January 1, 2018, or later, or to Servicemembers with early entry dates and fewer than 12 years of service who opted in to the new system during 2018. This report analyzes Thrift Savings Plan contributions by Active component Servicemembers, across Services, eligibility categories, and Servicemember characteristics. We find that age, regular military compensation, paygrade, race, and gender are all correlated to varying degrees with retirement savings rates. In particular, older and higher income Servicemembers save at higher rates. We also find substantial differences across Services in the savings patterns of auto-enrollees, suggesting differences in training or messaging. Furthermore, some Servicemembers may be saving inefficiently by reaching the annual limit on TSP contributions prior to December and thereby forgoing matching funds.

This work was performed under Federal Government Contract No. N00014-16-D-5003.

Cover image credit: Col Darren Halford, 9th Operations Group commander (left), presents CMSgt James Crites, 9th Operations Group superintendent, his shadow box during Crites' retirement ceremony at Beale Air Force Base, CA, Jan. 9, 2015. Crites served more than 30 years in the Air Force. (US Air Force photo by Senior Airman Bobby Cummings/Released)

Approved by: **September 2019**

Anita U. Hattiangadi, Program Director
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Resources and Force Readiness Division

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Executive Summary

The Blended Retirement System (BRS), implemented in 2018, aims to make Servicemembers more active participants in retirement saving. It does so by lowering the pension payments automatically available to Servicemembers upon completing 20 years of service (YOS) and instead automatically contributing an amount equal to one percent of the member's basic pay to the member's retirement savings account and by matching the member's voluntary contributions to that retirement savings account. This allows Servicemembers to retain their retirement savings if they leave before qualifying for a pension, but means that career Servicemembers who do not proactively save for retirement will be worse off than under the previous system. This report examines how Servicemembers save for retirement and the characteristics associated with higher retirement contributions as a first step in determining whether these contributions are offsetting the reduction in pension payments.

Prior to the BRS, the Department of Defense (DOD) used a cliff-vesting pension program. Servicemembers became vested in the program (i.e., eligible for pension payments) only after 20 years of service (YOS), and received no pension benefit if they left the military prior to 20 YOS. The BRS instead provides benefits that Servicemembers may access even if they do not reach 20 YOS, while encouraging them to actively participate in their retirement planning. The BRS reduces the payment associated with the cliff-vesting program, but it compensates for the reduction by incentivizing participation in the Thrift Savings Plan (TSP), a retirement savings plan that vests member and matching contributions immediately and that vests automatic contributions after two years of service. It does so by matching Servicemembers' contributions at a 100 percent rate up to 3 percent of basic pay and at a 50 percent rate between three and five percent of basic pay. BRS participants also receive an automatic contribution equal to 1 percent of their basic pay regardless of their contribution rate; thus, the government will contribute between 1 percent (for Servicemembers who make no contribution) and 5 percent (for Servicemembers who contribute at least 5 percent) of a Servicemember's basic pay. Servicemembers who are ineligible for the BRS or who opt to remain in the legacy pension system still may contribute to the TSP, but they do not receive any matching funds or automatic contributions.

The BRS was implemented on January 1, 2018; TSP contributions prior to this date did not receive matching funds, regardless of a Servicemember's eventual BRS enrollment status. Servicemembers with Dates of Initial Entry into Military Service (DIEMS dates) or Dates of Initial Entry into Uniformed Service (DIEUS dates) on or after January 1, 2018 were automatically enrolled in the BRS, though they will receive matching benefits only after two

YOS. Those with DIEMS/DIEUS dates prior to January 1, 2018 could opt in to the BRS at any point in 2018 if they had fewer than 12 YOS, but they became ineligible upon reaching 12 YOS. Servicemembers who opted in to the BRS began receiving matching funds immediately, regardless of their YOS at the time of opt-in. Servicemembers who failed to opt in by the end of 2018 became ineligible for the BRS at the beginning of 2019.

This report examines how TSP contributions vary by Service, eligibility category, and Servicemember characteristics, using aggregate-level data provided by the Defense Manpower Data Center (DMDC) (for the Marine Corps) and TSP data (for the Army, Navy, and Air Force). We used different datasets because only the Marine Corps provided usable TSP data to DMDC in 2018. Each dataset has strengths and weaknesses—DMDC data let us observe Servicemembers' characteristics but did not show whether they had an active TSP account or had opted in to the BRS (if eligible), whereas TSP provided data on only Servicemembers enrolled in the BRS. We examined how the Marine Corps' contribution patterns varied prior to and during BRS implementation, along with how Marines who were ineligible for the BRS may have been affected during this process, but we could not determine whether contribution rates among eligible Marines changed because they planned to opt in to the BRS or because they were better informed about retirement savings more generally. Conversely, we could clearly view behavior by Soldiers, Sailors, and Airmen who opted in to the BRS, but we had a far more limited set of characteristics by which to evaluate them and could not observe how their behavior changed prior to or immediately upon opting in.

Our principal findings include the following:

- Auto-enrolled Servicemembers from all four Services are more likely than those who opted in to contribute the default rate of 3 percent.
- Soldiers and Airmen were much more likely than Sailors or Marines to make the default TSP contribution of three percent of basic pay, likely reflecting Service-level differences in BRS implementation.
- Both BRS-eligible and BRS-ineligible Marines became much more likely to contribute to the TSP in the May 2017 pay data, likely reflecting both Corps-wide education on the BRS and positive spillover effects.
- Age, regular military compensation (RMC), and paygrades (both enlisted and officer) exhibited clear correlations with contribution levels, as predicted by research on civilian retirement saving.
- Some Servicemembers may be contributing to the TSP at too high a rate and forgoing matching funds by reaching the elective deferral limit prior to December. This issue can likely be addressed at low cost to the Services.

Contents

Introduction

The Blended Retirement System (BRS), implemented in January 2018, aims to make Servicemembers more active participants in retirement saving. It does so by lowering the pension payments automatically available to Servicemembers upon completing 20 years of service (YOS) and instead automatically contributing an amount equal to one percent of the member's basic pay to that member's Thrift Savings Plan (TSP) account and matching a portion of voluntary contributions to the TSP. Servicemembers who exit the uniformed services prior to 20 YOS will retain their TSP contributions, but BRS participants who do not proactively save for retirement will receive lower pension payments without sufficient TSP savings to offset the difference.

Servicemembers entering after January 1, 2018, are automatically enrolled in the BRS. Those who entered before this date could opt in to the BRS at any point in 2018, provided they had not completed 12 YOS before choosing to opt in. Eligible Servicemembers who did not opt in to the BRS remained in the legacy system and became BRS-ineligible on January 1, 2019. Considering that some Servicemembers had a choice to enroll in the BRS and some did not, this study has three main objectives:

1. Describe the contribution patterns of opt-in BRS participants.
2. Describe the contribution patterns of auto-enrolled BRS participants.
3. Identify differences in contribution rates by Service, paygrade, gender, and other relevant factors.

We used data from the Defense Manpower Data Center (DMDC) pay records and the TSP Office. The DMDC data contain information for only the Marine Corps on Servicemember eligibility for the BRS, those auto-enrolled, and contribution percentages. The data also contain information on Servicemember paygrade, age, regular military compensation (RMC) level, gender, race, and Hispanic ethnicity. Using this information, we examined Marine Corps TSP contribution rates by various demographic and socioeconomic characteristics.

The TSP Office provided data on Soldiers, Sailors, and Airmen; however, these data do not contain as much demographic information as those from DMDC. Using the TSP Office data, we examined contribution patterns among auto-enrollees and among Servicemembers who opted in to the BRS. However, we did not have data on Soldiers, Sailors, or Airmen who remained in the legacy retirement system or data from prior to any Servicemember's BRS enrollment.

Furthermore, we could examine differences in participation and contribution patterns only by age and basic pay.

The rest of the paper is organized as follows. We start by providing background information about the BRS, previous studies on the BRS, and the literature on civilian retirement plans that are relevant to this study. Then, we show participation and contribution patterns of opt-in and auto-enrolled participants. As part of this analysis, we emphasize overall Service-level differences over time; differences between older. Finally, we conclude with a discussion of the implications of our results and how they relate to the single-salary system.

Background

The fiscal year (FY) 2013 National Defense Authorization Act (NDAA) established the Military Compensation and Retirement Modernization Commission (MCRMC) to review and make recommendations regarding compensation and retirement reform in the military [2]. The commission was established in response to concerns over the legacy retirement system, which provides a defined benefit plan that is vested upon 20 YOS. According to some, this system is inflexible as a force-shaping tool because of its one-size-fits-all nature. It is inefficient because Servicemembers generally are younger and place a higher value on current rather than deferred income. And finally, it is inequitable because most officers and enlisted personnel do not meet the vesting cliff of 20 YOS [3].

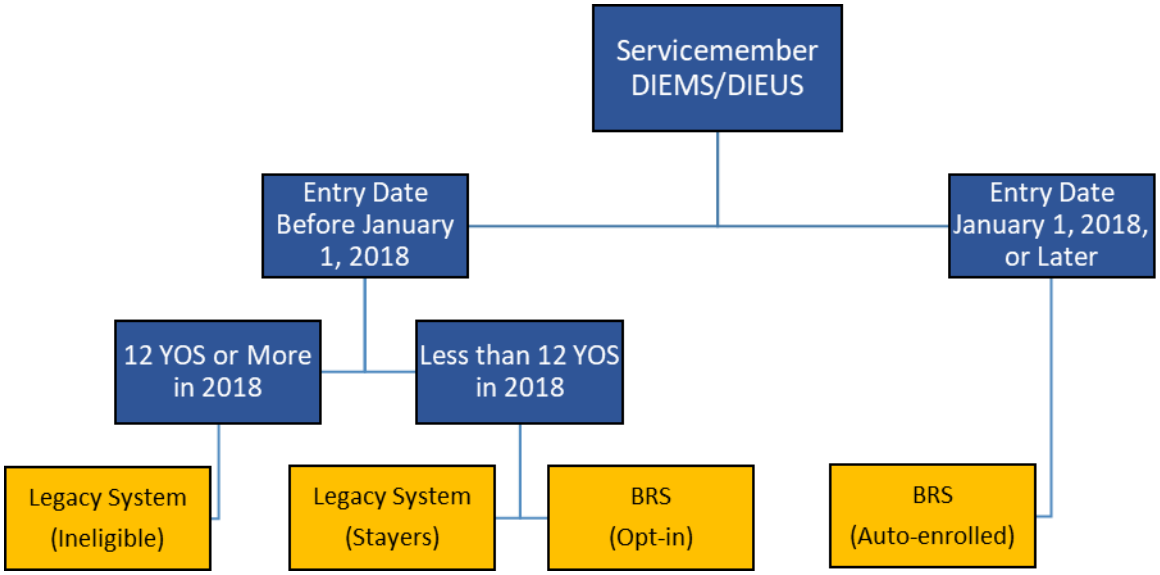
Responding to these concerns, the goals for a new retirement system were to maintain the current force structure, reduce personnel costs, and provide some retirement benefits to Servicemembers leaving before 20 YOS [4-5]. The final MCRMC report, released in January 2015, provided several recommendations intended to accomplish these goals [6]. Based on these recommendations, the FY 2016 NDAA established the BRS, to be implemented in January 2018 [7]. Before we discuss the changes to the retirement system in more detail, we describe BRS eligibility requirements.

BRS eligibility

BRS eligibility is determined by date of entry[1] into the Uniformed Services and YOS. Servicemembers entering on or after January 1, 2018, are automatically enrolled in the BRS and do not participate in the legacy system. Active component (AC) personnel with less than 12 YOS who entered before January 1, 2018 were eligible to opt in to the BRS between January 1, 2018, and December 31, 2018. Those who did not opt in remained in the legacy system. Those with 12 or more YOS were ineligible to enroll in the BRS and remained under the legacy system. Figure 1 shows the different paths to the BRS and the legacy system depending on the date of entry and YOS. Essentially, this results in four groups of interest: BRS auto-enrolled participants, BRS opt-in participants, legacy system stayers, and Servicemembers ineligible for the BRS.

[1] This is the date of initial entry to military service (DIEMS) or the date of initial entry to uniformed services (DIEUS).

Figure 1. Retirement system eligibility



Source: CNA generated.
Note: DIEMS—Date of Initial Entry to Military Service. DIEUS—Date of Initial Entry to Uniformed Services. Servicemembers entering before January 1, 2018 with less than 12 YOS were grandfathered into the legacy system, but could choose to opt in to the BRS in 2018.

Elements of the BRS

The BRS instituted the following four main changes to the military retirement system [7]:[2]

- The establishment of Department of Defense (DOD) automatic and matching contributions to a thrift savings plan (TSP)[3]
- The reduction of the defined benefit plan monthly annuity payment multiplier
- The establishment of continuation pay at 12 YOS[4]
- The establishment of a lump-sum retirement option

[2] The Office of Financial Readiness provides a succinct guide to these four BRS elements [8].

[3] TSP has existed since 1986 as a federal program available to civilian employees. In FY2001, the Floyd D. Spence National Defense Authorization Act extended the TSP to military personnel. In general, Servicemembers did not receive matching contributions until the establishment of the BRS [9].

[4] This has since been updated; Servicemembers are now able to receive continuation pay any time between 8 and 12 YOS, though Services may determine the timing and amount.

This paper focuses on the TSP component of the BRS; however, Servicemembers make decisions regarding TSP based on the entire military retirement package. Therefore, we describe each aspect of the BRS system in more detail.

TSP defined contribution plan

TSP is a defined contribution plan, which means its retirement value depends on the contributions of the employer and employee and on market performance after contributions have been made. Once a TSP account has been set up for a Servicemember, which typically takes 60 days from application, an automatic contribution of 1 percent of basic pay is made from the Services, regardless of what the Servicemember contributes. Servicemembers are allowed to make additional contributions within the limits set by the Internal Revenue Service.[5] In addition, the Services will match up to 4 percent of basic pay if a Servicemember contributes 5 percent of basic pay (see Table 1 for more details). Servicemembers opting in to the BRS choose initial contribution rates. Servicemembers automatically enrolled are started at 3 percent, although they can adjust this amount at any time. Servicemembers who opt in to the BRS receive Service matching contributions immediately, regardless of YOS. For auto-enrolled Servicemembers, matching starts after 2 YOS.

Table 1. BRS Servicemember contribution and Service matching contributions

Servicemember Contribution	Service Automatic (1%) Contribution	Service Matching Contribution	Total Contribution
0.0%	1.0%	0.0%	1.0%
1.0%	1.0%	1.0%	3.0%
2.0%	1.0%	2.0%	5.0%
3.0%	1.0%	3.0%	7.0%
4.0%	1.0%	3.5%	8.5%
5.0%	1.0%	4.0%	10.0%
>5.0%	1.0%	4.0%	>10.0%

The TSP allows Servicemembers to receive some retirement benefits if they serve fewer than 20 years. In contrast, the legacy retirement system provided a defined benefit plan that became vested only after 20 or more YOS. In other words, if a Servicemember did not serve 20 or more years, he or she received no retirement benefit from the military. With TSP, Servicemembers

[5] Contribution limits change over time, but in 2018 the limit on Servicemember contributions to TSP was $18,500. This does not include Service matching contributions. The total cap on Servicemember contributions and Service matching contributions was $55,000 in 2018. Individuals 50 years old or older can make catch-up contributions up to $6,000.

become vested (have ownership) of the Service's automatic 1 percent contribution after two YOS. Servicemembers always are vested in their own contributions and their earnings. Servicemembers are immediately vested in Service matching contributions and their earnings.

Servicemembers who do not participate in BRS, either because they are ineligible or because they opted to stay with the legacy system, may still contribute to the TSP. They will not receive Service matching contributions, but will still receive all tax advantages that come with retirement savings accounts.

Defined contributions

Both the legacy system and the BRS have a defined benefit component. The difference is that under the BRS, the defined benefit multiplier was changed from 2.5 percent to 2.0 percent. The formula for calculating the monthly pension payment for life is 2.0 percent × years served × average of highest 36 months of basic pay. This implies that the longer the service, the higher the monthly pension payment. Payments are adjusted for cost of living over time.

Continuation pay

Under the BRS, AC Servicemembers between 8 and 12 YOS are eligible for continuation pay (CP), which is a one-time bonus of between 2.5 to 13 times regular pay in exchange for 3 or more years of additional service [8]. Currently, all Services set the timing of CP for AC personnel to 12 YOS with a multiplier of 2.5 and an additional commitment of 4 years of service [10]. However, Services may adjust the timing, multiplier, or additional commitment within the bounds mentioned above. CP adds flexibility and is an adjustable lever for the Services to affect retention. Under the BRS, CP offsets potential declines in retention due to the decreased defined benefit multiplier. Servicemembers may contribute CP to the TSP.

Lump-sum retirement option

Finally, between the age of military retirement and the age of Social Security retirement, Servicemembers may elect to receive a portion of their future retirement payments in a discounted lump sum paid at the time of retirement from military service. Servicemembers can choose to receive 25 or 50 percent of future payments. This implies that the monthly retirement pay until Social Security retirement age will be 75 or 50 percent of the full monthly value if the lump-sum option is chosen. Once a person reaches full Social Security age, which is usually 67, the payments will revert to their full value. The lump-sum option is available at retirement upon 20 or more YOS, and Servicemembers must make the lump-sum election no less than 90 days before retirement.

Literature Review

We divide the literature review into two sections. The first examines studies conducted before BRS implementation that either discuss or simulate the possible effects of BRS on force structure, retention, and personnel costs. The second reviews papers on civilian retirement plans, including enrollment rates, employer match rates, and employee contribution rates. Private-sector defined contribution plans are comparable to TSP and can inform the analysis in this report.

BRS literature

We begin the BRS literature review by discussing the analysis that laid the groundwork for MCRMC's BRS plan and the subsequent analysis of the potential implications of BRS. These studies do not analyze Servicemember behavior under BRS; rather, they use simulation or other methods to infer how BRS may affect Servicemember behavior and DOD personnel costs. We close with a discussion of a paper that analyzes actual Servicemember behavior under BRS.

Simulation papers and discussion papers

In 2011, the Office of the Secretary of Defense convened a DOD working group to review military compensation. Between 2011 and 2013, RAND provided analytic support to this group as it considered two concepts. Asch et al. (2014) use RAND's dynamic retention model (DRM) to evaluate the effects of a hybrid retirement plan that combines a reduced defined benefit with a defined contribution plan and continuation pay. They find that the blended approach can maintain the current force structure while decreasing personnel costs and increasing flexibility in using the system as a retention tool [16].

The DOD working group developed two concepts that were given to MCRMC, and the MCRMC BRS plan was, in part, based on the working group concepts. Evaluating the MCRMC plan, Asch et al. (2015) use RAND's DRM to find that the BRS plan could maintain force structure while decreasing cost, adding flexibility, and being valuable to Servicemembers because of early vesting in the defined contribution plan and the lump-sum option [3]. Finally, Asch et al. (2017) use the DRM to further analyze the BRS with a focus on retention and cost effects, as well as add a Coast Guard analysis.[6] They find that the enlisted CP multiplier can be set at or

[6] See Asch et al. (2019) for a detailed analysis of the effects of BRS on the Army Reserve [17].

near the floor of 2.5 to achieve baseline retention, but the officer continuation pay multiplier would have to be higher.

Grefer and coauthors also produced several analyses of BRS. The first study, Grefer (2016), examines the potential effects of the MCRMC's BRS plan assumptions on recruitment, retention, and personnel costs in the Navy and Marine Corps [5]. He concludes that young enlisted recruits may prefer the new system, but officers may prefer the old system if they perceive TSP to be a series of short-term investments. To maintain the current length of service profiles (LOS) for both enlisted and officers, he suggests that the Services will need to pay higher CP than the MCRMC estimate of 2.5 times basic pay. This implies higher personnel costs than the commission estimated.

The second and third studies evaluate the effects of MCRMC's BRS plan on the Marine Corps' force management objectives (FMOs). Both studies find that the effects of BRS on the Marine Corps' FMOs change based on the underlying assumptions of MCRMC's BRS plan, including assumptions about personnel discount rates, CP amounts, average DOD contributions to TSP, and opt-in rates in the first year. Grefer et al. (2016a) reason that recruitment may benefit under the new system, but if older Servicemembers have higher personal discount rates (PDRs), retention may be negatively affected [11]. They also reason that potential savings to DOD and the Services may decrease if CP needs to be increased to maintain force profiles, if BRS opt-in rates are lower than expected, or if TSP contribution rates are higher than expected.

Using simulation methods, Grefer et al. (2016b) find that YOS profiles for active component (AC) personnel are not very sensitive to changes in assumptions; however, personnel cost savings estimates for both officers and enlisted in the AC are more sensitive to assumptions [18]. Additionally, Huff et al. (2018) model the effects of CP on enlisted force profiles for the Navy [4]. They find that CP can offset decreases in retention due to the pension reduction. The lowest level they model (2.5 times monthly basic pay) is not enough to match retention levels before BRS; however, 7.5 and 12.5 are enough.

Several CNA reports focus on specific BRS aspects. Ladner and Malone (2018) show that leave percentages in some occupation groups are higher at 8 and 9 YOS, suggesting that offering CP earlier than 12 YOS may be advantageous [12]. Because of the concern that Servicemembers may choose the lump-sum option without considering its costs, Grefer and Parcell (2017) discuss treating the lump-sum option in BRS as a loan, and they developed a calculator showing the costs and benefits of the regular pension and the lump-sum option [13]. Lien (2016) focuses on the discount rate used by MCRMC and its relation to the lump-sum option and recommends that the discount rate should not vary between enlisted and officers, should be the same for the 25 and 50 percent lump-sum options, and should not encourage any particular

choice [14]. Finally, Lien and Alper (2016) discuss options for setting the lump-sum discount rate [15].

BRS analysis studies

Both the simulation studies and discussion papers use historical, pre-BRS data or theory to infer what would happen under BRS. None use information on Servicemember behavior after BRS implementation. However, Brockert (2019) examines actual BRS participation rates and TSP contribution rates in the Marine Corps [19]. He finds that about 50 percent of eligible Marines opted in to BRS by the end of 2018. Perhaps unsurprisingly, Marines with fewer YOS and younger Marines were more likely to opt in to BRS. He also finds that many Marines are not maxing out contributions to receive the full Service matching contribution.[7]

Brockert (2019) is the first study we know of that analyzes actual Servicemember behavior under BRS. We contribute to this literature by conducting an analysis across Services, and while Brockert (2019) focuses on participation, we provide an in-depth analysis of contribution patterns.

Retirement plan literature

This subsection starts by describing defined benefit and defined contribution plans in more detail. Then, we discuss reports related to the participation and contribution patterns of employees in defined contribution plans. Since the focus of this report is on TSP, which is a defined contribution plan, we restrict our attention to the literature on this subject.

Defined benefit and defined contribution plans

Defined benefit plans (pensions) offer payouts to former employees based on a predetermined formula that is usually based on salary and years of employment. This type of plan requires no employee contribution. The employer invests in the appropriate funds to make future payouts to its employees. In this way, the firm bears the majority of the risk and administrative costs. However, as recent recessions have demonstrated, pensions are not guaranteed, and payouts can be reduced if the pension fund is mismanaged by the employer or if outside forces, such as the 2008–2009 financial crash, reduce its value.

[7] Although not a direct study of BRS, Pontiff (2018) finds that new Air Force recruits and airmen with 2 YOS have poor financial knowledge and practices, which may be a cause for concern as Servicemembers choose BRS participation and TSP contribution rates [20].

Defined contribution plans are retirement plans in which the employee, employer, or both contribute funds to a retirement account. Employee contributions come with tax advantages—either contributions are tax deductible or withdrawals are tax free. Examples of defined contribution plans include 401(k)s, 403(b)s, IRAs, and ROTH IRAs. Employees have the ability to choose their contribution rate and, to a limited extent, how the funds are invested. Employers often will match contributions up to a certain percentage of an employee's salary.

Because defined contribution plans place more decision-making power in the hands of the employee, questions have been raised about employee retirement-saving behavior. For example, should employees be automatically enrolled in a retirement plan? What if they have multiple options? How do employees respond to employer matching? How much do employees choose to contribute to their defined contribution plans? We review the literature addressing these questions in the following subsection.

In the last four decades, defined contribution plans have grown in popularity to the point that most large private employers offer only defined contribution plans and not defined benefit plans to new employees [21-23]. Although defined contribution plans became the primary vehicle for retirement savings in the private sector, the public sector lagged, although its use of defined contribution plans also increased [21].

Participation and contribution rates

Enrollment rates in employer-sponsored defined contribution plans are not 100 percent, even though these plans provide tax advantages and often employer-matched contributions. The Bureau of Labor Statistics shows that 62 percent of private industry workers in 2016 had access to defined contribution plans but only 44 percent participated [24]. Further, research finds that many employees are reluctant to join or take full advantage of attractive retirement plans—even in "for-sure profit" situations [25-26].[8]

Research shows that participation can be affected by the default option. For example, studies find that automatically enrolling employees in defined contribution plans, but giving the option to decline enrollment, increases defined contribution enrollment rates [27-28]. Further, Chingos and West (2013) show that when teachers in Florida were automatically enrolled in a defined benefit plan but given the choice to switch to a defined contribution plan, only 30 percent did [29]. This suggests that people often choose the option that requires the least

[8] In the for-sure profit case, employees of a certain age are allowed to withdraw funds from a retirement account while working without penalty, and they receive an employer match. In effect, these employees can immediately withdraw the funds they invest while still receiving the employer match. The authors find about 36 percent of employees in these situations do not contribute enough for the full match.

effort. This research suggests that automatically enrolling Servicemembers into BRS will increase participation, but that Servicemembers eligible to switch to BRS may stay under the legacy system even when BRS should be a preferable option.

In 2016, Vanguard reported that participants in its defined contribution plans contributed 6.2 percent of their salaries on average [30]. With employer matches, the contribution rate was 10.9 percent. Studies show that, under automatic enrollment, employees are likely to keep the automatic contribution rate [27-28]. According to the Vanguard report, it is common for the default contribution rate to be set at or near 3 percent [30]. This suggests that auto-enrolled BRS participants may have a 3 percent contribution rate on average since this is the default rate.

Studies have also examined the effects of employer matching on employee participation and contributions. Huberman et al. (2007) find that employer matching increases employee contributions, especially for low-income employees [31]. However, Engelhardt and Kumar (2007) find that employer matching has small positive effects on participation and contribution, and they conclude that matching is a rather poor policy instrument to increase savings [32]. Therefore, under BRS, it is unclear whether the lower DOD match rates at Servicemember contribution rates of 4 and 5 percent will induce Servicemembers to contribute beyond the 3 percent default rate.

Finally, studies examine differences in participation and contribution patterns in defined contribution plans along several other dimensions. Huberman et al. (2007) find that participation rates and contribution rates increase with income and that women have higher participation and contribution rates than men [31]. The Vanguard report also shows that participation and contribution rates increase with age [30]. Based on these papers, we expect Servicemember characteristics to affect TSP participation and contribution rates.

Implications

The previous discussion indicates that automatic enrollment and a default contribution rate of 3 percent under BRS align with features of the private-sector retirement system. Since participants usually maintain the default settings, MCRMC's assuming a 3 percent contribution rate may be reasonable. However, Servicemembers opting in to BRS have no default contribution rate, so it is unclear what rates they would choose. Further, since research indicates that people often choose the default plan regardless of value, opt-in rates into BRS may not be as high as MCRMC anticipated. In the next section, we empirically examine enrollment rates and contribution patterns.

Overall Differences in TSP Contribution Rates

In this section, we present TSP contribution rates over 2018 for BRS auto-enrollees and opt-ins in the Army, Navy, and Air Force, and TSP contribution rates over 2017 and 2018 for auto-enrolled, BRS-eligible, and BRS-ineligible Marines. Our goal in this section is to highlight differences by Service and eligibility category.

Data comparability issues

Data on Army, Navy, and Air Force contributions came from the TSP Office and cover only Servicemembers who contributed to the TSP *under the BRS*. As a result, we cannot view TSP contributions by Servicemembers who did not participate in the BRS or that took place prior to BRS enrollment.

We present data on the Marine Corps separately form the other three Services because DMDC data do not state whether Servicemembers were enrolled in the BRS; DIEMS dates let us infer whether they were auto-enrolled in or ineligible for the BRS, but we cannot determine whether those eligible for the BRS opted in.[9] Because TSP contribution rates among BRS-eligible Marines could reflect either Marines opting into the BRS or spillover effects on those remaining in the legacy system, comparing BRS-eligible Marines to auto-enrollees and BRS-ineligible Marines may provide suggestive evidence of the extent to which either is true.

Some Servicemembers contributed amounts that seemed implausibly high or impossibly low. The TSP Office separated out contribution rates less than 0 percent or greater than 30 percent

[9] Because the Marine Corps was the only Service that treated remaining in the legacy retirement system as an affirmative choice rather than a passive default option, we cannot assume that Marines opted into the BRS at the same rate as other Servicemembers, that the distribution of opt-in decisions across months in 2018 was identical for Marines and other Servicemembers, or that Marines who opted into the BRS were as likely as other Servicemembers to make any TSP contribution. Although eligible Marines who made TSP contributions were probably more likely than those who did not to have opted into the BRS, we cannot comment on the extent to which this is true in practice. It is possible that this framing may have forced more Marines to weigh the benefits and costs of the BRS prior to its implementation and thereby increased early opt-in rates (and the amount of time Marines would receive matching funds for a given basic pay level relative to Soldiers, Sailors, and Airmen).

and listed them under a single category as errors.[10] Because we cannot tell which types of errors are which, we chose to omit these values from our analysis. However, the Marine Corps data obtained from DMDC treated the former set of flagged values as equal to a 0 percent contribution rate and the latter as greater than 5 percent, without indicating how many such values there were. Furthermore, DMDC data may list Marines as making 0 percent TSP contributions for multiple reasons: because they are participating in the legacy retirement system and therefore do not wish to contribute to the TSP, because they are participating in BRS and wish to receive only the 1 percent automatic contribution, or because they have been auto-enrolled in BRS but do not yet have TSP accounts to contribute to. Because the last of these reasons distorts graphs of auto-enrolled Marines based on sample size, as Marines enlist or receive their commissions without providing an actionable interpretation, we omit auto-enrolled Marines making 0 percent TSP contributions. As a result, our analysis may understate how often Marines contribute 0 percent to the TSP relative to Soldiers, Sailors, or Airmen and overstate how often they contribute over 5 percent.[11]

Table 2 presents the differences of the data sources. Other than age, demographic information such as gender, and education level are only available from one source and for one Service. Additionally, the income measures differed between the two data sources, with the DMDC providing by Regular Military Compensation (RMC), and TSP data providing Basic Pay. Because RMC contains the basic allowance for housing (BAH) and basic allowance for subsistence (BAS) in addition to basic pay, it is closer to a Servicemember's total pay and may therefore be a better determinant of how much a Servicemember would be choose to contribute.

Table 2. Disparities between DMDC and TSP data sources

	DMDC Data	TSP Data
Services	Marine Corps	Army, Navy, Air Force
BRS enrollment required?	No	Yes
Can identify opt-ins?	No	Yes
Contains 2017 data?	Yes	No
Income measures	RMC	Basic Pay
Other characteristics	Paygrade, age, gender, race, Hispanic ethnicity, marital status, race x gender, education level	Age

[10] Brockert (2019) theorizes that Marines may contribute large percentages of their basic pay while deployed; similar behavior also might exist among those in other Services.

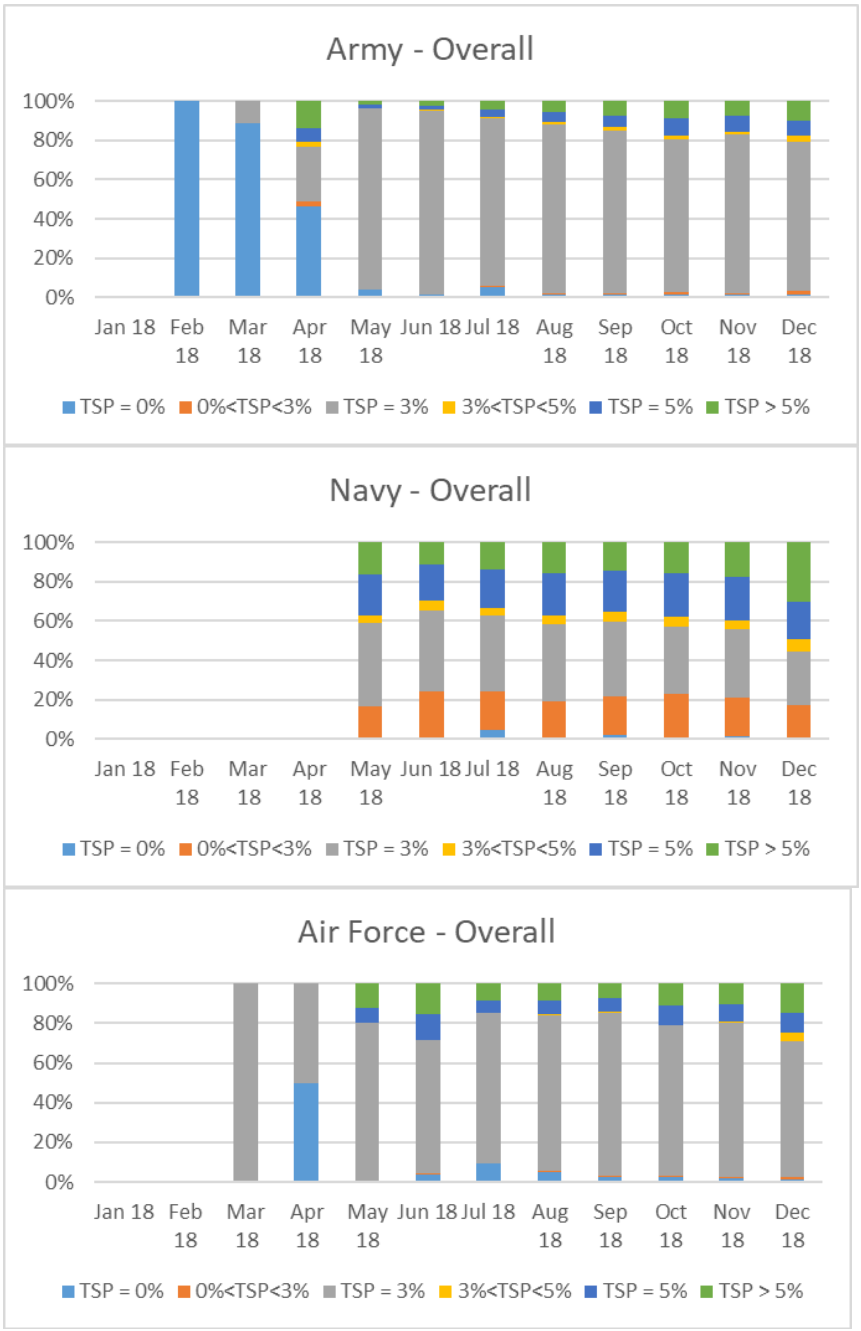
[11] We show in Appendix A how auto-enrolled Marines' contributions patterns vary when including Marines with 0 percent contribution rates.

Army, Navy, and Air Force TSP contributions

Figure 2 shows contribution patterns by auto-enrolled Servicemembers in the Army, Navy, and Air Force in 2018. These graphs show the percentages of Soldiers, Sailors, and Airmen, respectively, contributing different amounts in each month. The 12 months of 2018 are arranged along the vertical axis, and percentages are stacked to sum to 100. Each contribution level is shaded a different color.

Three things immediately stand out. First, TSP contribution data do not exist in January 2018 for any Services and are available for all three Services only in May 2018. This is chiefly because TSP cannot report information on Servicemembers whose accounts do not yet exist, but may reflect some Service-level differences in how quickly TSP accounts were set up or how quickly these data were provided to the TSP office. May is also the first month in which a clear picture of contribution patterns begins to emerge, likely because it is the first month in which each Service provided data on over 100 Servicemembers. Second, Soldiers and Airmen default to a 3 percent contribution level far more often than Sailors. In every month since May 2018, at least 75 percent of auto-enrolled Soldiers and 67 percent of auto-enrolled Airmen contributed 3 percent; by contrast, fewer than 45 percent of Sailors contributed at this level in any month. However, while Sailors were more likely to receive all possible matching funds by contributing at least 5 percent, they also were more likely to forgo some of the matching funds available at the default contribution rate of 3 percent. Over the second half of 2018, Soldiers and Sailors gradually became less likely to contribute the default rate, and the percentage contributing over 5 percent increased. However, Airmen became more likely to contribute the default rate through September 2018, likely reflecting the fact that the sample of Airmen was both smaller and grew at a different rate than the samples of Soldiers and Sailors.

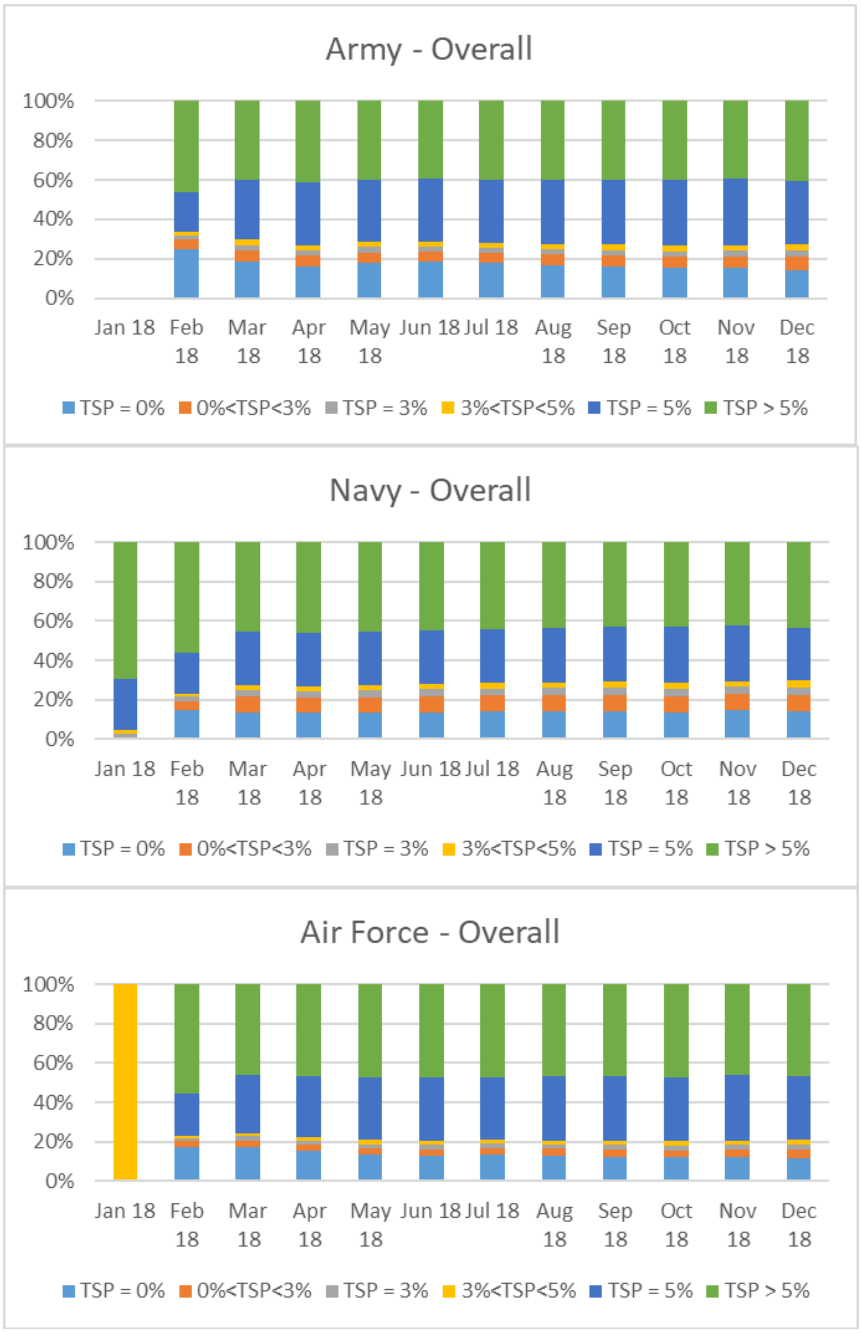
Figure 2. Army, Navy, and Air Force TSP contribution rates, auto-enrollees, 2018



Notes: Sample sizes for Soldiers ranged from 3 (in February) to 28,629 (in December). Sample sizes for Sailors ranged from 165 (in May) to 23,568 (in December). Sample sizes for Airmen ranged from 1 (in March) to 9,526 (in December).
Source: TSP.

Figure 3 shows the corresponding enrollment rates for Soldiers, Sailors, and Airmen who opted into the BRS. Samples in January 2018 were extremely low for each Service (0 Soldiers, 43 Sailors, and 1 Airman) but grew rapidly over the next two months (approximately 2,000 Soldiers and Sailors and approximately 1,500 Airmen in February; 27,457 Soldiers, 46,242 Sailors, and 29,083 Airmen in March). Over the remaining 10 months of 2018, opt-in samples grew much more steadily; as a result, contribution patterns change noticeably between January and March 2018 as the sample composition shifts but remain fairly stable afterwards.

Figure 3. Army, Navy, and Air Force TSP contribution rates, opt-ins, 2018



Notes: Sample sizes for Soldiers ranged from 1,983 (in February) to 54,362 (in December). Sample sizes for Sailors ranged from 43 (in January) to 121,152 (in December). Sample sizes for Airmen ranged from 1 (in January) to 50,746 (in December).
Source: TSP.

As a rule, Servicemembers who opted into the BRS contributed different amounts to the TSP than those who were auto-enrolled. In any given month, auto-enrolled Sailors were over 6 times more likely than opt-in Sailors to contribute 3 percent, and corresponding ratios for Soldiers and Airmen were even higher. In general, Servicemembers who opted into the BRS were more likely than auto-enrollees to appear in any contribution category other than 3 percent. This may be because Servicemembers who are auto-enrolled can easily minimize the effort involved in selecting a contribution rate by choosing the default level. For Servicemembers who opt in, any effort involved in selecting an optimal contribution rate is incorporated into the decision to opt in. Curiously, however, Sailors who opted into the BRS were less likely than auto-enrollees to contribute below 3 percent; the opposite is true for Soldiers and Airmen.

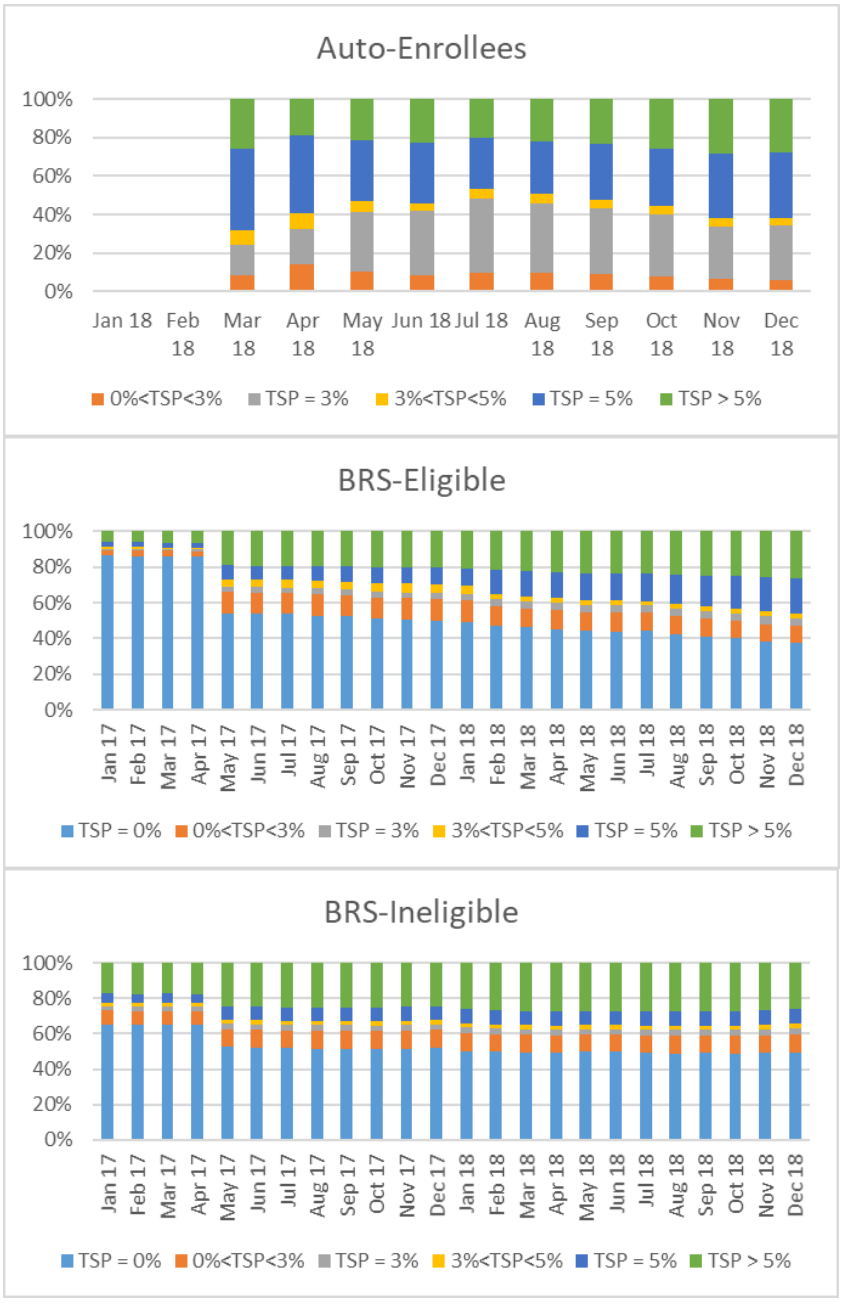
From March onward, the share of Soldiers and Airmen contributing nothing fell somewhat, while the share of Sailors increased slightly. During this period, the shares of Soldiers and Airmen in every other contribution category increased, and the share of Sailors contributing over 5 percent fell, while the share of Sailors contributing other amounts increased or remained the same.

Marine Corps TSP Contributions

Figure 4 shows contributions among Marines, by eligibility category. These graphs are organized similarly to those for Soldiers, Sailors, and Airmen, with three main differences. The first is that, without observing BRS enrollment status in the Marine Corps, we can state only whether Marines are BRS-eligible or BRS-ineligible. However, for these two groups of Marines, we can show how their TSP contributions changed over 2017, as BRS training was implemented, as well as in 2018, when Marines could opt into the BRS. Recall that auto-enrolled Marines contributing 0 percent to the TSP have been omitted from this figure and subsequent ones.[12]

[12] However, because fewer than 3 percent of Soldiers, Sailors, or Airmen make TSP contributions of 0 percent in September 2018 or onward, it appears unlikely that this will noticeably distort the TSP contribution rates of Marines with active TSP accounts.

Figure 4. USMC TSP contribution rates by retirement system eligibility group



Notes: Sample sizes ranged from 60 (in January) to 15,558 (in December) for auto-enrolled Marines, from 139,378 (in December 2018) to 153,412 (in January 2018) for eligible Marines, and from 24,523 (in December 2018) to 25,268 (in May 2017) for ineligible Marines.
Source: DMDC.

Contribution patterns varied over time and by eligibility category. Auto-enrollees rarely contributed any amount between 0 and 3 percent or between 3 and 5 percent. Although many likely contributed 3 percent because it was the default option, matching rates should not have affected how much they contributed at this time, since auto-enrollees do not receive matching contributions (beyond the automatic 1 percent contribution) until their 25th month of service. Contribution rates greater than 3 percent therefore should reflect a desired savings level in the absence of any incentive.[13]

Contribution patterns were more stable among Marines who became eligible to opt into the BRS in 2018. In May 2017, contribution rates in each contribution category increased dramatically, likely due to BRS training programs, which first became available in March 2017 [32]. Over the rest of 2017, contribution categories greater than 3 percent grew slightly. In 2018, these Marines became eligible for the BRS, with immediate matching for TSP contributions. Although contribution levels did not change noticeably in January 2018, the shares contributing 5 percent and more than 5 percent increased in February and in every subsequent month in 2018. Meanwhile, the share contributing less than 3 percent dropped gradually over 2018. This suggests that Marines who opted into the BRS and had to choose a contribution level were disproportionately likely to seek the maximum matching level.

Contribution patterns were even steadier among BRS-ineligible Marines. These Marines were far more likely to contribute to the TSP prior to May 2017 than those with fewer years of service. However, these graphs alone cannot tell us whether (and/or to what extent) these Marines contributed more to their retirement savings because they (a) were older and therefore felt that retirement saving was more salient, (b) had served with the Marine Corps longer and therefore gave greater thought to the retirement plan the Marine Corps provided, or (c) differed materially from younger Marines in some way unrelated to age or years of service. In May 2017, the likelihood of BRS-ineligible Marines contributing within each category increased, just as it did for those who eventually would become eligible; however, this increase was much smaller. After this increase, all contribution categories stayed relatively stable; by the end of 2018, eligible Marines were contributing to the TSP at a higher rate than ineligible Marines.

[13] Alternatively, some may base their contributions on the match rate if they do not anticipate that they will remember to update their contribution levels later; however, it would be impossible to evaluate this possibility without conducting extensive Servicemember interviews or observing contribution patterns in 2020 and beyond.

Takeaways

As shown in Table 3, Servicemembers from all four Services frequently failed to maximize the amount of matching funds that they were able to receive. As Table 3 uses data from December 2018, it should not reflect delays in initial implementation, BRS enrollment, or accession, or other factors that might be relevant earlier in the year. Some individuals may be making suboptimal contributions because they have reached the elective deferral limit (discussed in further detail in its own section); however, it is highly unlikely that this affects over 10 percent of each Service. Likelier explanations include some degree of financial constraint or an impression that only a full match is worth the required contribution.

Table 3. Inefficient contributions by Service, December 2018

Service	Auto-enrollees		Opt-Ins[b]	
	No Contribution	Less than 5%	No contribution	Less than 5%
Army	1.1%	82.2%	14.2%	27.1%
Navy	0.4%	50.6%	14.1%	29.6%
Air Force	1.5%	75.1%	11.5%	21.0%
Marine Corps	N/A[a]	38.2%[a]	37.7%[b]	54.1%[b]

Source: DMDC and TSP.

[a] Calculations for auto-enrolled Marines omit those contributing 0 percent, as this frequently indicates that the Marine has recently enlisted and does not yet have a TSP account. These results therefore understate the share of Marines contributing 0 percent or contributing any amount less than 5 percent.

[b] Calculations reflect BRS-eligible Marines, rather than those who opted in. Because those who did not opt in had much lower incentives to contribute any given amount, they are disproportionately unlikely to have done so. These results should not be directly compared against those for the other three Services.

There are clear Service-level disparities in the amount that auto-enrolled Sailors and Marines contribute to the TSP relative to Soldiers and Airmen; the latter two are far more likely to select the default contribution rate of 3 percent. Although direct comparisons with the Marine Corps are difficult due to different data sources, auto-enrolled Marines were more likely than Soldiers or Airmen to contribute over 3 percent *even when including Marines who did not yet have TSP accounts*. This suggests that Services presented the default contribution rate differently to auto-enrolled Servicemembers and that Sailors and Marines may have received greater encouragement to select contribution rates other than the default. Alternatively, some Soldiers and Airmen may be choosing the default contribution rate with the intent of increasing it once they can receive matching funds; to evaluate this possibility, we would have to observe their behavior in 2020 and onward, once they qualify.

However, the differences across the Army, Navy, and Air Force are much smaller among those who opted into the BRS. This suggests that Servicemembers' unconstrained behavior will be

similar across Services and that any differences may be limited to how default contribution rates are addressed or the degree of training that auto-enrollees receive on TSP contributions. Although we cannot directly compare contribution rates to those in the Marine Corps, the consistency in contribution levels among Soldiers, Sailors, and Airmen who opted into the BRS suggests that changes in contribution levels over time among eligible Marines may be attributable to additional Marines opting into the BRS rather than changes among those who already have opted in.

Overall contribution patterns by eligibility category align with findings in the civilian research literature and provide us with several theories for further investigation. First, providing a default contribution level will lead to many more Servicemembers selecting that contribution level, since auto-enrolled Marines were far more likely to contribute 3 percent than those who opted into the BRS. The choice of a default contribution rate could therefore be used to encourage optimal savings behavior. Since the Federal Retirement Thrift Investment Board has recently announced that the default contribution rate for Servicemembers enrolling on or after October 1, 2020, will increase to 5 percent, Servicemembers entering after this date will probably become much more likely to contribute 5 percent.

Second, before the introduction of BRS training programs, Marines with at least 12 YOS were more likely both to contribute to the TSP and to do so at higher rates than those with fewer than 12 YOS. This finding aligns with prior research, since Marines who were ineligible were older and had more disposable income than those who were eligible. Afterwards, BRS-eligible Marines began contributing to the TSP at a higher rate—whether because they intended to enroll in the BRS, because they had been encouraged to think about retirement planning, because they were made aware of savings options that they had not previously know about, or for some other reason. However, BRS training also appears to have affected Marines who were ineligible. Although additional research would be necessary to determine why this was the case, it is worth considering that changes in behavior may not be limited to the targeted group of Servicemembers.

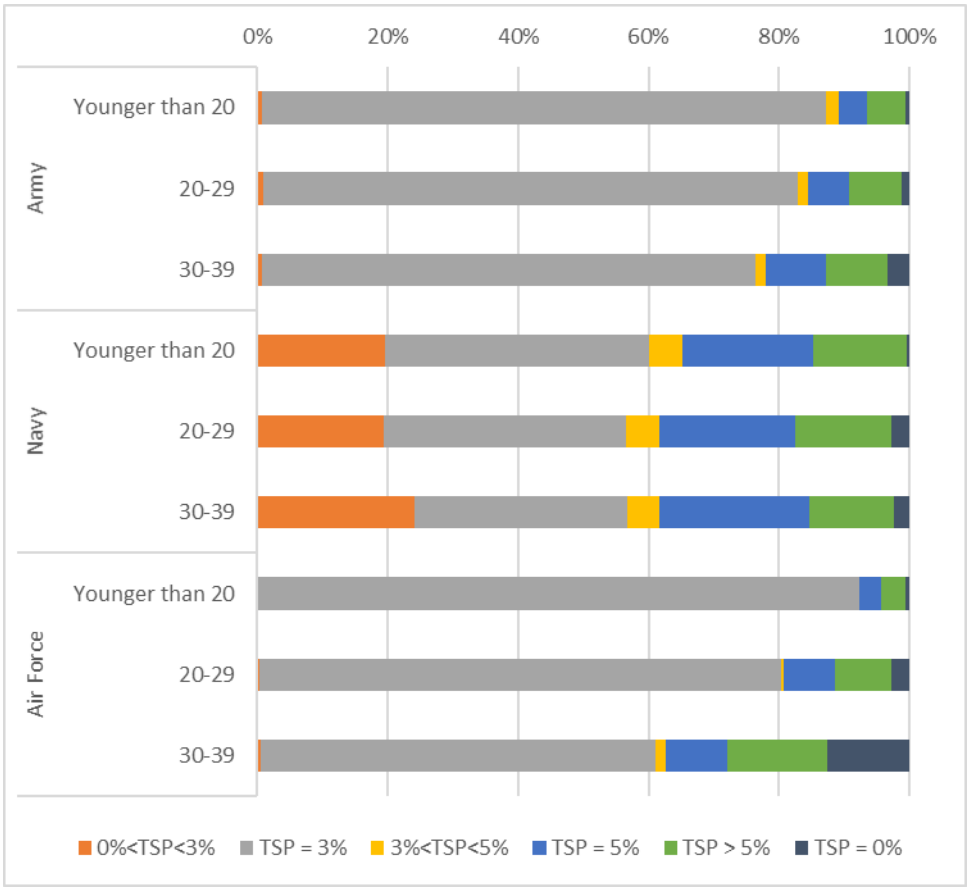
Lifecycle Differences in TSP Contribution Rates

In the research literature on civilian retirement saving, age and income can affect retirement contributions. We examine how age affected retirement savings among Soldiers, Sailors, and Airmen, and how age, RMC, and enlisted and officer paygrades affected contribution rates among Marines.

TSP contribution rates by age

Figure 5 and Figure 6 show how Soldiers, Sailors, and Airmen of different age groups contributed to TSP accounts; Figure 5 focuses on auto-enrollees, while Figure 6 focuses on opt-ins. These figures use data from September 2018 for comparability across figures. By this point, there is a suitably large sample of auto-enrollees, and it is far enough from the end of the year that it is unlikely for opt-ins to have reached the elective deferral limit on TSP contributions. Both figures show the percentages of Soldiers, Sailors, and Airmen by age grouping in each contribution category. Graphs are organized first by Service, then by age within Service. The length of each bar segment represents the percentage of Servicemembers in that contribution category.

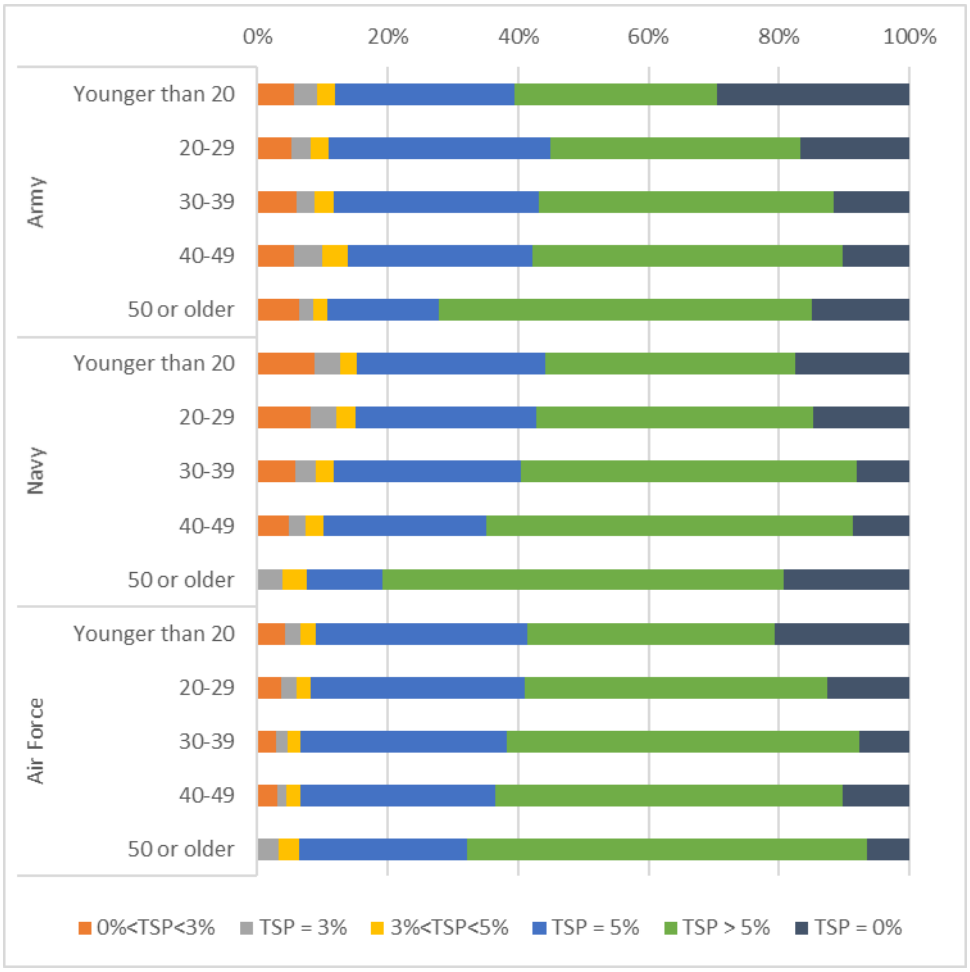
Figure 5. TSP contribution rates by age among auto-enrolled Soldiers, Sailors, and Airmen, September 2018



Source: TSP.

The Service-level differences observable in Figure 2 are present across all age groups. However, older auto-enrollees in all three Services were less likely to adopt the default contribution rate of 3 percent. Among Soldiers and Airmen, this reflects a greater likelihood of contributing 5 percent or more to a TSP, but results are more ambiguous among Sailors.

Figure 6. TSP contribution rates by age among opt-in Soldiers, Sailors, and Airmen, September 2018

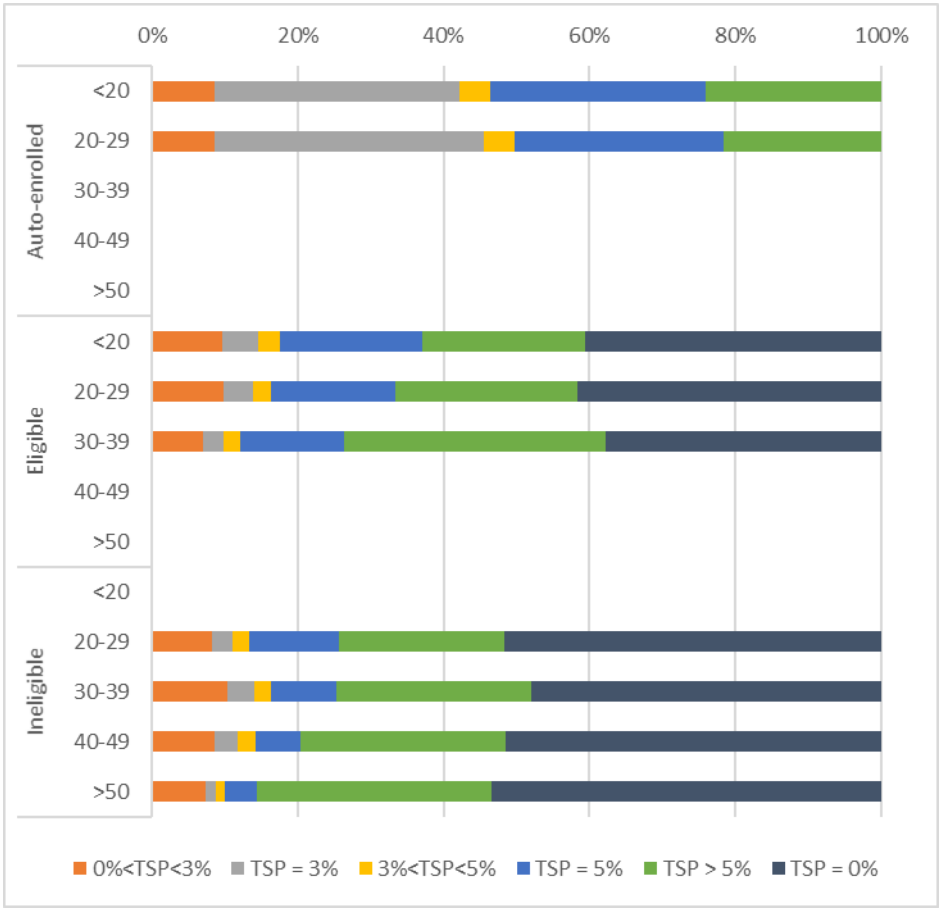


Source: TSP.

Among opt-ins, age is positively correlated with the probability of contributing over 5 percent and negatively correlated with the probability of contributing nothing, but negatively correlated with the probability of contributing exactly 5 percent. Within each Service, opt-ins of all age groups were far less likely than auto-enrollees of any age group to contribute 3 percent. Across all age groups, Soldiers were less likely than Sailors or Airmen to contribute over 5 percent; Soldiers younger than 40 also were more likely than Sailors or Airmen to contribute nothing.

Figure 7 shows contribution rates among Marines by age and eligibility group. As in Figure 4, we omit Marines who made no TSP contribution because it is likely to reflect the lack of a TSP account rather than a conscious decision to make no contribution. In addition, while graphs for Soldiers, Sailors, and Airmen use their age at any given point in time, graphs for Marines use their age *as of January 1, 2018*.[14] This means, for example, that a Marine whose birthday is January 2, 1998, will remain in the "younger than 20" category, even though he or she has turned 20 prior to appearing in the graph below.

Figure 7. TSP contribution rates by age and eligibility category among Marines, September 2018



Source: DMDC.

[14] DMDC data contained Marines' dates of birth, from which it was possible to manually compute age as of any given reference date. We chose January 1, 2018, since it was the date the policy went into effect.

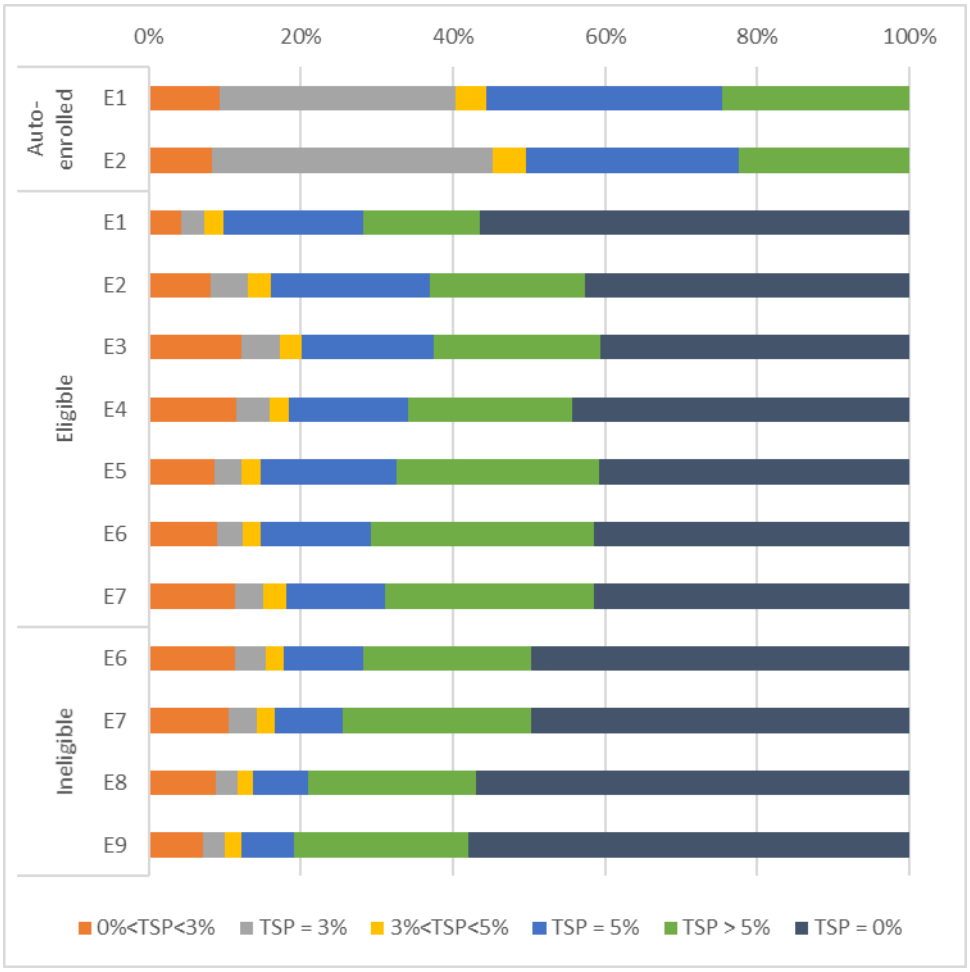
In contrast to both the civilian literature and the other three Services, auto-enrolled Marines aged 20–29 contributed less to the TSP (conditional on making any contribution) than those younger than 20. Among BRS-eligible Marines, age was positively correlated with the probability of contributing over 5 percent to the TSP and negatively correlated with contributing lower amounts. Curiously, older BRS-ineligible Marines were simultaneously less likely to make any TSP contribution yet more likely to contribute over 5 percent.

TSP contribution rates by paygrade and RMC (Marine Corps only)

Figure 8 and Figure 9 show how contribution rates varied by officer and enlisted paygrade, respectively, for each eligibility category. Because the TSP Office did not have access to Servicemembers' paygrades, this analysis is restricted to the Marine Corps. We show graphs for only a subset of paygrade and eligibility group combinations. Some combinations are impossible as a matter of policy—for example, an auto-enrolled Marine will not reach E9 within one year of enlisting. Others are possible but occur so infrequently as to provide little usable information—for example, some auto-enrolled Marines reach E6, and some Marines with 12 or more years of service are demoted to E1, but it would be inappropriate to regard these Marines as representative of any broader patterns or make inferences based on their behavior.

Figure 8 shows contributions among enlisted Marines. Auto-enrolled Marines at paygrade E2 were more likely than those at E1 (conditional on TSP contribution) to contribute 3 percent but less likely to contribute 5 percent or more. Eligible Marines at paygrades E3 through E7 were similarly likely to contribute to the TSP; however, the precise amount contributed by paygrade differs—in particular, eligible Marines at E5 or higher were more likely than those at E3 or E4 to contribute over 5 percent to the TSP. For ineligible Marines, paygrade appears to be *negatively* correlated with the probability of contributing to the TSP. While ineligible Marines at paygrades E8 and E9 are as likely as those at E6 and E7 to contribute over five percent to the TSP, they are less likely to have any other contribution rate.

Figure 8. TSP contribution rates by enlisted paygrade and eligibility category among Marines, September 2018

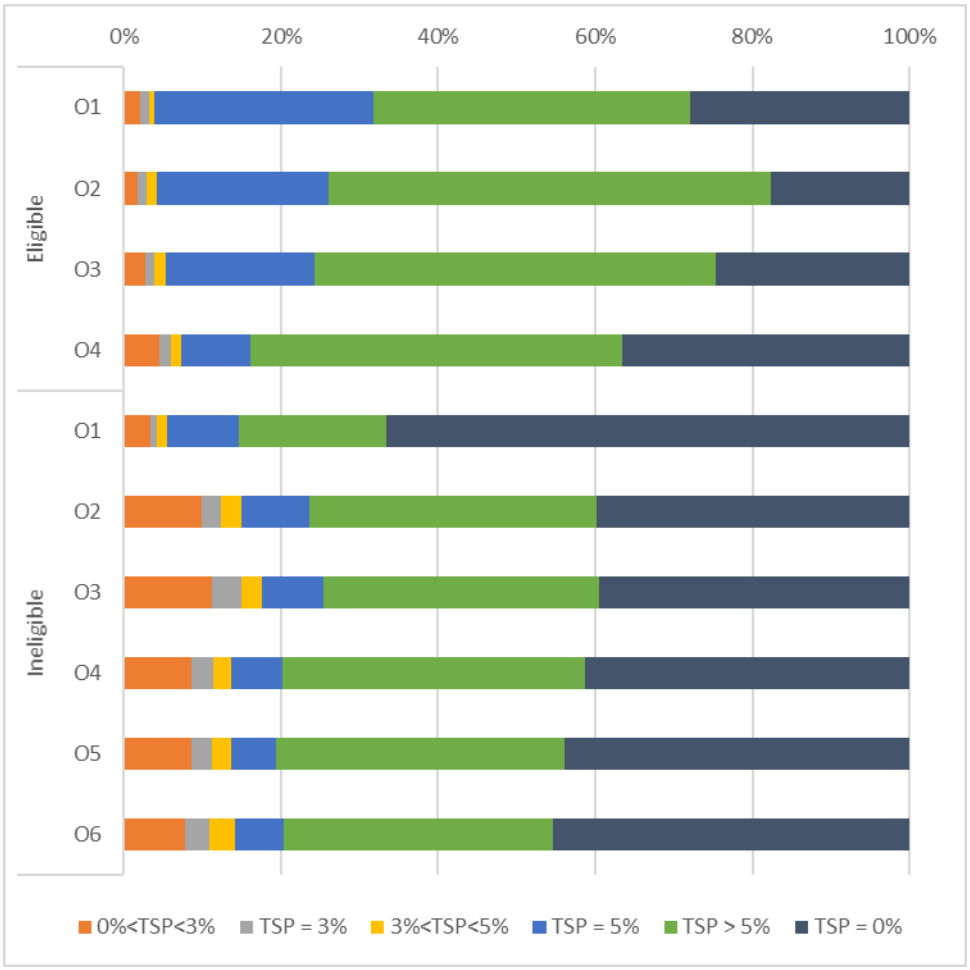


Source: DMDC.

Figure 9 shows contributions among Marine officers. We omit auto-enrollees, as there were only 42 auto-enrolled Marine officers as of September 2018; the most there were in any given month in 2018 was 156 in November. Both BRS-eligible and BRS-ineligible O1s are much less likely than O2s to contribute to the TSP or to contribute over 5 percent; this may reflect differences in basic pay or RMC, but is not immediately clear. At O2 and above, BRS-eligible Marines with higher paygrades had lower probabilities of contributing to the TSP at all, reflected in substantially lower probabilities of contributing five percent or more. Among BRS-

ineligible Marines, higher paygrades above O2 are also correlated with lower probabilities of contribution to the TSP, though differences in individual contribution levels are less dramatic.

Figure 9. TSP contribution rates by officer paygrade and eligibility category among Marines, September 2018

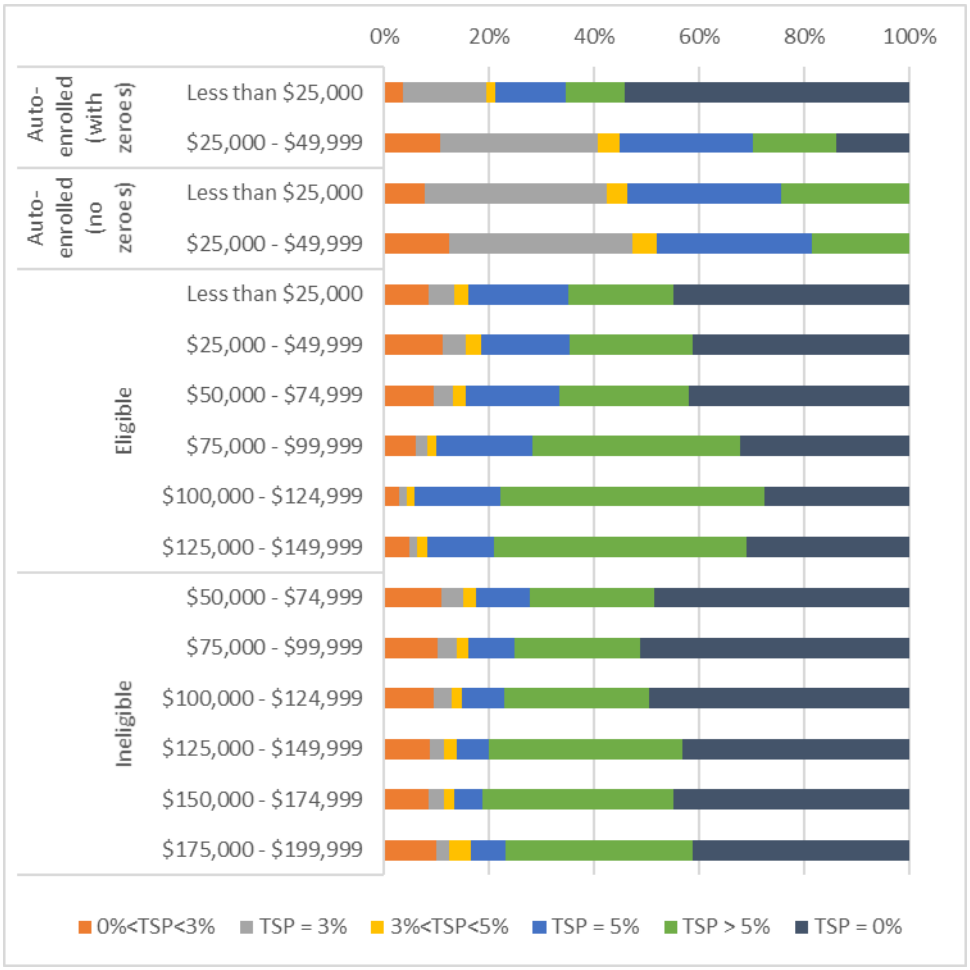


Source: DMDC.

Figure 10 shows how Marines' TSP contribution levels vary by RMC. It is organized similarly to the two figures above, but shows auto-enrollees both including and omitting zero contribution levels. While paygrade is one of the factors determining RMC, it is unlikely that attaining higher paygrades *in and of itself* causes certain Marines to change their contribution levels. It is much more plausible that a change in RMC would cause this (e.g., if Marines prefer to meet a certain subsistence-level basic pay before saving for retirement). Although we cannot

fully isolate the effect that RMC has on Marines' TSP contribution levels, we can nevertheless examine how it varies with TSP contributions.

Figure 10. TSP contribution rates by RMC and eligibility category among Marines, September 2018



Source: DMDC.

Auto-enrollees earning less than $25,000 were much less likely than those earning higher levels of basic pay to contribute to the TSP at all. This may reflect the need for a certain level of baseline income before Marines are willing to devote part of their paycheck to retirement saving. However, there are two competing reasons that might take precedence. First, Marines who do not yet have TSP accounts are more likely than those who do to be earning less than $25,000; some portion of the contribution gap reflects an inability to contribute, rather than a

choice to do so. Second, enlisted auto-enrolled Marines in 2018 would be unable to earn $25,000 in RMC through basic pay alone – with less than 2 YOS, an enlisted Marine would have needed to rate E4 to do so. As a result, auto-enrolled Marines would have needed to either rate BAH or be officers to have earned at least $25,000 in RMC.[15] Auto-enrollees who earned at least $25,000 in RMC may therefore have additional systematic differences from those who did not, making it challenging to assess which factors are causing different contribution rates. Omitting Marines who contributed zero percent to the TSP, however, is the difference between Marines who earned less than $25,000 contributing less in every non-zero category than those earning at least $25,000 versus being substantially more likely to contribute over five percent and less likely to contribute less than three percent.

For eligible Marines earning less than $125,000, basic pay levels were positively correlated with both the probability of making any TSP contribution and the probability of contributing over 5 percent. However, eligible Marines earning between $125,000 and $149,999 were less likely to contribute to the TSP or to contribute over 5 percent than those earning between $100,000 and $124,999. They also were the least likely group to contribute 5 percent. Eligible Marines who earned less than $25,000 were the most likely to contribute 3 percent, 5 percent, or any amount in between.

Among ineligible Marines, it makes sense to think about those earning less than $125,000 separately from those earning at least $125,000. Those earning less than $125,000 are less likely to contribute to the TSP, more likely to contribute exactly five percent, and substantially less likely to contribute over five percent. In general, the probability of contributing over five percent is positively correlated with RMC.

Takeaways

Contribution rates appear to be strongly correlated with both paygrade and RMC; however, it is likely that RMC is the more relevant factor. Marines with low incomes may wish to prioritize immediate necessities over future savings, limiting the effectiveness of matching plans; however, this result might also be explained by factors such as rating BAH, officership, or other characteristics separate from RMC itself. Among BRS-eligible and BRS-ineligible Marines, though, the probability both of contribution and of contributing over five percent is positively correlated with RMC, suggesting that earnings do play some role in contribution levels.

[15] For context, the annualized basic pay of an auto-enrolled E1 in our data with less than four months of service would have been approximately $18,192. Any BAH payment over $567.33 would therefore result in earning at least $25,000 per year.

The Elective Deferral Limit

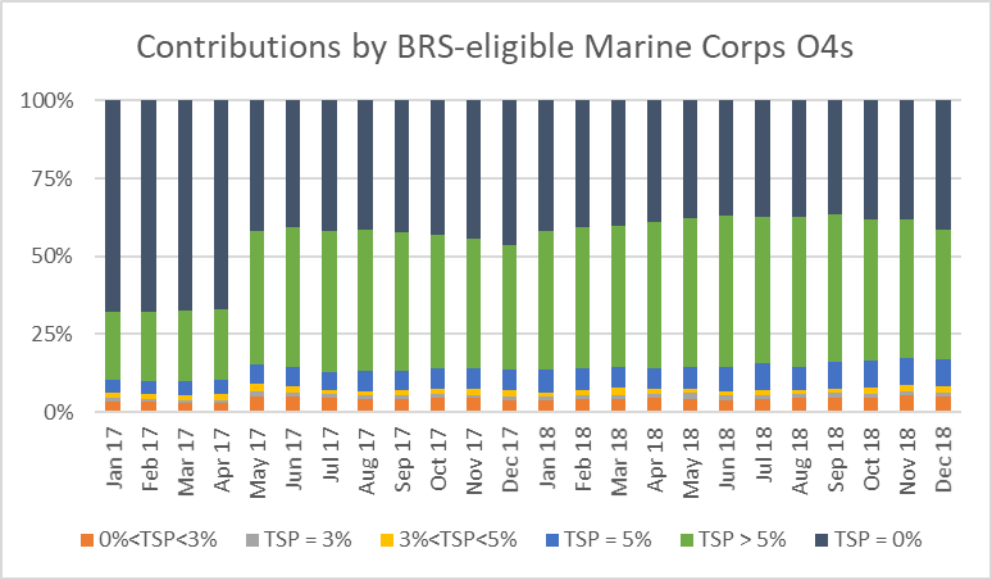
Since matching funds are distributed in each month and are determined by the percentage of basic pay contributed in that month, the timing of TSP contributions may matter as much as the total amount contributed over the course of a year. As an extreme case, consider a Servicemember who contributes 36 percent of his or her basic pay in one month and nothing else for the remainder of the year and another Servicemember who contributes 3 percent of the same basic pay in every month. The first Servicemember will receive a 5 percent match in January and the automatic 1 percent contribution in the remaining 11 months (for a total of 16 percent of monthly basic pay), while the second will receive 4 percent of basic pay in every month (for a total of 48 percent of monthly basic pay).[16]

A less extreme version of the scenario above involves Servicemembers reaching the TSP elective deferral limit prior to December. TSP contributions are capped on several dimensions: direct employee contributions have an elective deferral limit ($18,500 for 2018), while automatic and matching contributions made by employers have an annual addition limit ($55,000 for 2018). If this happens, they still will receive the automatic 1 percent contribution in any remaining months, since the limit applies only to personal contributions, not to employer contributions; however, any months in which a Servicemember cannot contribute due to the deferral limit will result in forgone matching funds.

While we are unable to show conclusively that this happens on a regular basis, we can show some evidence consistent with reaching the elective deferral limit. Figure 11 shows contributions by BRS-eligible Marine O4s. In this figure, there is a clear drop in both overall contribution rates and in the share of Marines contributing over 5 percent of basic pay toward the end of both calendar years. This is what we would expect to see if a Marine reaches the contribution limit; to reach the 2018 limit of $18,500, a Marine would have needed to contribute an average of $1,541.67 per month, which is substantially higher than 5 percent of any monthly rate in the 2018 basic pay tables. Importantly, the share of Marines contributing to TSP accounts reaches local maxima in June 2017 and September 2018, so some Servicemembers may be forgoing several months of matching funds.

[16] While this example does not consider interest accrual over the course of the year, there is no realistic interest rate that would make the first Servicemember's savings pattern preferable to the second's.

Figure 11. Evidence that eligible Marine Corps O4s may reach the elective deferral limit too soon



Source: DMDC.

Table 4 illustrates potential forgone investment using the example of a Marine O4 with 11 YOS—the highest-earning combination of service length and paygrade for a BRS-eligible individual. This Marine would have earned $7,052.70 each month in 2018. If this Marine contributed 25 percent of his or her basic pay, he or she would only be able to contribute through November before reaching the $18,500 cap. During this time frame, they would receive $352.64 in matching contributions, but would only receive the automatic contribution of $70.53 in December. By contrast, a Servicemember who contributed approximately 21.9 percent in each month would receive the full $352.64 match in every month, earning an additional $282.11 in matching funds while reaching the same personal TSP contribution of $18,500.[17]

[17] To put this in context, a Servicemember who forgoes $282.11 per year, with a 5 percent interest rate compounded monthly would lose a total of $10,468.58 over 20 years.

Table 4. Example of effects of an O4 with 11 YOS reaching contribution limit

Month	Monthly Basic Pay	Personal Contribution	Match	Total Contribution	Cum. Total Contribution	Cum. Personal Contribution
Contributing 25% of Basic Pay						
January	$7,052.70	$1,763.18	$352.64	$2,115.81	$2,115.81	$1,763.18
February	$7,052.70	$1,763.18	$352.64	$2,115.81	$4,231.62	$3,526.35
March	$7,052.70	$1,763.18	$352.64	$2,115.81	$6,347.43	$5,289.53
…		…			…	
October	$7,052.70	$1,763.18	$352.64	$2,115.81	$21,158.10	$17,631.75
November	$7,052.70	**$868.25**	**$352.64**	**$1,220.89**	$22,378.99	$18,500.00
December	$7,052.70	**$0.00**	**$70.53**	**$70.53**	**$22,449.51**	$18,500.00
Contributing 21.9% of Basic Pay						
January	$7,052.70	$1,541.72	$352.64	$1,894.36	$1,894.36	$1,541.72
February	$7,052.70	$1,541.72	$352.64	$1,894.36	$3,788.71	$3,083.44
March	$7,052.70	$1,541.72	$352.64	$1,894.36	$5,683.07	$4,625.16
…		…			…	
October	$7,052.70	$1,541.72	$352.64	$1,894.36	$18,943.55	$15,417.20
November	$7,052.70	**$1,541.72**	**$352.64**	**$1,894.36**	$20,837.91	$16,958.92
December	$7,052.70	**$1,541.08**	**$352.64**	**$1,894.36**	**$22,732.26**	$18,500.00

Source: Defense Finance and Accounting Service 2018 Military Active & Reserve Component Pay Table.

There are several scenarios in which Marines might reach the elective deferral limit prior to December in any given year. First, they may simply have very high baseline contribution levels. However, this is unlikely to occur commonly across the Marine Corps—even the highest earning BRS-eligible Marines would need to contribute over a fifth of their salary in every month to reach the limit.

Brockert (2019) mentions two other scenarios in which Marines might increase their TSP contribution levels, and which could therefore lead Marines to reach the elective deferral limit too quickly. First, Marines may increase their contributions while deployed, since their immediate needs are being accounted for by the Marine Corps. For those in combat zones, this may be a sensible choice, as traditional TSP contributions made in a combat zone apply to the annual addition limit rather than the elective deferral limit. However, Marines deployed outside of combat zones or making Roth contributions still face the elective deferral limit and

may therefore reach it at an inefficiently early date.[18] Second, Marines could increase their contribution levels upon receiving one-time bonus pay. In this case, all contributions will still count towards the elective deferral limit.

This issue currently affects relatively few Marines, but could become more salient in time. Because Servicemembers with 12 YOS or more were ineligible for BRS enrollment, the highest earning Marines (who may therefore be most likely to reach the elective deferral limit) do not have matching contributions to forego. However, as current enrollees gain additional YOS, their basic pay rates will increase, and so will their TSP contributions; they will also begin to attain higher paygrades than those we currently observe them holding. Nevertheless, this issue will be more applicable to officers rather than enlisted Servicemembers, as an O3 earns more in basic pay than an E9.[19]

[18] Servicemembers deployed to combat zones should generally make Roth contributions below the elective deferral limit. Roth contribution plans differ from traditional plans in applying taxes at contribution rather than at withdrawal; Roth contributions made in combat zones are exempt from these up-front taxes, allowing Servicemembers in combat zones to make completely tax-free contributions. Contributions above the elective deferral limit should instead come from traditional contributions. Comparison of taxes avoided via Roth contributions versus contributions foregone by reaching the elective deferral limit depends on when in the calendar year a Servicemember is deployed, for how long TSP contributions will accrue interest, and a forecast of future tax rates, and is therefore beyond the scope of our analysis.

[19] Making specific predictions beyond 2019 would require either estimating changes in both the basic pay table and the elective deferral limit or assuming that the same proportional changes apply to each. Using 2019 values, an E9 with 20 YOS would need to contribute over 25 percent of his or her basic pay to reach the elective deferral limit, while an E5 with 20 YOS would need to contribute slightly over 17 percent.

Implications of the Single-Salary System

The effects of a single-salary system on TSP contribution rates and its costs to DOD and the federal government depend on the structure of the single-salary system, which has not yet been well defined. However, we can start with the assumptions used by IDA in their briefing concerning the Salary-Based Pay System [34]. They start by assuming that "all allowances are redistributed as basic pay across the entire force." They conclude that this would increase current basic pay by 69 percent. Based on this increase and a retirement pay accrual calculated at 30.4 percent of basic pay, they conclude an extra cost of 11.8 billion to DOD and 9.9 billion to the federal government. However, this does not include higher costs to match higher Service contributions to the TSP.

If Servicemembers' contribution rates are not affected by the move to a single-salary system, an increase in basic pay by a factor of 1.69 would also increase Service matching contribution levels by 69 percent. However, the single-salary system is likely to increase take-home pay for some Servicemembers and decrease it for others [34]. An increase or decrease in take-home pay may induce Servicemembers to change their contribution rates. This, in turn may increase or decrease the costs to DOD.

Finally, the Federal Retirement Thrift Investment Board (FRTIB) recently announced that the default contribution rate for people automatically enrolled on or after October 1, 2020, will be increased from 3 percent to 5 percent [35]. Given that Servicemembers auto-enrolled in the BRS are likely to contribute the default rate or higher, the change in the default rate likely implies even higher TSP costs for DOD.

Conclusion and Recommendations

Our Marine Corps analysis shows that auto-enrolled participants are more likely to contribute the default 3 percent contribution than those who opt to participate. Contribution rates for the Army, Navy, and Air Force reveal that auto-enrollees are much more likely to contribute the default 3 percent rate while the majority of Servicemembers who opt in contribute 5 percent or more. This may be the result of two factors. First, auto-enrolled participants are assigned a default contribution rate of 3 percent, while those opting in must choose a contribution rate. The civilian retirement literature indicates that people are likely to choose the easiest path, which for auto-enrolled participants is to stick with the default rate. Second, opt-in participants immediately receive Service matching contributions, while auto-enrolled participants must complete two YOS to receive full Service matching contributions. This may be inducing opt-in participants to contribute more—a result consistent with the civilian literature.

> **Recommendation:** *If the Services view higher contribution rates as a positive outcome, they could increase the default contribution rate of auto-enrollees or allow for immediate Service-level matching for auto-enrolled participants.*

> **Recommendation:** *We cannot separately observe both those who opt in to the BRS and those who remain in the legacy system. Because those opting in have high contribution rates, the Services may be more interested in the proportion who participate—a topic for future research*.[20]

A second interesting result for the Army, Navy, and Air Force is that Sailors have very different contribution rates than Soldiers or Airmen. In the Army and Air Force, auto-enrollees are much more likely to stick with the default contribution rate, while those in the Navy are the most likely to contribute more than the default rate.

> **Recommendation:** *Investigate why the Navy has higher contribution rates than the other Services, and potentially apply its method to the other Services.*

A third finding, which may be immediately actionable at relatively low cost, is that a small number of Servicemembers may reach the annual limit on elective contributions to the TSP before the end of the year and thereby end up forgoing matching funds. It should be relatively inexpensive to compute the maximum contribution rate at which a Servicemember would optimize his or her matching funds, based on the TSP-provided contribution limit and military

[20] A recent study found that only 50 percent of the eligible Marine Corps population opted in (officers and enlisted) [19]. This study did not evaluate opt-in rates across the Services.

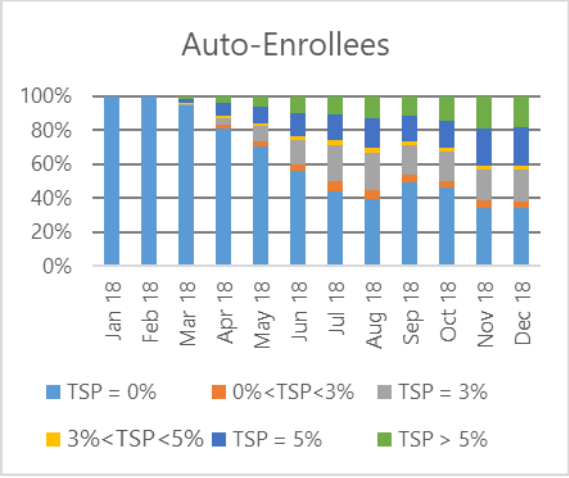
pay charts by paygrade and YOS. Given the stability in military pay relative to civilian pay, it could additionally take into account any raises based on YOS without a significant increase in effort.[21] This could be incorporated as highlighted value on any paperwork or electronic forms or as an error message or confirmation prompt on electronic forms.

[21] While increases in paygrade might not be as easily predicted, this could be incorporated into any paperwork necessary at promotion.

Appendix A: Auto-enrolled Marines Contributing 0 percent to the TSP

Figure 12 shows how auto-enrolled Marines' TSP contribution rates varied by month in 2018, when including all zero values; the vast majority of these are likely to reflect newly-enlisted Marines who do not yet have TSP accounts set up rather than Marines choosing not to contribute, but we are unable to determine how often either is the case. However, it is almost certainly why auto-enrollees contributed none of their basic pay in January 2018. As Marines' TSP accounts are set up, they begin contributing; however, because new Marines enlist every month, there are always some who do not contribute simply because they cannot. As a result, the graph for auto-enrollees consistently overstates the number of Marines who wish to contribute nothing and understates all other contribution levels. Contribution shares also may be affected by months in which many Marines enlist. For example, if 30 Marines are enlisted and contribute to the TSP but another 20 do not yet have TSP accounts, then 60 percent contribute. If in the following month another 50 Marines enlist—with the resulting lag in TSP account creation—then the share contributing to the TSP will fall *even if the 20 who were not contributing previously all begin to do so*. The influx of new recruits likely explains why contribution levels appear to fall in September 2018.

Figure 12. USMC TSP contribution rates by auto-enrollees, including zero values



Source: DMDC.

Appendix B: Contributions over Time by Servicemember Characteristics

In this section, we present TSP contribution rates over 2018 for auto-enrollees and over 2017 and 2018 for BRS-eligible and BRS-ineligible Marines based on their characteristics. Because Servicemembers may react differently to policy changes over time, the progression of contribution rates may be of additional interest above and beyond snapshots. This appendix includes auto-enrolled Marines who do not contribute to TSP accounts.

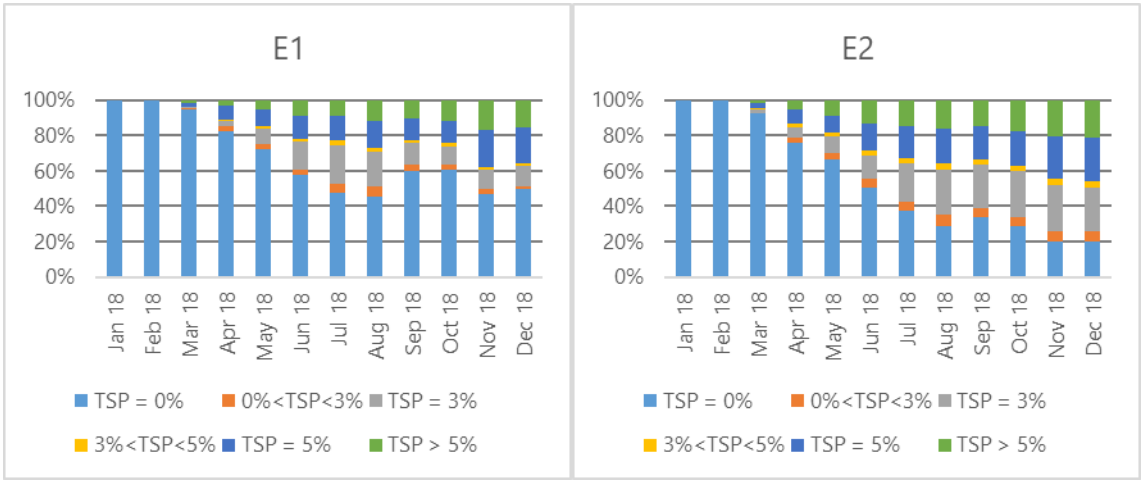
USMC contributions by paygrade

Enlisted paygrade

Figure 13, Figure 14, and Figure 15 show how TSP contributions vary by enlisted paygrade for each BRS eligibility group. We do not include graphs for every combination of paygrade and eligibility group. Some are impossible as a matter of policy—for example, an auto-enrolled Marine will not reach E9 within one year of enlisting. Others are possible but occur so infrequently as to provide little usable information—for example, some auto-enrolled Marines reach E6, and some Marines with 12 or more years of service are demoted to E1, but it would be inappropriate to regard these Marines as representative of any broader patterns or make inferences based on their behavior.

Figure 13 shows contributions by auto-enrolled Marines in paygrades E1 and E2. Readers should note that while auto-enrolled Marines in E2 appear more likely to contribute at each non-zero level than those in E1, this may be because Marines in E1 are much less likely to have active TSP accounts; after removing zero values, auto-enrolled Marines in paygrade E1 are more likely to contribute five percent or more.

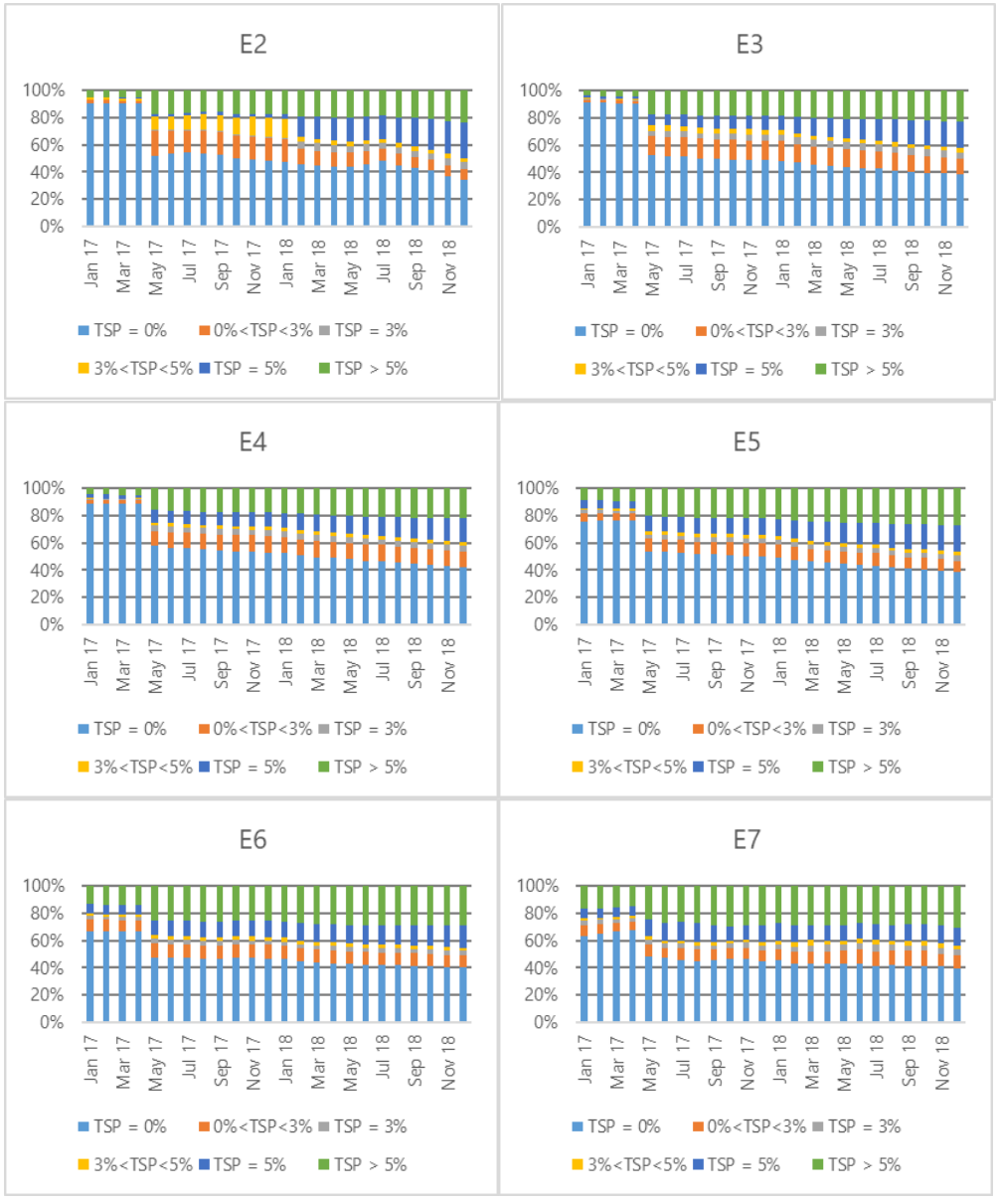
Figure 13. USMC TSP contribution rates by enlisted paygrade, auto-enrollees, 2018



Notes: Among E1s, sample sizes ranged from 41 (in January) to 7,707 (in December). Among E2s, sample sizes ranged from 16 (in January) to 7,262 (in December).
Source: DMDC

Figure 14 shows contribution rates for paygrades E2 through E7 among Marines who were eligible for the BRS. Eligible Marines at paygrade E2 had notably different contribution patterns than those at higher paygrades; in particular, they were much more likely to contribute between 3 and 4 percent between May 2017 and January 2018. Although there is a clear positive correlation prior to May 2017 between enlisted paygrade and contributing to the TSP, eligible Marines at pay grades E3 through E7 were similarly likely to contribute to the TSP; between 40 and 50 percent contributed in May 2017 and approximately 60 percent contributed in December 2018. However, the precise amount contributed by paygrade differs—in particular, eligible Marines at E5 or higher were more likely than those at E3 or E4 to contribute over 5 percent to the TSP and less likely to contribute exactly 5 percent.

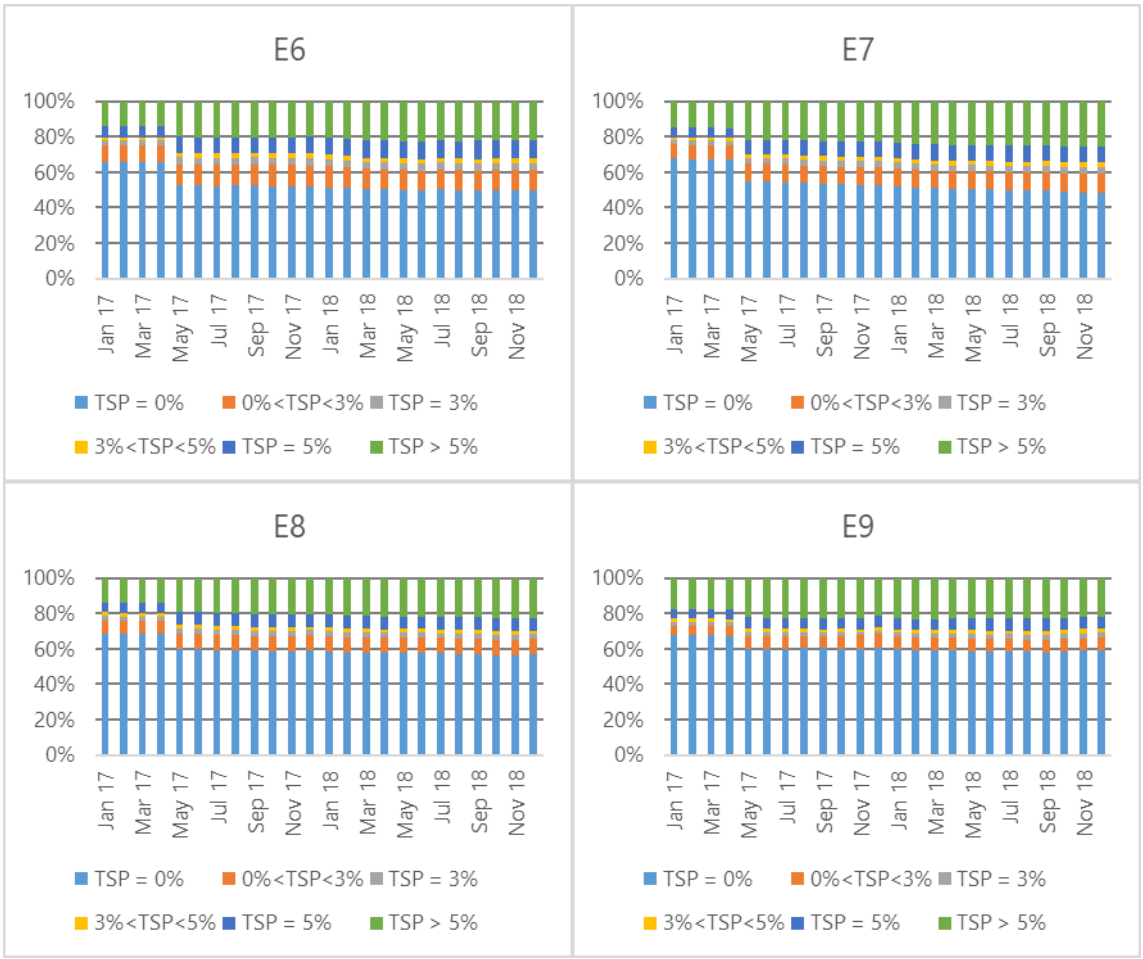
Figure 14. USMC TSP contribution rates by enlisted paygrade, eligible for the BRS, 2017–2018



Notes: For E2s, sample sizes ranged from 11,637 (in December 2018) to 21,298 (in February 2018). For E3s, sample sizes ranged from 41,142 (in October 2017) to 43,594 (in May 2018). For E4s, sample sizes ranged from 34,059 (in August 2017) to 35,717 (in June 2018). For E5s, sample sizes ranged from 25,002 (in October 2018) to 25,582 (in June 2017). For E6s, sample sizes ranged from 7,770 (in September 2017) to 9,951 (in December 2018). For E7s, sample sizes ranged from 258 (in September 2017) to 406 (in February 2018).
Source: DMDC.

Figure 15 shows contribution rates for paygrades E6 through E9 among Marines who were ineligible for the BRS. In general, for these Marines, paygrade appears to be negatively correlated with the probability of contributing to the TSP. Ineligible Marines at paygrades E8 and E9 are noticeably less likely to contribute less than 3 percent or exactly 5 percent to the TSP than those at E6 or E7, but differences in contribution patterns by paygrade are much smaller for this group of Marines than for auto-enrolled or eligible Marines.

Figure 15. USMC TSP contribution rates by enlisted paygrade, ineligible for the BRS, 2017–2018

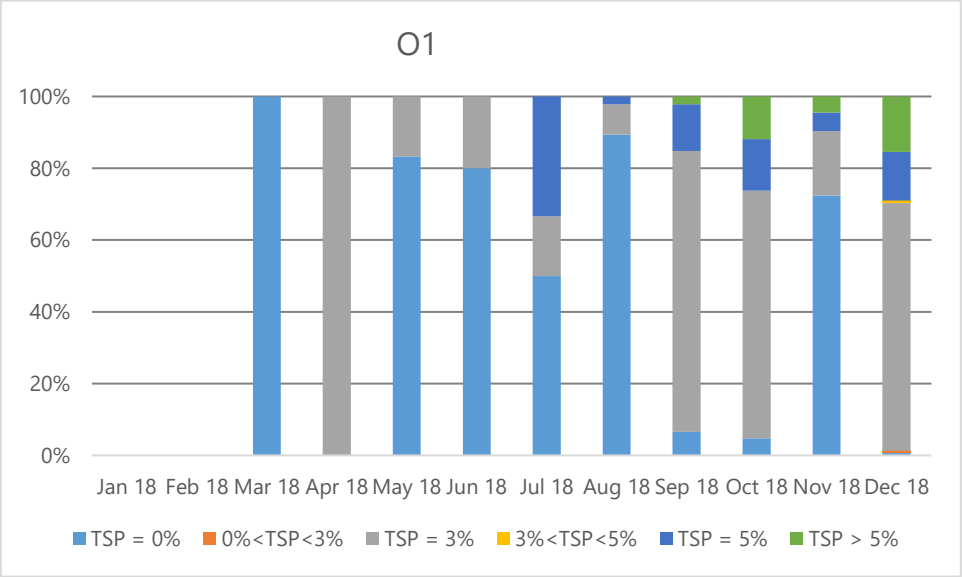


Notes: For E6s, sample sizes ranged from 4,329 (in October 2018) to 5,265 (in June 2017). For E7s, sample sizes ranged from 6,609 (in June 2017) to 7,328 (in December 2018). For E8s, sample sizes ranged from 3,135 (in January 2018) to 3,363 (in September 2018). For E9s, sample sizes ranged from 1,375 (in September 2017) to 1,415 (in November 2017).
Source: DMDC.

Officer paygrade

Figure 16 shows TSP contributions for auto-enrolled Marines in paygrade O1; no auto-enrolled Marines appeared in any other officer paygrade.[22] This figure contains barely enough Marines to be interpretable—the first month with more than 10 Marines is August 2018, and the highest number of Marines in any given month is 156 (in November 2018). Nevertheless, influxes of Marines in August 2018 and November 2018 are visible as spikes in the number of Marines who do not yet have TSP accounts (and therefore cannot contribute toward them). However, the month after each of these two shocks, the contribution rate rises to over 90 percent. Although additional data are necessary to observe longer term patterns, it appears at a glance that auto-enrolled officers are substantially more likely than auto-enrolled enlisted Marines to contribute the default amount to the TSP.[23]

Figure 16. USMC TSP contribution rates for O1, auto-enrollees, 2018



Notes: Sample sizes ranged from 1 (in March and April) to 156 (in November).
Source: DMDC.

[22] We omit discussion of warrant officer paygrades because they contain relatively few Marines, none of whom were auto-enrolled.

[23] Based on December 2018 values, enlisted Marines may be more likely to contribute any amount other than the default; however, this could change as more Marines determine their ideal contribution levels or become officers.

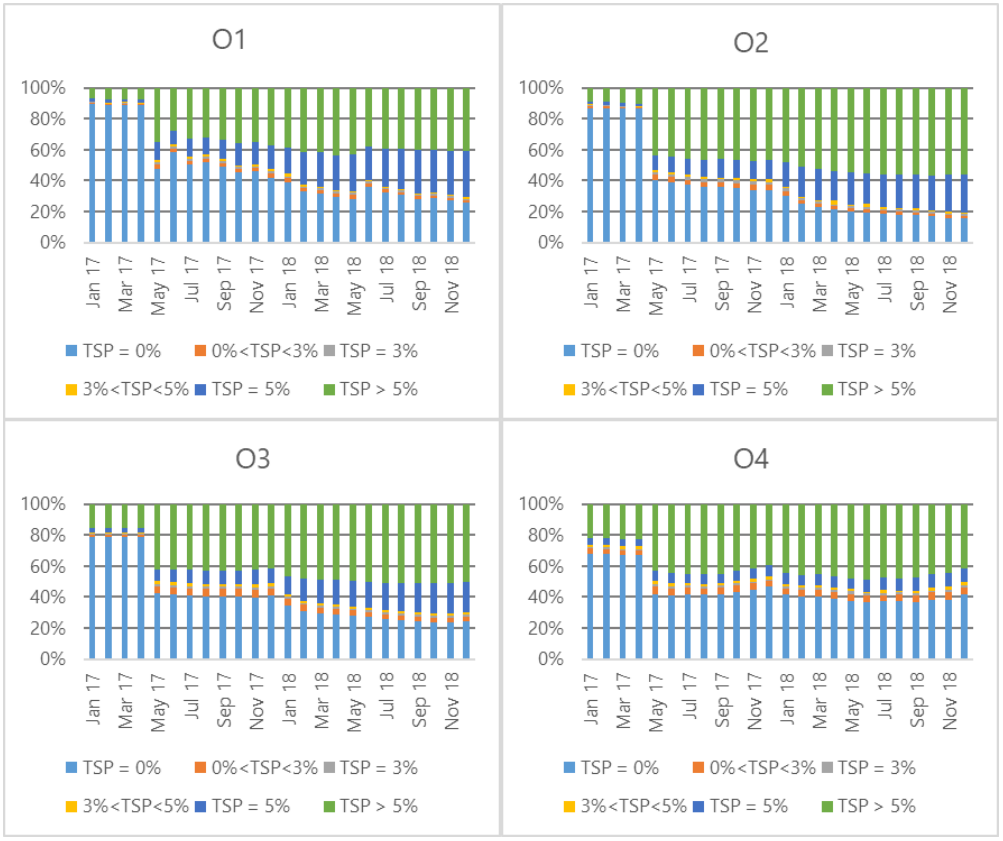
Figure 17 shows TSP contributions by paygrades O1 through O4 among Marines who were eligible for the BRS.[24] Prior to May 2017, officer paygrade was positively correlated with the likelihood of contributing to the TSP at all or appearing in any given contribution category. After 2018, these officers became much more likely to contribute to TSP, chiefly at levels over 5 percent. The likelihood of contributing exactly 5 percent, meanwhile, became negatively correlated with officer paygrade. The entry and promotion schedule for officers explains some of the variation in the O1 graph—more than 450 officers leave paygrade O1 and more than 400 enter paygrade O2 in May of each year in our data, followed by an influx at O1 the following month.[25] The new officers at O1 may need time to establish their TSP accounts—explaining the gradual rise in contributions between June 2017 and June 2018—but those promoted to O2 have had plenty of time to determine their ideal contribution rates.

Some contribution patterns among Marine officers may reflect hitting the elective deferral limit. Among O2s, contribution rates had nearly flattened by December 2017 after a gradual rise. In January 2018, their contribution rates began to rise again (quickly in the beginning of the year, but more slowly afterwards). Among O3s, contribution rates declined slightly in December 2017 from their prior low the month before, then rose over the next 11 months before falling again in December 2018. The decline in contribution rates at the end of the year was more pronounced among O4s, whose contribution rates fell from September to December 2017 and in November and December 2018.

[24] Due to typical promotion schedules, at most three Marines with fewer than 12 years of service held paygrade O5 in any given month, and none held paygrades O6 or higher.

[25] Although most of these differences likely represent promotion, aggregate data combined with the possibility of demotion do not let us say exactly how many.

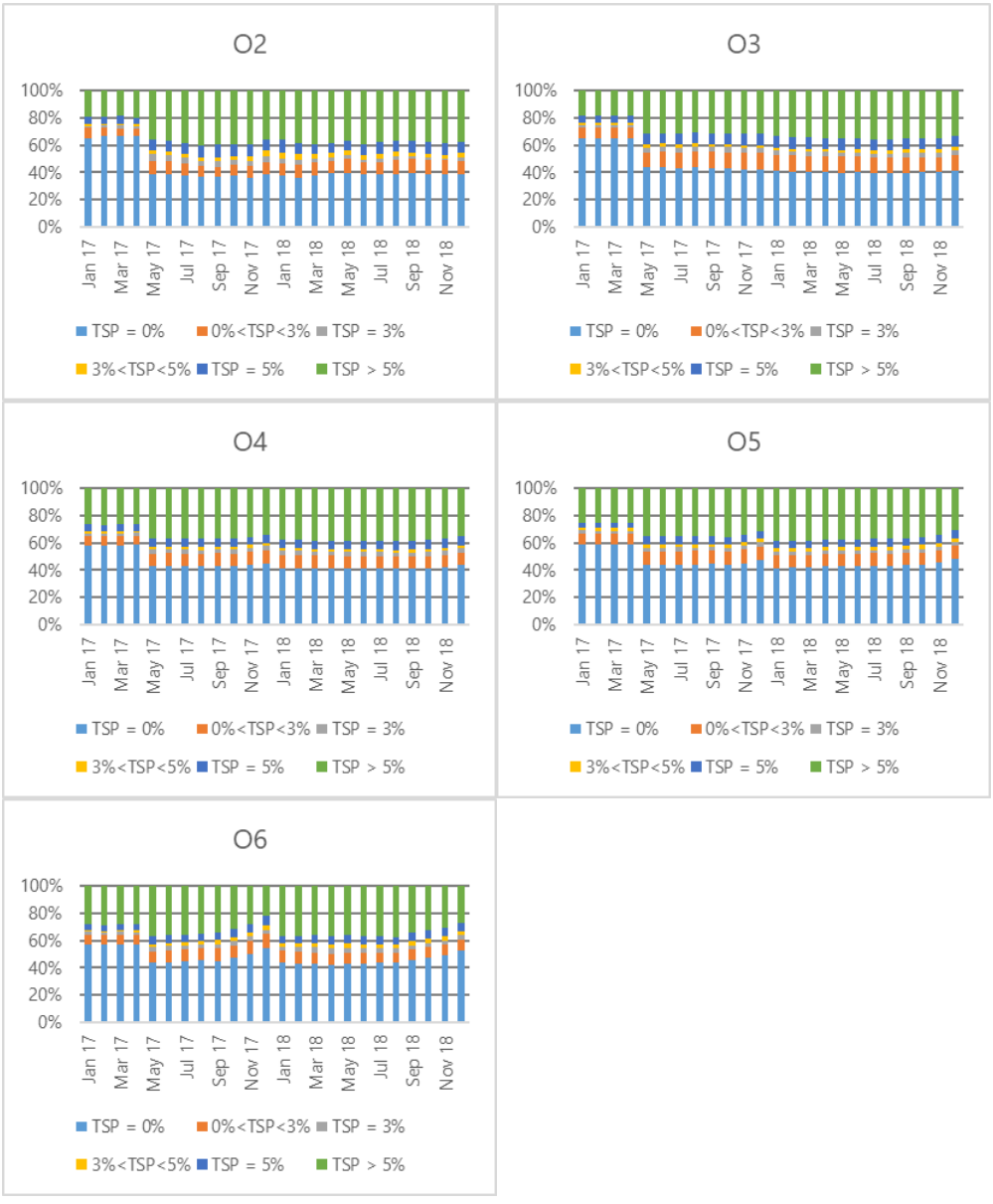
Figure 17. USMC TSP contribution rates by officer paygrade, eligible for the BRS, 2017–2018



Notes: For O1s, sample sizes ranged from 2,231 (in May 2017) to 3,044 (in February 2018). For O2s, sample sizes ranged from 2,593 (in February 2018) to 3,161 (in May 2017). For O3s, sample sizes ranged from 4,240 (in October 2017) to 4,604 (in April 2018). For O1s, sample sizes ranged from 623 (in April 2018) to 887 (in October 2017).
Source: DMDC.

Figure 18 shows TSP contributions by paygrades O2 through O6 among ineligible Marines. In general, the probability of contributing to the TSP is negatively correlated with paygrade for ineligible Marine officers. Again, there is evidence of the elective deferral limit, even without the incentive of automatic or matching payments: for paygrades O4 and higher, the probability of contributing fell over the second half of each year, becoming more pronounced as paygrades rise. In each year, this decrease in contribution was most closely tied to an accompanying decrease in contributions of over 5 percent.

Figure 18. USMC TSP contribution rates by officer paygrade, ineligible for the BRS, 2017–2018



Notes: For O2s, sample sizes ranged from 157 (in October 2018) to 239 (in August 2018). For O3s, sample sizes ranged from 1,077 (in November 2017) to 1,185 (in April 2018). For O4s, sample sizes ranged from 2,593 (in December 2018) to 2,851 (in June 2017). For O5s, sample sizes ranged from 1,779 (in September 2017 and November 2018) to 1,795 (in March 2018). For O6s, sample sizes ranged from 605 (in June and July 2018) to 616 (in June 2018).
Source: DMDC.

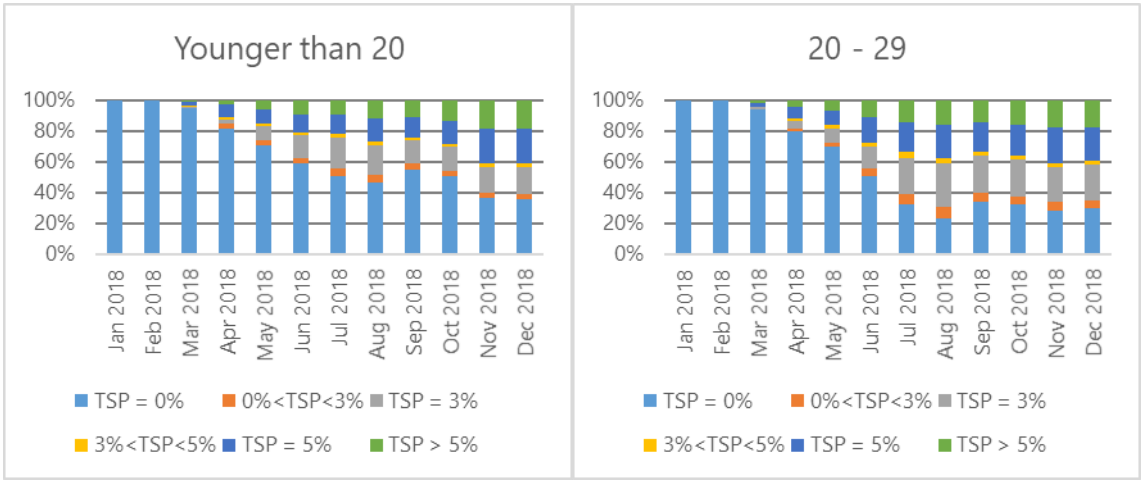
USMC contributions by age and RMC

Figure 19 shows contribution rates by auto-enrolled Marines, separated into categories based on their 10-year age range *as of January 1, 2018*.[26] This means, for example, that a Marine whose birthday is January 2, 1998 will remain in the "younger than 20" category for the duration of our analysis, even though he or she turns 20 one day into our sample. Although Marines may enter and exit our sample entirely, they will not transfer across categories. Although Marines age 20–29 were much more likely to contribute to the TSP than those under 20, this may reflect different growth in the two samples. In 11 of 12 months, the under-20 sample grew at a higher rate than the 20–29 sample.[27] In particular, in July 2018, when the gap in TSP contribution widened, the 20–29 sample had grown by only 6.7 percent versus 33.3 percent for the under-20 sample. The difference in sample growth across age categories means a difference in the percentage of Marines without TSP accounts. However, despite continual growth in the under-20 category, the contribution gap narrowed noticeably in the last two months of 2018. In the second half of the year, once contribution patterns began to stabilize, Marines in the 20–29 age group were much more likely to contribute the default rate to the TSP than those in the under-20 age group. Through middle and late 2018, they were also more likely to contribute 5 percent or more, though the under-20 age group caught up in the final two months of the year.

[26] DMDC data contained Marines' dates of birth, from which it was possible to manually compute age as of any given reference date. We chose January 1, 2018, since it was the date the policy went into effect.

[27] The exception was in May 2018, when the under-20 sample grew by 88.0 percent over the previous month and the 20–29 sample grew by 88.1 percent.

Figure 19. USMC TSP contribution rates by age, auto-enrollees, 2018

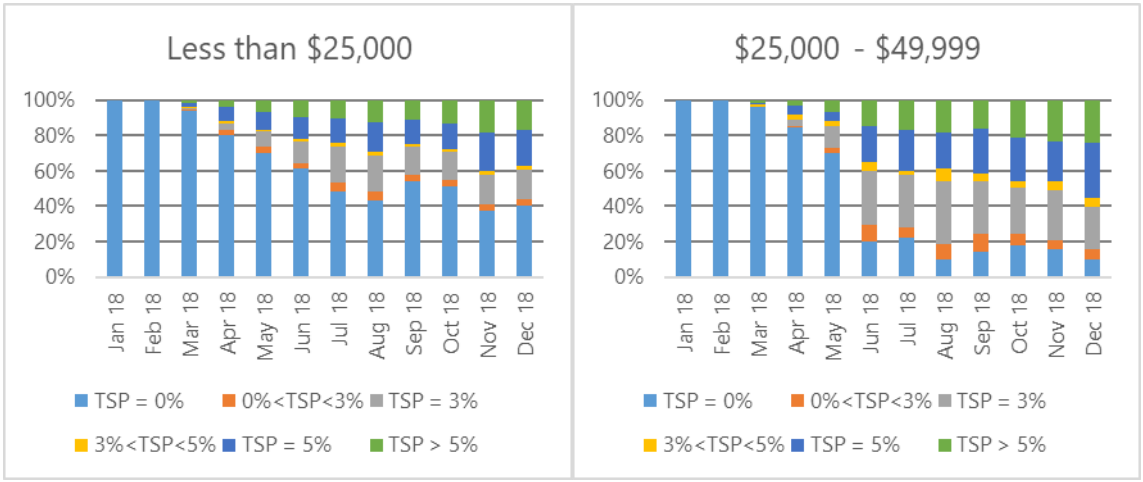


Notes: For Marines younger than 20, sample sizes ranged from 20 (in January) to 11,871 (in December). For Marines aged 20–29, sample sizes ranged from 40 (in January) to 3,678 (in December).
Source: DMDC.

Figure 20 shows that auto-enrollees earning less than $25,000 in RMC were much less likely than those earning higher levels of RMC to contribute to the TSP and, from June 2018 onward, were less likely to appear in nearly every contribution category than Marines earning between $25,000 and $49,999.[28] As discussed in the body of the paper, this could reflect the desire for a threshold income level prior to saving, or could reflect correlation with qualifying for BAH.

[28] In July 2018, Marines earning between $25,000 and $49,999 were 0.4 percentage points less likely than those earning less than $25,000 to contribute between 3 and 5 percent.

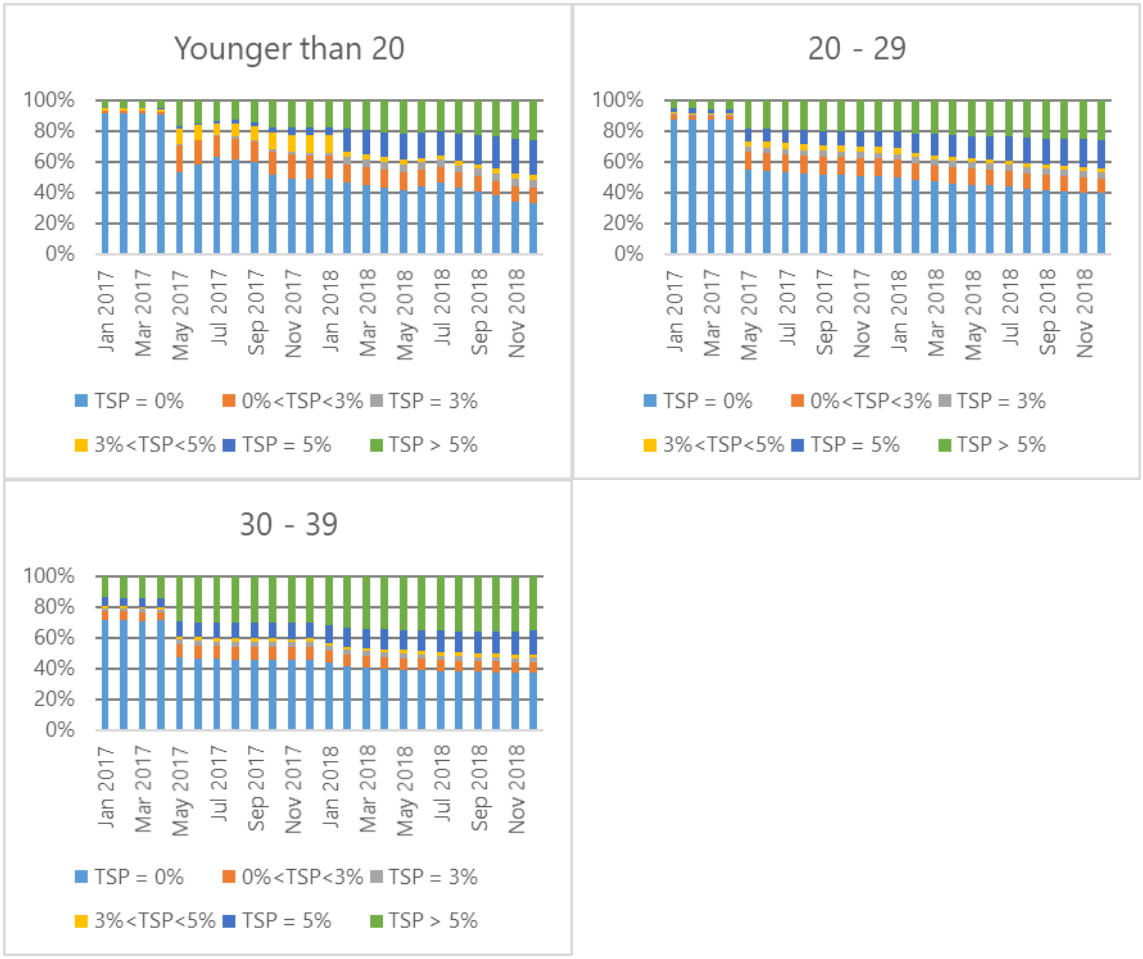
Figure 20. USMC TSP contribution rates by total gross annual income, auto-enrollees, 2017–2018



Notes: For Marines earning less than $25,000, sample sizes ranged from 59 (in January) to 12,329 (in December). For Marines earning $25,000–$49,999, sample sizes ranged from 1 (in January) to 3,007 (in December).
Source: DMDC.

Figure 21 shows mixed trends in TSP contribution rates by age group among eligible Marines. Though eligible Marines younger than 20 were contributing at much lower rates than those aged 20–29 or 30–39 well into 2017, their probability of contributing rose steadily in the second half of 2017 and all of 2018, and they were the group most likely to contribute in November and December 2018. This corresponds to steady (if uneven) growth in the probability of contributing 5 percent or more during this time, including a rapid and simultaneous decrease in the probability of contributing between 3 and 5 percent and increase in the probability of contributing 5 percent in February of 2018. The 20–29 age group and 30–39 age group also showed steady (though more gradual) increases in the probability of contributing to the TSP, each driven by growth in the number of Marines contributing 5 percent or more.

Figure 21. USMC TSP contribution rates by age, eligible for the BRS, 2017–2018

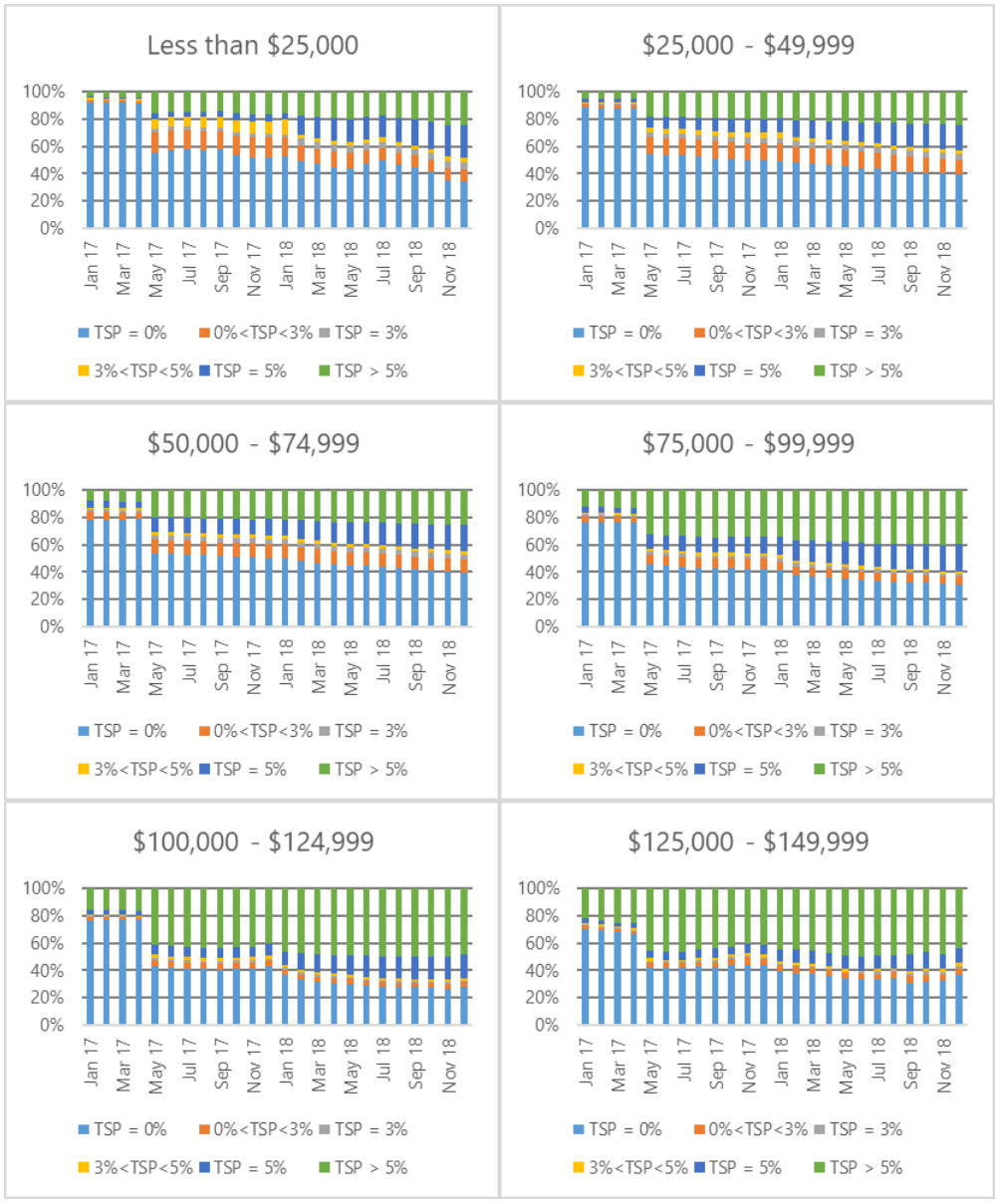


Notes: For Marines younger than 20, sample sizes ranged from 9,407 (in January 2017) to 36,225 (in November 2018). For Marines aged 20–29, sample sizes ranged from 96,387 (in December 2018) to 128,815 (in January 2017). For Marines aged 30–39, sample sizes ranged from 6,808 (in December 2018) to 13,827 (in January 2017).
Source: DMDC.

Figure 22 shows that, for eligible Marines earning less than $125,000, RMC levels were positively correlated with both the probability of making any TSP contribution and the probability of contributing over 5 percent. However, eligible Marines earning between $125,000 and $149,999 were less likely to contribute to the TSP or to contribute over 5 percent than those earning between $100,000 and $124,999. They also were the least likely group to contribute 5 percent during all months of 2018. Beginning in February 2018, eligible Marines

who earned less than $25,000 were the most likely to contribute 3 percent, 5 percent, or any amount in between. Some Marines earning less than $25,000 also appear to have noticeably increased their TSP contributions once the BRS was implemented, perhaps because they required some form of matching to justify a reduction in their already-low gross incomes. Among eligible Marines earning over $100,000, contribution patterns again appear to reflect reaching the elective deferral limit.

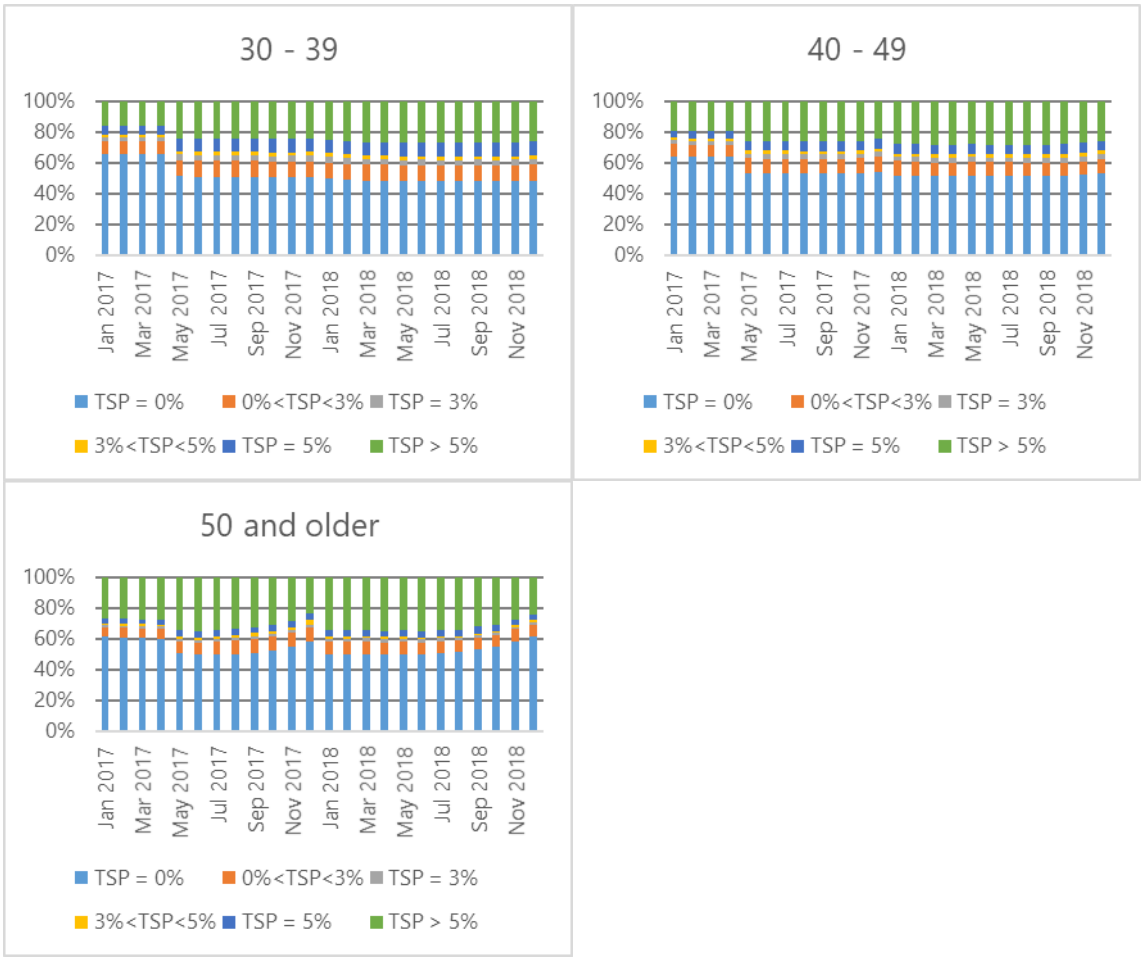
Figure 22. USMC TSP contribution rates by total gross annual income, eligible for the BRS, 2017–2018



Notes: Between 23,675 (December 2018) and 42,539 (December 2017) Marines earned less than $25,000. Between 65,394 (August 2017) and 78,824 (January 2018) Marines earned $25,000–$49,999. Between 32,565 (November 2017) and 34,217 (May 2018) Marines earned $50,000–$74,999. Between 7,815 (November 2017) and 8,779 (July 2018) Marines earned $75,000–$99,999. Between 2,803 (September 2017) and 3,157 (February 2018) Marines earned $100,000–$124,999. Between 388 (April 2017) and 546 (March 2018) Marines earned $125,000–$149,999.
Source: DMDC.

Figure 23 shows that TSP contribution rates are positively correlated with age among ineligible Marines. For ineligible Marines under age 50 as of January 2018, contributions remain extremely steady starting in May 2017—the share contributing at all and the share contributing over 5 percent always remain within 3 percentage points of their values in May 2017, and other contribution categories are even more stable. Ineligible Marines age 50 and older in January 2018 instead appeared increasingly likely to reach the elective deferral limit over the course of each year.

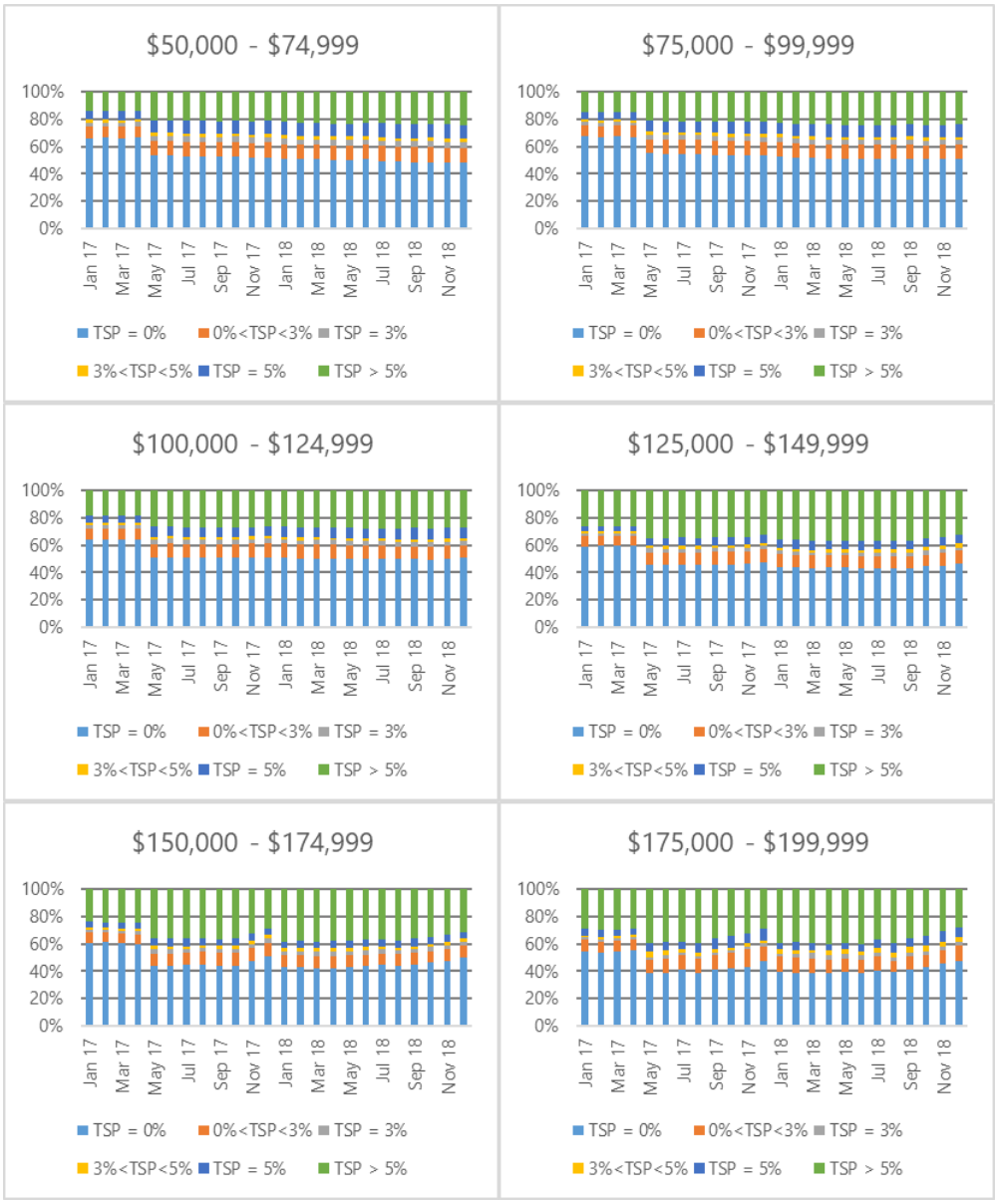
Figure 23. USMC TSP contribution rates by age, ineligible for the BRS, 2017–2018



Notes: For Marines aged 30–39, sample sizes ranged from 15,365 (in January 2017) to 17,531 (in November 2018). For Marines aged 40–49, sample sizes ranged from 6,048 (in December 2018) to 8,841 (in January 2017). For Marines aged 50 or older, sample sizes ranged from 410 (in December 2018) to 7525 (in January 2017).
Source: DMDC.

Figure 24 shows three distinct patterns for ineligible Marines based on their RMC levels. Ineligible Marines earning under $100,000 gradually became more likely to contribute to the TSP between May 2017 and December 2018; those earning $100,000 to $124,999 had extremely stable contribution levels over this time; and those earning $125,000 or more became less likely to contribute to the TSP over the second half of each year, with the decrease in contribution rates becoming more pronounced as RMC rises. This again is likely to reflect hitting the TSP contribution limit.

Figure 24. USMC TSP contribution rates by total gross annual income, ineligible for the BRS, 2017–2018



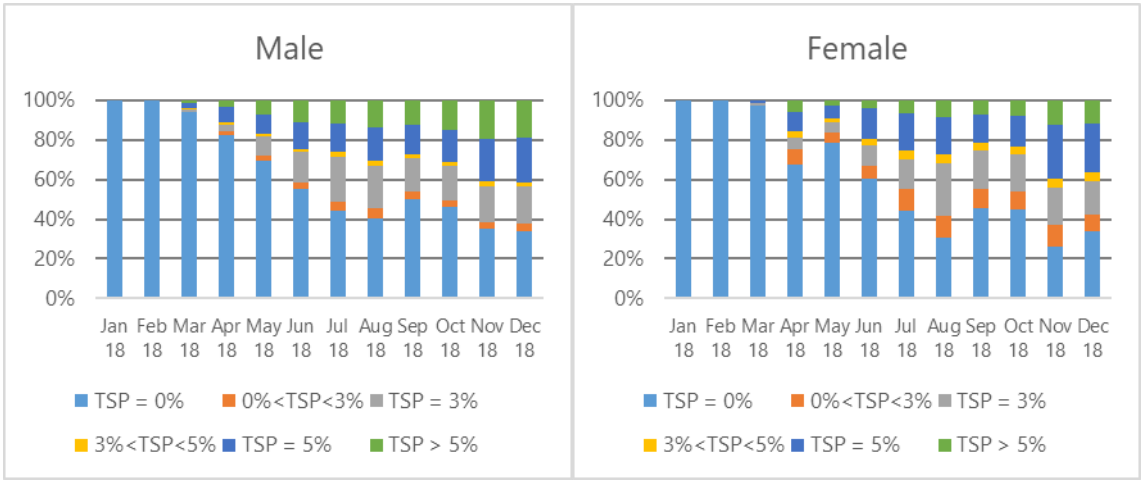
Notes: Between 4,964 (August 2018) and 5,877 (November 2017) Marines earned $50,000–$74,999. Between 9,329 (December 2017) and 9,869 (June 2018) Marines earned $75,000–$99,999. Between 4,774 (November 2018) and 5,271 (July 2017) Marines earned $100,000–$124,999. Between 2,940 (October 2017) and 3,298 (July 2018) Marines earned $125,000–$149,999. Between 1,121 (November 2017) and 1,371 (May 2018) Marines earned $150,000-$174,000. Between 322 (February 2017) and 408 (March 2018) Marines earned $175,000-$199,999.
Source: DMDC.

USMC contribution rates by gender, race, and Hispanic ethnicity

Gender

Figure 25 shows that female enrollees were slightly more likely to contribute to the TSP in the second half of 2018 (patterns earlier in the year may reflect small sample sizes). However, the percent of basic pay contributed varied by gender. Beginning in April 2018, female Marines were more likely than male Marines in each month to select a non-default contribution rate below 5 percent; in six of these nine months, they also were more likely to contribute exactly 5 percent. However, male Marines were consistently more likely than female Marines to contribute over 5 percent to the TSP.[29]

Figure 25. USMC TSP contribution rates by gender, auto-enrollees, 2018



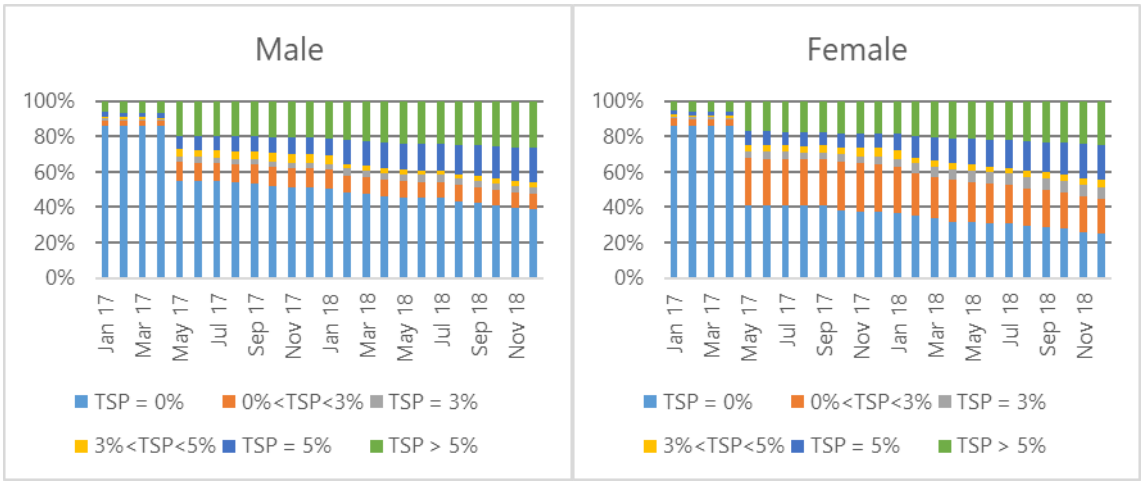
Notes: For men, sample sizes ranged from 56 (in January) to 14,002 (in December). For women, sample sizes ranged from 4 (in January) to 1,556 (in December).
Source: DMDC.

Figure 26 shows that, starting in May 2017, female Marines who would become eligible for the BRS were much more likely than their male counterparts to contribute to the TSP. After four months in which male and female Marines were almost equally likely to contribute to the TSP, female Marines were over 12 percentage points more likely to contribute in every subsequent

[29] The exceptions to this were in January and February, during which no Marines contributed to TSP, and in April, during which only 56 male Marines and 263 male Marines contributed to TSPs.

month. This gap was driven chiefly by women contributing between 1 and 3 percent of their basic pay. In every month, female Marines were more likely to contribute exactly 3 percent of their basic pay, while male Marines were more likely to contribute over 5 percent. Beginning in January 2018, female Marines became more likely than male Marines to contribute between 3 and 5 percent, after achieving this only once in the prior 12 months. Although men were more likely to contribute 5 percent in every month through June 2018, women were more likely to do so in four of the six subsequent months.

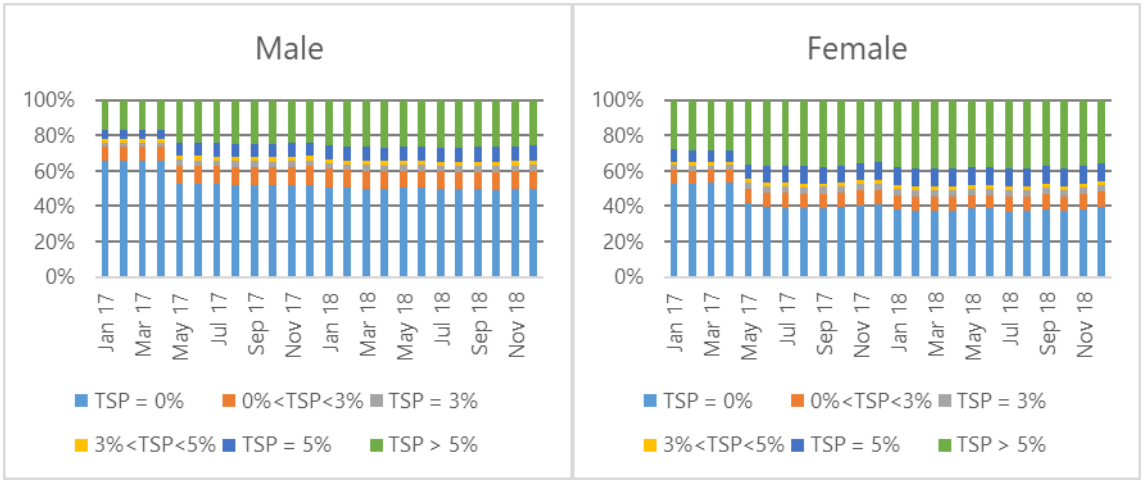
Figure 26. USMC TSP contribution rates by gender, eligible for the BRS, 2017–2018



Notes: For men, sample sizes ranged from 126,922 (in December 2018) to 139,916 (in January 2018). For women, sample sizes ranged from 12,456 (in December 2018) to 13,526 (in February 2018).
Source: DMDC.

Figure 27 shows that female Marines who were ineligible to enroll in the BRS were much more likely than their male counterparts to contribute to the TSP. Unlike auto-enrollees and Marines who were eligible for the BRS, female Marines who were ineligible for the BRS were more likely than men to contribute 5 percent or more of their basic pay in every month (or to contribute the default rate of 3 percent) and less likely to contribute between 0 and 3 percent. Male Marines generally were more likely to contribute between 3 and 5 percent.

Figure 27. USMC TSP contribution rates by gender, ineligible for the BRS, 2017–2018



Notes: For men, sample sizes ranged from 23,244 (in December 2018) to 23,987 (in May 2017). For women, sample sizes ranged from 1,236 (in April 2017) to 1,327 (in June 2018).
Source: DMDC.

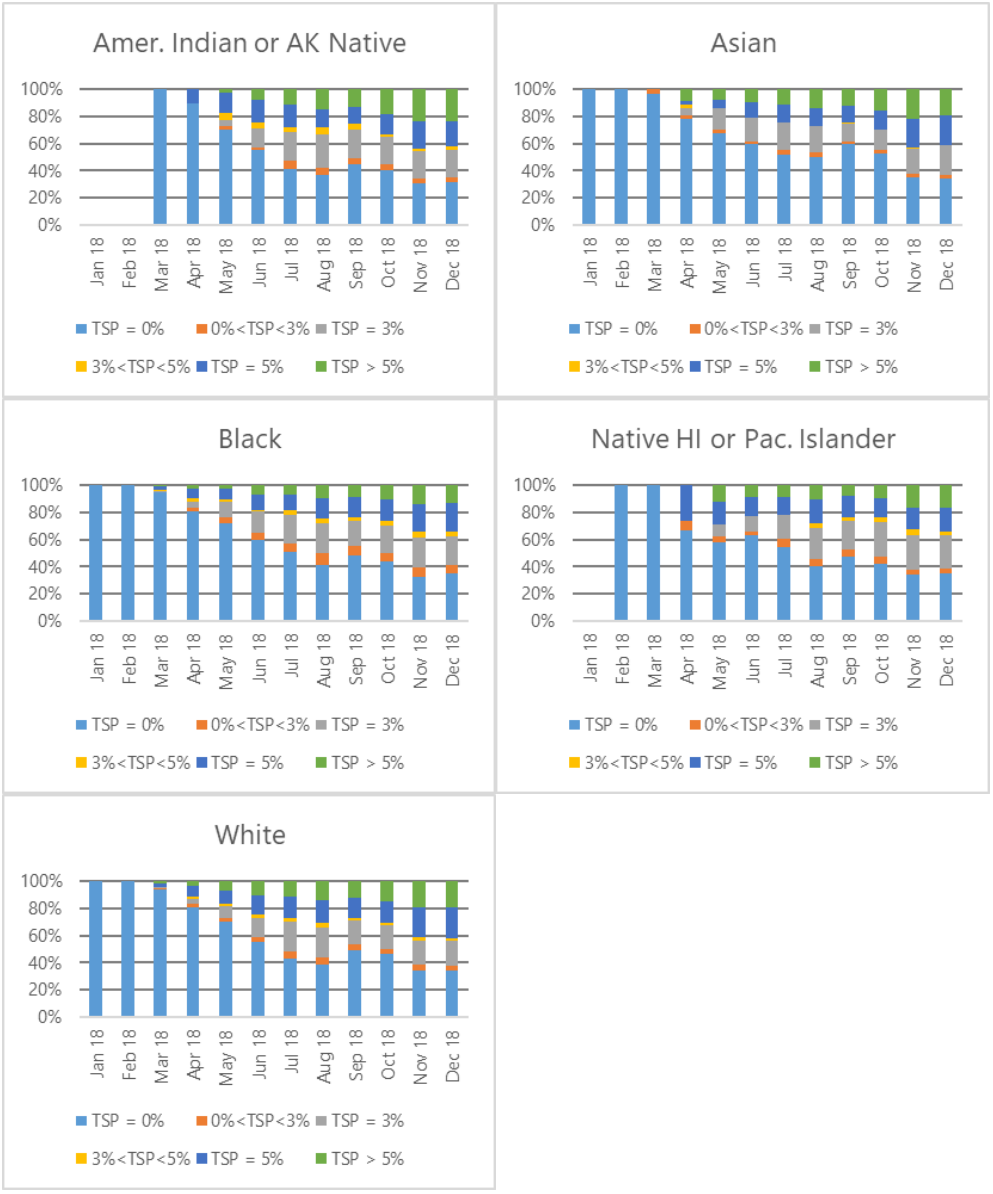
Race and Hispanic ethnicity

We examined race and Hispanic ethnicity separately. For race, we used the categorizations of American Indian/Alaska Native (AI/AN), Asian, Black, Native Hawai'ian/Pacific Islander (NH/PI), White, or two or more of the above, regardless of Hispanic status. We then treated Hispanic status as a binary category, regardless of race. Figure 28 and Figure 29 show TSP contribution rates by race and Hispanic ethnicity for auto-enrolled Marines. Figure 30 and Figure 31 show contributions for Marines who were eligible for the BRS (or would have been eligible had the BRS existed in 2017). Figure 32 and Figure 33 show TSP contribution rates for Marines who were ineligible for the BRS (or would have been ineligible had it existed in 2017).

Figure 28 shows that in December 2018, between 65 and 69 percent of auto-enrollees in all racial groups contributed to the TSP.[30] In this month, AI/AN auto-enrollees were the most likely to make any contribution or to contribute over 5 percent of their basic pay. NH/PI auto-enrollees were the least likely to contribute and the most likely to contribute the default rate of 3 percent. White auto-enrollees were the most likely to contribute 5 percent, and Black auto-enrollees were the most likely to contribute amounts below 5 percent other than the default.

[30] We omit a sub-graph for auto-enrolled Marines belonging to two or more races, since this category never contained more than 15 Marines. Because there were fewer than 200 AI/AN or NH/PI and fewer than 500 Asian auto-enrolled Marines in any month in 2018, results for these groups should also be treated with caution.

Figure 28. USMC TSP contribution rates by race, auto-enrollees, 2018

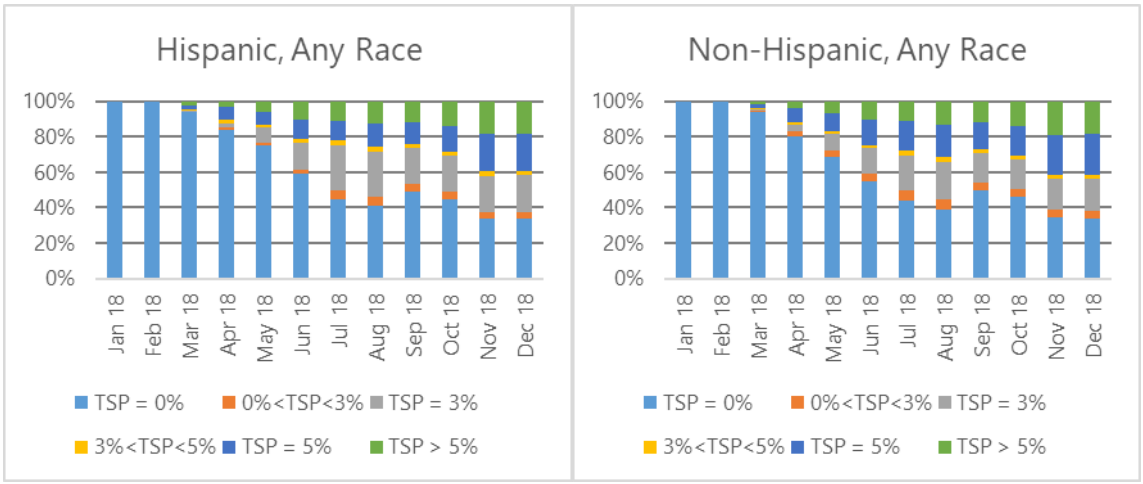


Notes: For AI/AN Marines, sample sizes ranged from 15 (in March) to 160 (in December). For Asian Marines, sample sizes ranged from 4 (in January) to 459 (in December). For Black Marines, sample sizes ranged from 5 (in January) to 1,773 (in December). For NH/PI Marines, sample sizes ranged from 1 (in February) to 137 (in December). For White Marines, sample sizes ranged from 51 (in January) to 13,014 (in December).
Source: DMDC.

Figure 29 shows that Hispanic and non-Hispanic auto-enrollees were similarly likely to contribute to the TSP over the course of 2018. In general, Hispanic auto-enrollees were more

likely than non-Hispanic auto-enrollees to contribute 3 percent and less likely to contribute 5 percent. Probabilities of contributing other rates were similar across all months.

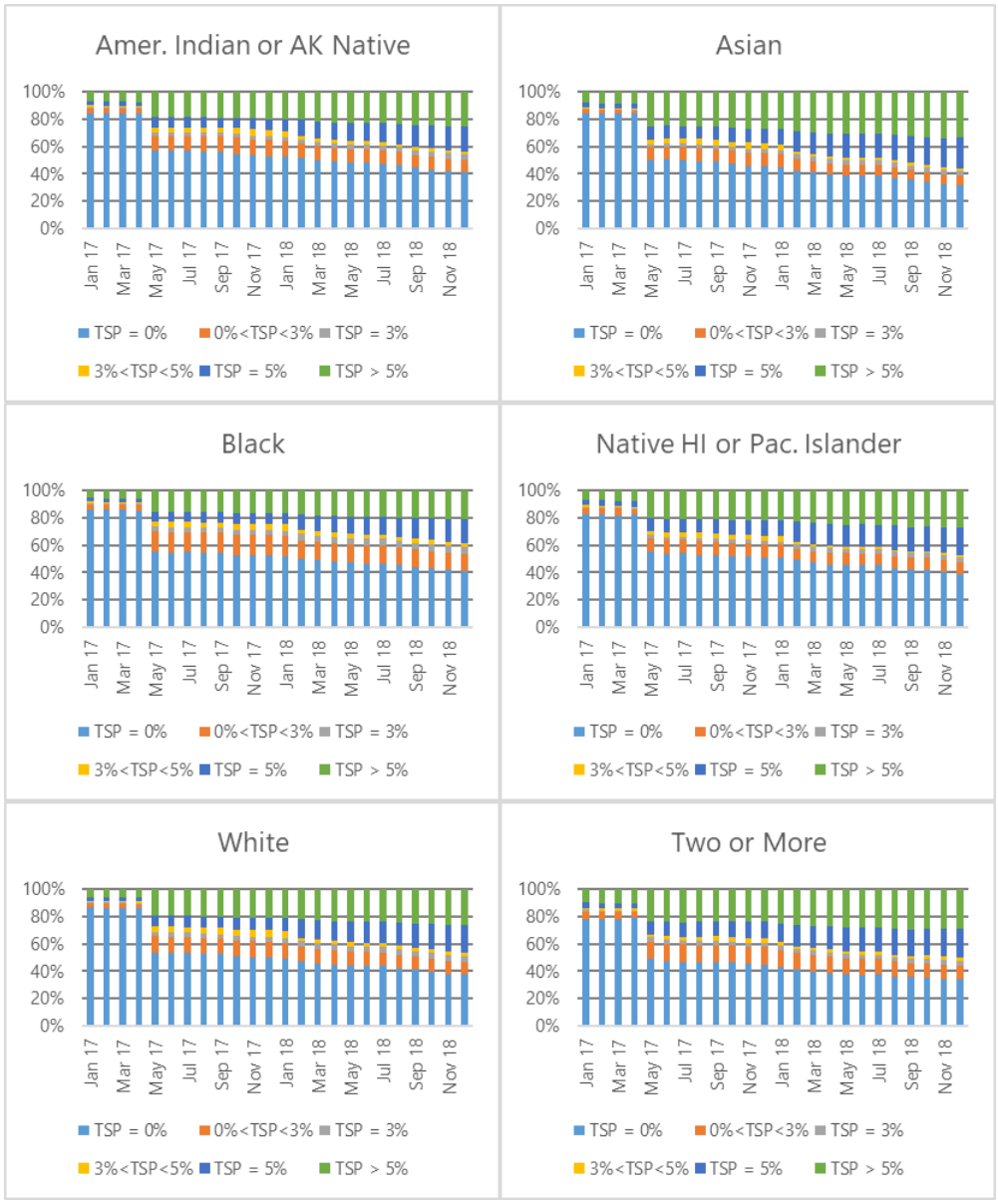
Figure 29. USMC TSP contribution rates by Hispanic ethnicity, auto-enrollees, 2018



Notes: Among Hispanic Marines, sample sizes ranged from 10 (in January) to 3,889 (in December). Among non-Hispanic Marines, sample sizes ranged from 50 (in January) to 11,669 (in December).
Source: DMDC.

Figure 30 shows contribution patterns by race for Marines eligible for the BRS. In every month through September 2018, multiracial eligible Marines were the most likely to contribute to the TSP; in the final three months of 2018, Asian eligible Marines were the most likely to do so. For nearly all of the two years we observed, AI/AN eligible Marines were the least likely to contribute to the TSP. Over all of 2017 and 2018, Black eligible Marines were the least likely group to contribute 5 percent or more to the TSP; beginning in May 2017, they were frequently the most likely group to contribute 3 percent or less, and for much of 2018 they were the most likely group to contribute any amount below 5 percent.

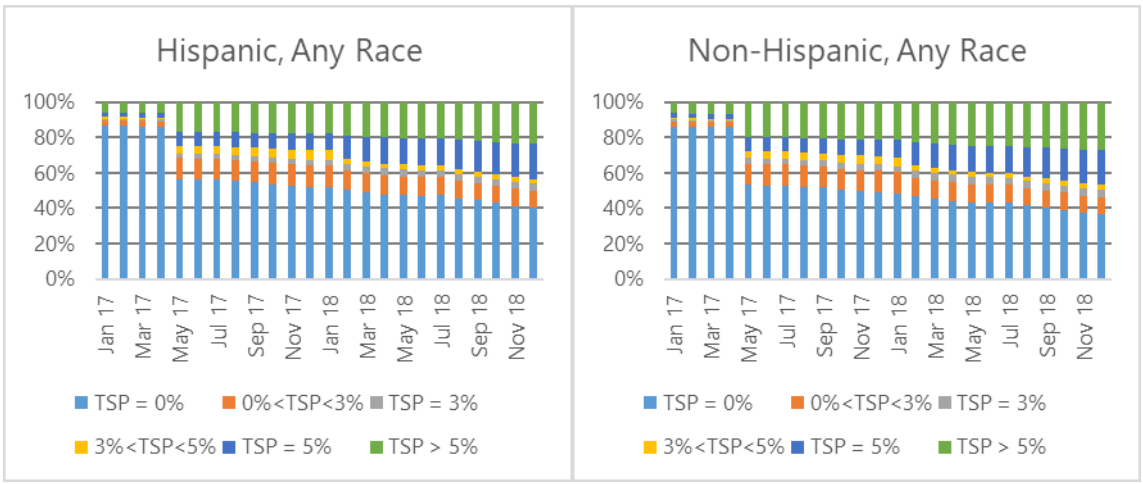
Figure 30. USMC TSP contribution rates by race, eligible for the BRS, 2017–2018



Notes: For AI/AN Marines, sample sizes ranged from 1,466 (December 2018) to 1,631 (January 2018). For Asian Marines, sample sizes ranged from 4,321 (December 2018) to 4,630 (January 2018). For Black Marines, sample sizes ranged from 14,454 (December 2018) to 16,382 (January 2018). For NH/PI Marines, sample sizes ranged from 1,595 (December 2018) to 1,775 (March 2017). For White Marines, sample sizes ranged from 115,926 (December 2018) to 127,532 (January 2018). For Marines of two or more races, sample sizes ranged from 1,403 (September and October 2017) to 1,616 (December 2018).
Source: DMDC.

As Figure 31 shows, beginning in May 2017, non-Hispanic eligible Marines were between 3.0 and 4.2 percentage points more likely than Hispanic Marines to contribute to the TSP and between 3.0 and 4.3 percentage points more likely to contribute 5 percent. Differences across other contribution categories were small—at most 0.6 percentage points.

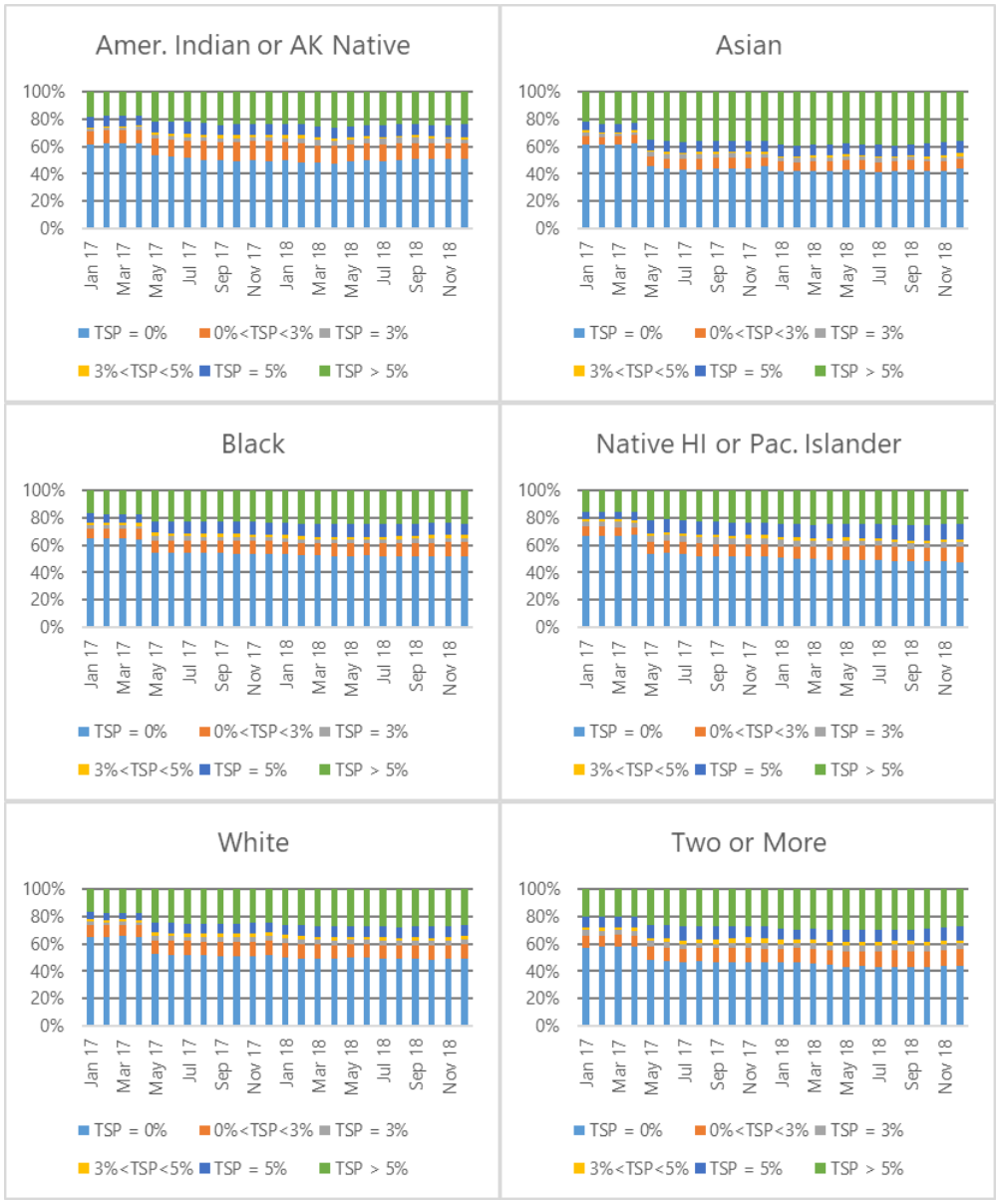
Figure 31. USMC TSP contribution rates by Hispanic ethnicity, eligible for the BRS, 2017–2018



Notes: Among Hispanic Marines, sample sizes ranged from 30,331 (in January 2017) to 32,574 (in February 2018). Among non-Hispanic Marines, sample sizes ranged from 108,680 (in December 2018) to 121,820 (in January 2017).
Source: DMDC.

Figure 32 shows that among those ineligible for the BRS, Asian Marines were the most likely to contribute to the TSP in every month from May 2017 onward, while Black Marines were the least likely. Asian ineligible Marines also were by far the most likely to contribute over 5 percent; the next-closest group never came closer than 8 percentage points. AI/AN, Black, and NH/PI ineligible Marines were the least likely groups to contribute over 5 percent; in any given month from May 2017 onward, one of these groups was the least likely contribute this amount, and differences between the three groups only infrequently exceeded 1 percentage point.

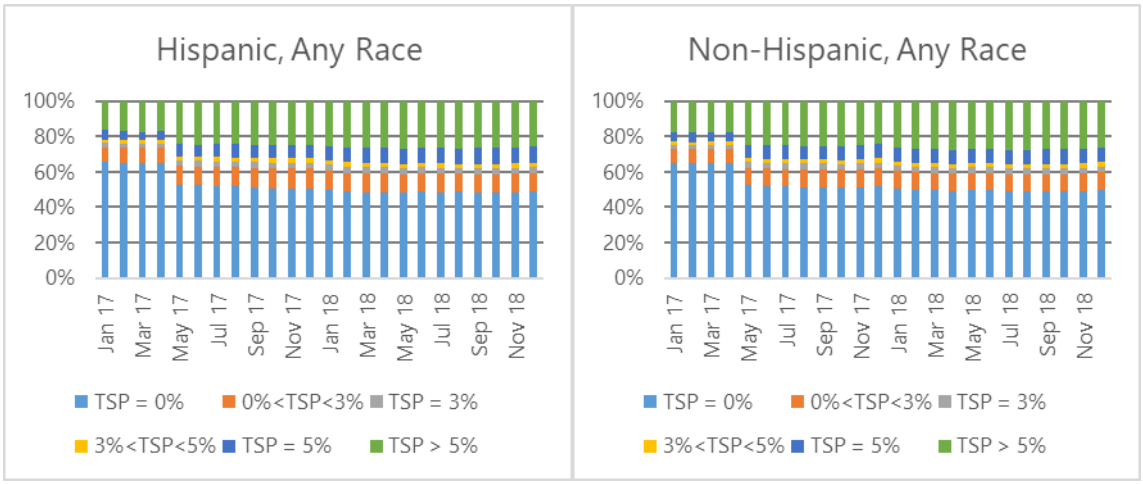
Figure 32. USMC TSP contribution rates by race, ineligible for the BRS, 2017–2018



Notes: For AI/AN Marines, sample sizes ranged from 297 (in December 2018) to 322 (in January 2018). For Asian Marines, sample sizes ranged from 704 (in March 2017) to 743 (in September 2018). For Black Marines, sample sizes ranged from 3,207 (in December 2018) to 3,584 (in January 2018). For NH/PI Marines, sample sizes ranged from 244 (in January 2017) to 264 (in November 2018). For White Marines, sample sizes ranged from 19,551 (in December 2018) to 20,120 (in June 2018). For Marines of two or more races, sample sizes ranged from 414 (in January 2017) to 472 (in December 2018).
Source: DMDC.

Figure 33 shows that ineligible Marines contributed to the TSP at very similar rates regardless of Hispanic ethnicity. In no month were differences in any contribution category greater than 1.5 percentage points.

Figure 33. USMC TSP contribution rates by Hispanic ethnicity, ineligible for the BRS, 2017–2018



Notes: Among Hispanic Marines, sample sizes ranged from 3,065 (in April 2017) to 3,174 (in June 2018). Among non-Hispanic Marines, sample sizes ranged from 21,400 (in December 2018) to 22,154 (in May 2017).
Source: DMDC.

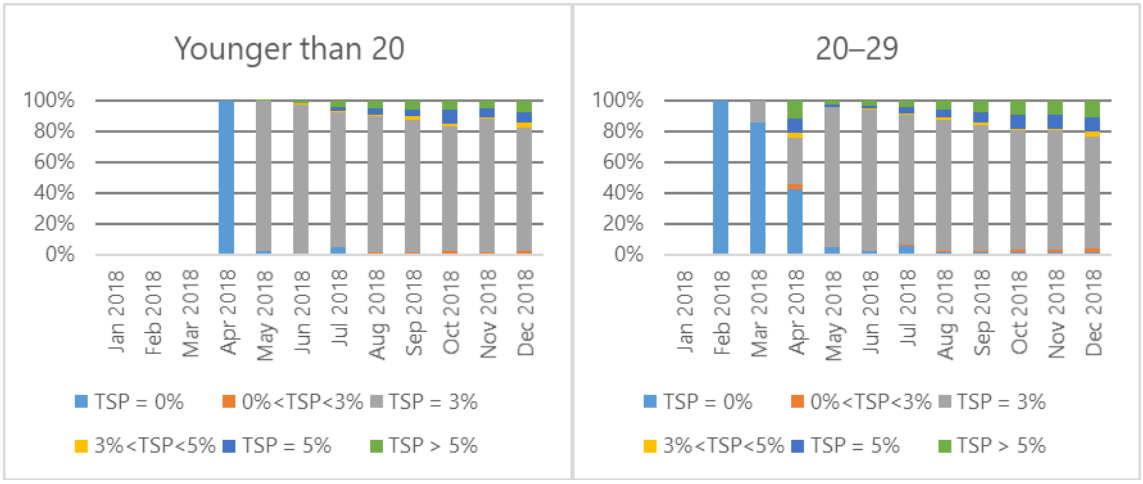
While we observe differences in contribution rates by gender and by race (though not by Hispanic ethnicity), we urge caution in interpreting these results for two primary reasons. First, increasing diversity in the Marine Corps may mean that female and/or minority Marines have different average paygrades, YOS, income levels, or other factors that directly or indirectly affect contribution levels. Second, race and gender may interact in unexpected ways—for example, among ineligible Marines, Black women are more likely than AI/AN women to contribute to the TSP or to contribute at least 5 percent, but AI/AN men are more likely than Black men to do either.

Army, Navy, and Air Force TSP contributions by age

Auto-enrollees

Figure 34, Figure 35, and Figure 36 respectively show how auto-enrolled Soldiers, Sailors, and Airmen contributed to the TSP by age.[31] For auto-enrolled Soldiers, age is positively correlated with selecting contribution values other than 3 percent, though differences are most visible for contributions above 3 percent. However, a clear majority still contribute 3 percent. Among auto-enrolled Sailors, neither age group is consistently more likely than the other to appear in a given contribution category. However, some patterns hold across both age groups. Auto-enrolled Sailors from each age group are less likely to contribute 3 percent and more likely to contribute more than 5 percent over the year, with a large change in these probabilities towards the end of the year. Auto-enrolled Airmen behave more similarly to Soldiers than Sailors, since they are extremely likely to make the default TSP contribution of 3 percent. However, Airmen aged 20–29 were more likely than Soldiers to contribute higher amounts.

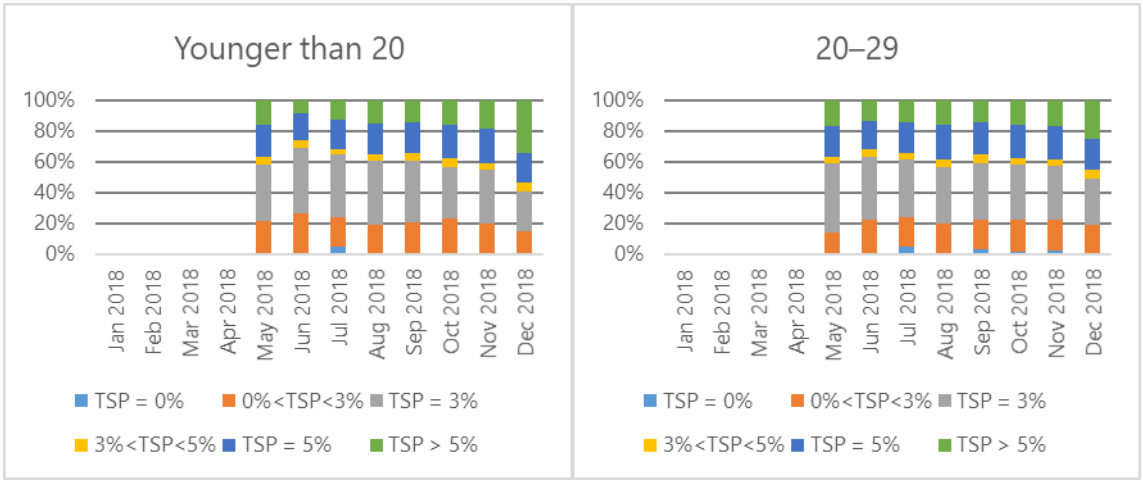
Figure 34. Army TSP contribution rates by age, auto-enrollees, 2018



Notes: Sample sizes for Soldiers younger than 20 ranged from 1 (in April) to 11,723 (in December). Sample sizes for Soldiers aged 20–29 ranged from 2 (in February) to 16,507 (in December).
Source: TSP.

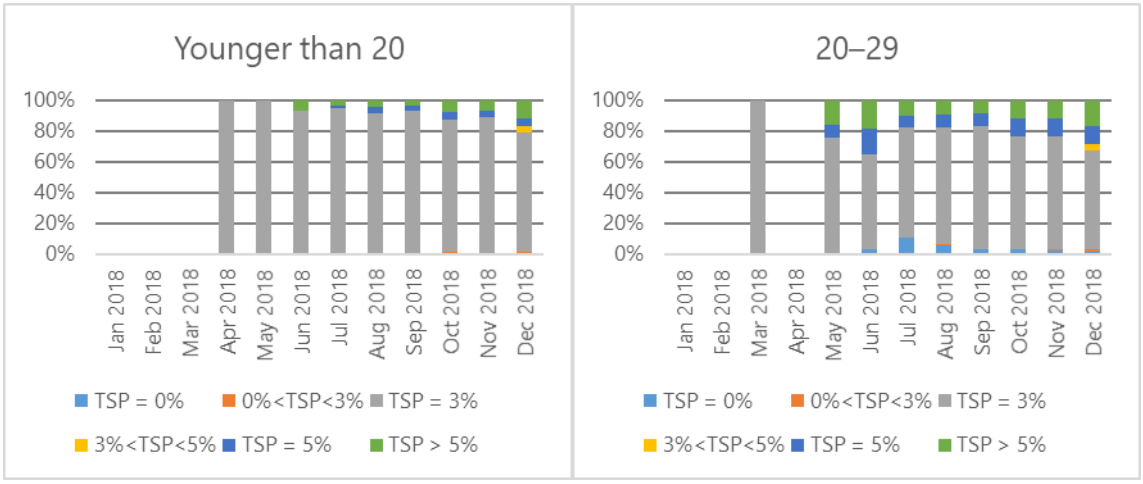
[31] We omit graphs for auto-enrollees aged 30 and above due to small sample sizes.

Figure 35. Navy TSP contribution rates by age, auto-enrollees, 2018



Notes: Sample sizes for Sailors younger than 20 ranged from 62 (in May) to 12,160 (in December). Sample sizes for Sailors aged 20–29 ranged from 102 (in May) to 11,415 (in December).
Source: TSP.

Figure 36. Air Force TSP contribution rates by age, auto-enrollees, 2018



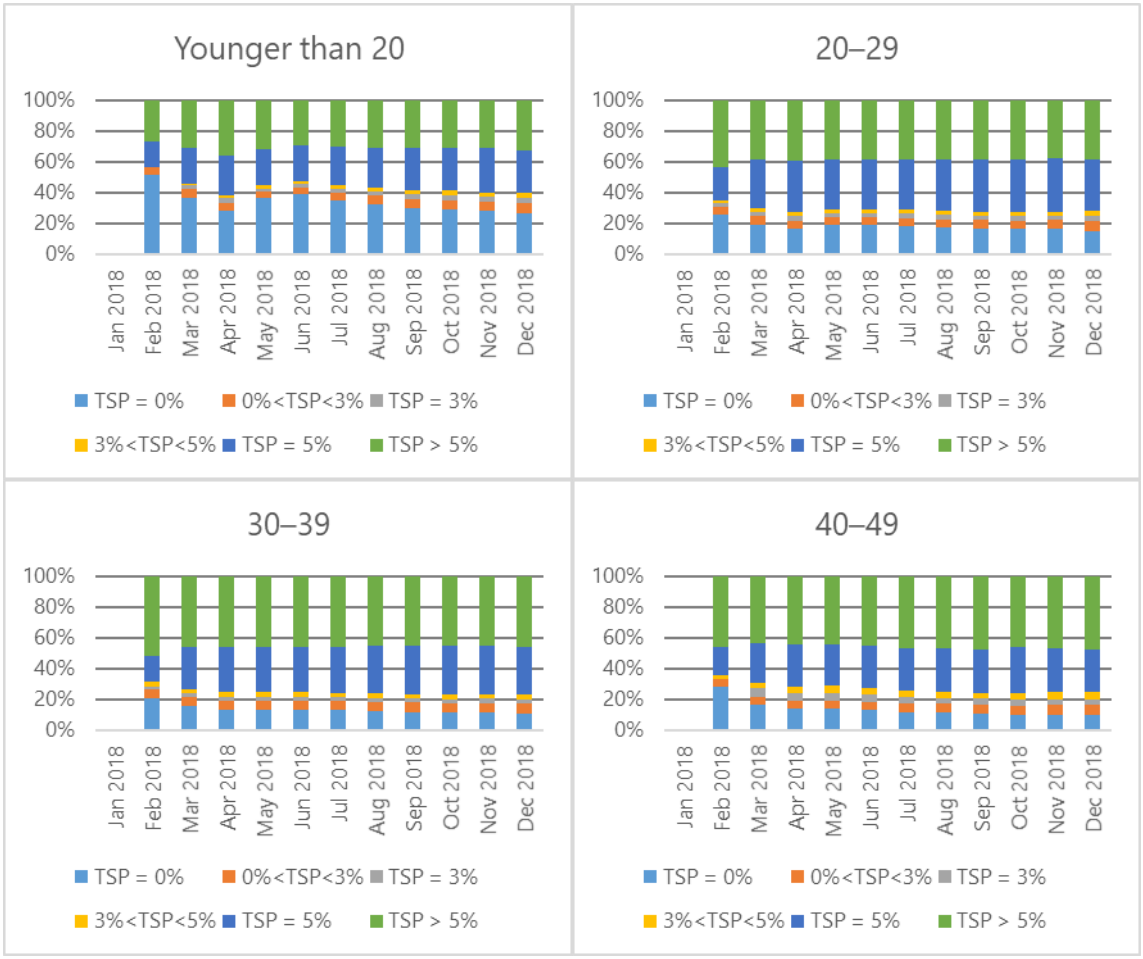
Notes: Sample sizes for Airmen younger than 20 ranged from 1 (in April) to 3,420 (in December). Sample sizes for Airmen aged 20–29 ranged from 1 (in March) to 5,885 (in December).
Source: TSP.

Opt-ins

Figure 37, Figure 38, and Figure 39 respectively show how TSP contribution rates varied by age for Soldiers, Sailors, and Airmen who opted in to the BRS.[32] In all three figures, age is positively correlated with the probability of contributing 5 percent or more than 5 percent and negatively correlated with the probability of contributing nothing. Opt-ins of all age groups were far less likely than auto-enrollees of either age group above to contribute the default of 3 percent, regardless of Service. As with opt-ins overall, contribution patterns among all age groups remained relatively stable from March 2018 onward. Soldiers younger than 20 who opted in had the greatest variation in contribution patterns across Services and age groups; this may reflect that even though there are more Soldiers under age 20 than Sailors or Airmen, fewer Soldiers under age 20 opted in to the BRS than Sailors or Airmen. Across all age groups, Soldiers were less likely than Sailors or Airmen to contribute over 5 percent; Soldiers younger than 40 also were more likely than Sailors or Airmen to contribute nothing.

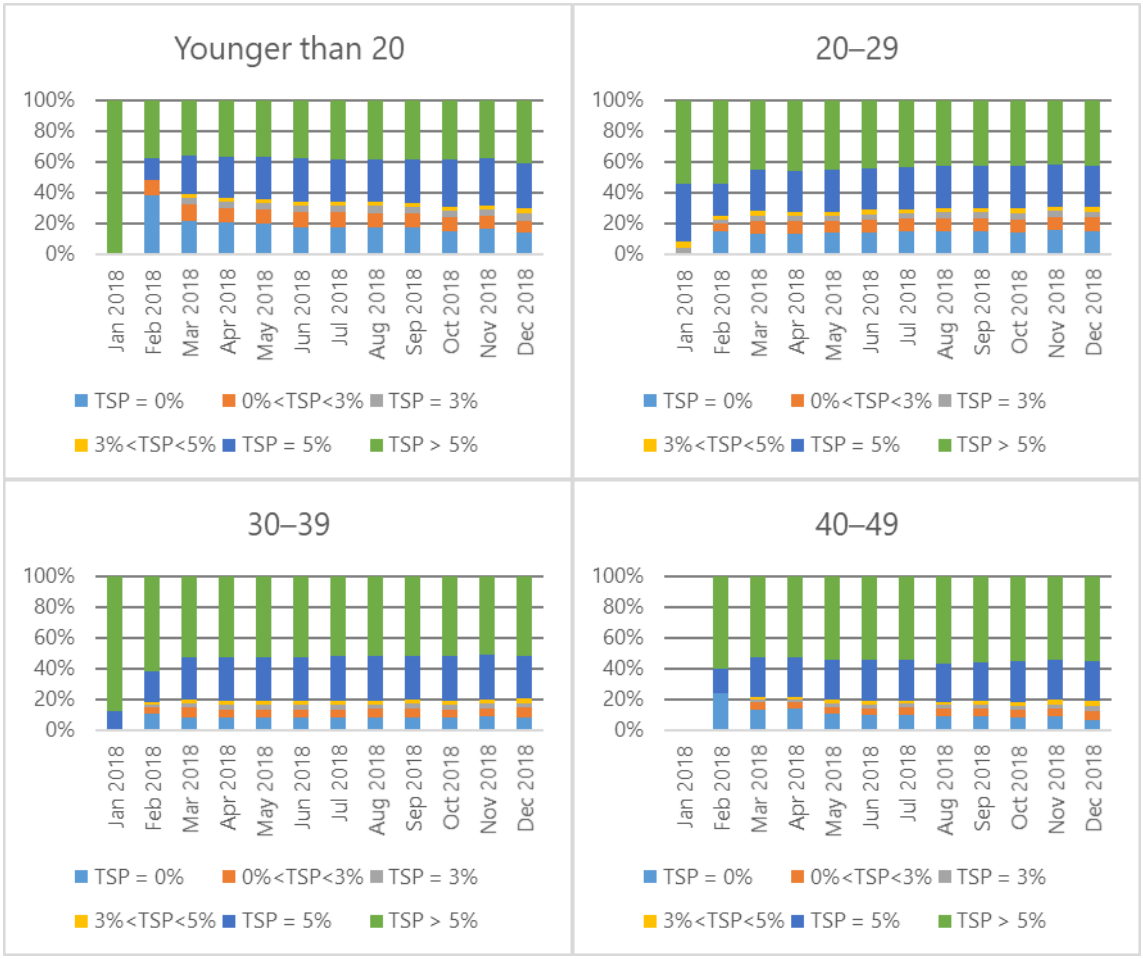
[32] In each figure, we omit those aged 50 and above due to small sample sizes.

Figure 37. Army TSP contribution rates by age, opt-ins, 2018



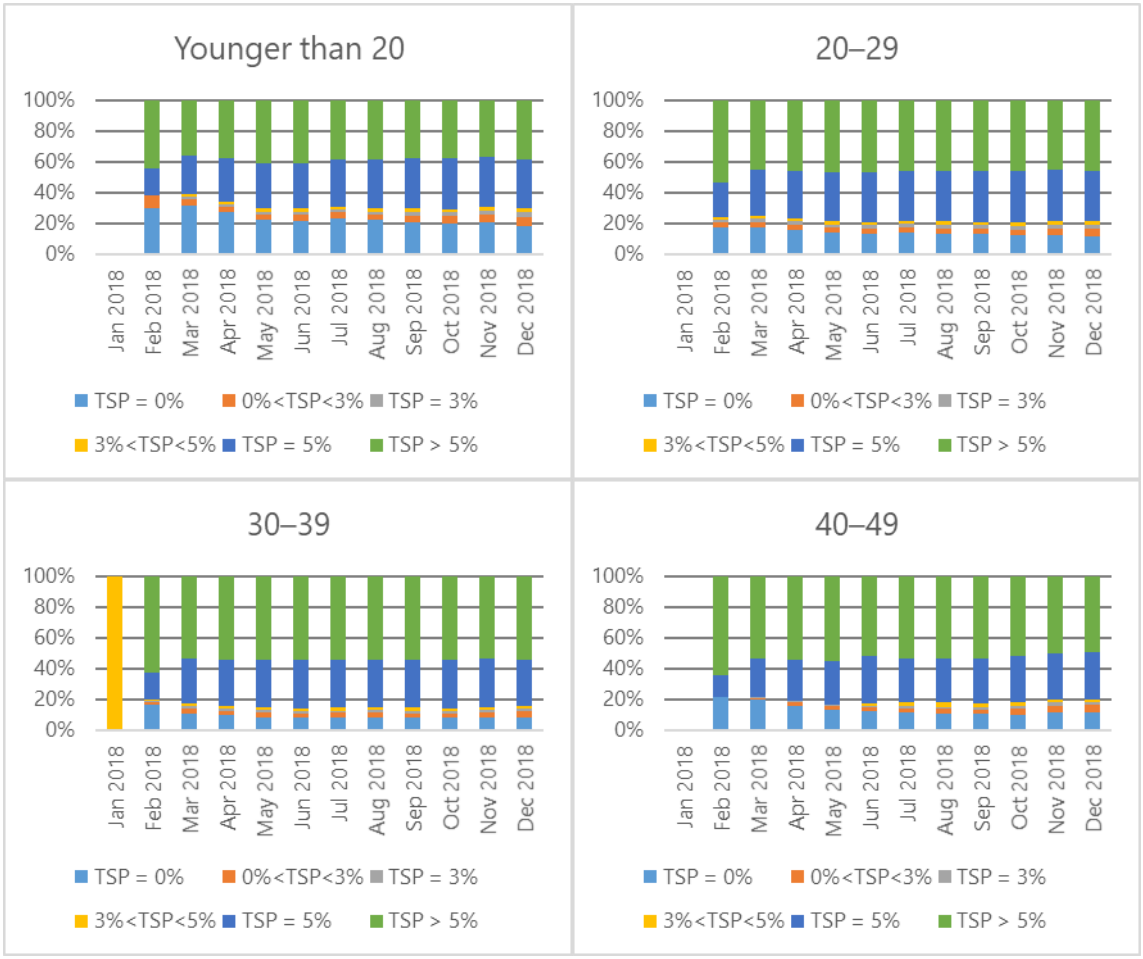
Notes: Sample sizes for Soldiers younger than 20 ranged from 37 (in February) to 1,799 (in December). Sample sizes for Soldiers aged 20–29 ranged from 1,337 (in February) to 40,028 (in December). Sample sizes for Soldiers aged 30–39 ranged from 564 (in February) to 12,236 (in December). Sample sizes for Soldiers aged 40–49 ranged from 39 (in February) to 1,012 (in December).
Source: TSP.

Figure 38. Navy TSP contribution rates by age, opt-ins, 2018



Notes: Sample sizes for Sailors younger than 20 ranged from 2 (in January) to 12,161 (in December). Sample sizes for Sailors aged 20–29 ranged from 24 (in January) to 97,341 (in December). Sample sizes for Sailors aged 30–39 ranged from 17 (in January) to 12,892 (in December). Sample sizes for Sailors aged 40–49 ranged from 25 (in February) to 565 (in December).
Source: TSP.

Figure 39. Air Force TSP contribution rates by age, opt-ins, 2018



Notes: Sample sizes for Airmen younger than 20 ranged from 34 (in February) to 2,555 (in December). Sample sizes for Airmen aged 20–29 ranged from 1,017 (in February) to 40,740 (in December). Sample sizes for Airmen aged 30–39 ranged from 1 (in January) to 7,965 (in December). Sample sizes for Airmen aged 40–49 ranged from 14 (in February) to 289 (in December).
Source: TSP.

Army, Navy, and Air Force TSP contribution rates by basic pay level

Auto-enrollees

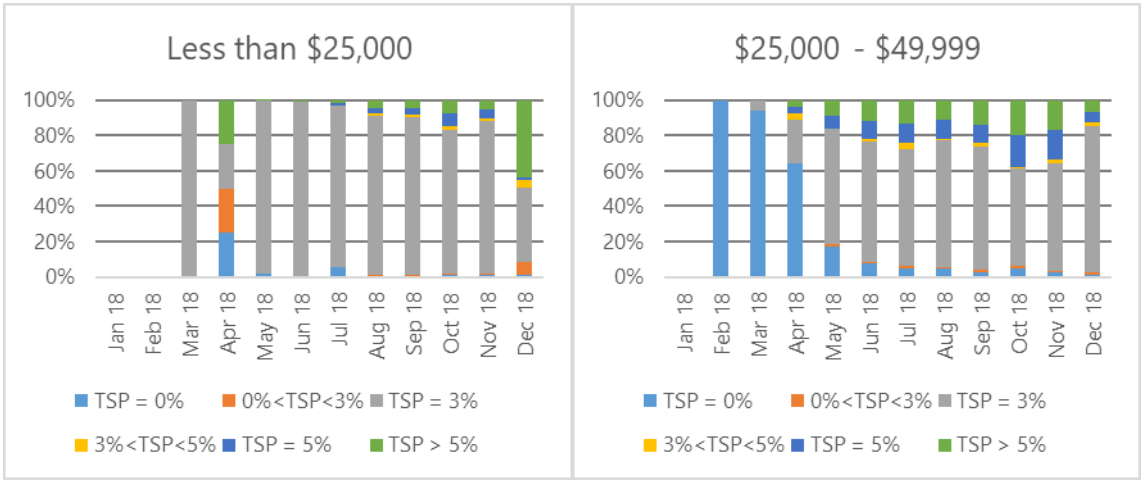
Figure 40, Figure 41, and Figure 42 show the respective contribution rates among auto-enrolled Soldiers, Sailors, and Airmen by pay range.[33] These figures should be interpreted with caution, and are placed here rather than in the body of the report, both because they do not contain BAH or BAS (which may affect contribution levels) and because sample sizes fluctuate substantially from month to month.[34] In particular, the number of Servicemembers earning $25,000–$49,999 drops noticeably in October 2018 for all three Services. Similarly, the number of Soldiers, Sailors, and Airmen earning less than $25,000 falls precipitously in December 2018, coincident with sharp increases in the numbers of Servicemembers in higher basic pay bands (though only those earning $25,000–$49,999 are shown here). It is possible that these fluctuations could reflect inconsistencies in how Servicemembers were paid in the beginning of the fiscal year; however, additional research and data would be necessary to determine whether this is in fact the case.

As with Marines, increases in income are correlated with increases in the probability of contributing 5 percent or more to the TSP across the other three Services. However, contribution levels among auto-enrollees earning $25,000–$49,999 fluctuate considerably across all three Services due to low sample sizes earlier in the year and the large variation in sample sizes between September and December. Across all three Services, there is a downward trend in the share contributing 3 percent (ignoring October and December due to sample size inconsistency), though this is most clearly visible in the Navy.

[33] We omit graphs for Servicemembers earning $50,000 or more, since very few auto-enrollees in any Service earned this amount prior to December 2018.

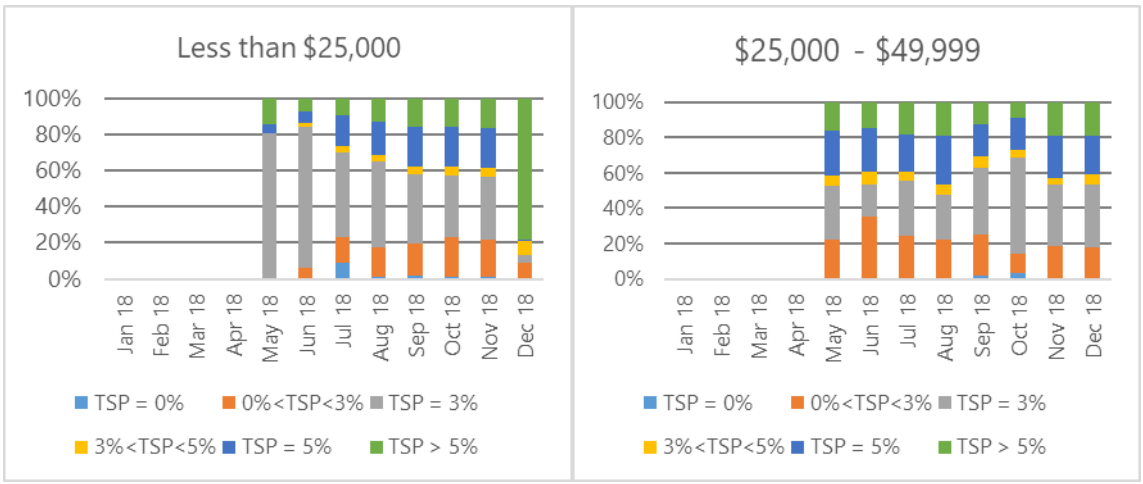
[34] Additionally, they do not include BAH or BAS, which may affect contribution levels.

Figure 40. Army TSP contribution rates by annualized basic pay, auto-enrollees, 2018



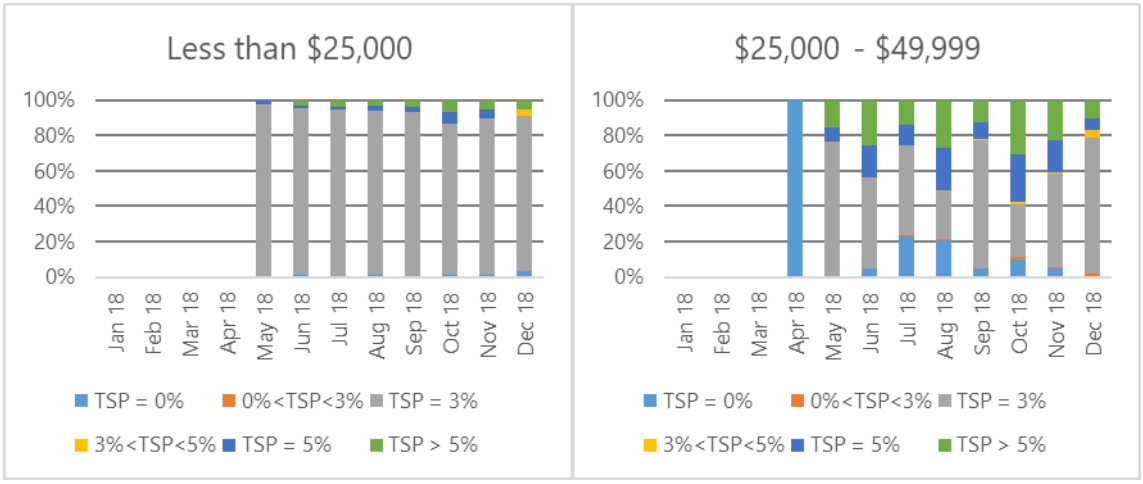
Notes: Sample sizes for Soldiers earning less than $25,000 ranged from 1 (in March) to 16,443 (in November). Sample sizes for Soldiers earning $25,000–$49,999 ranged from 3 (in February) to 22,275 (in December).
Source: TSP.

Figure 41. Navy TSP contribution rates by annualized basic pay, auto-enrollees, 2018



Notes: Sample sizes for Sailors earning less than $25,000 ranged from 31 (in May) to 11,081 (in October). Sample sizes for Sailors earning $25,000–$49,999 ranged from 122 (in May) to 14,612 (in December).
Source: TSP.

Figure 42. Air Force TSP contribution rates by annualized basic pay, auto-enrollees, 2018



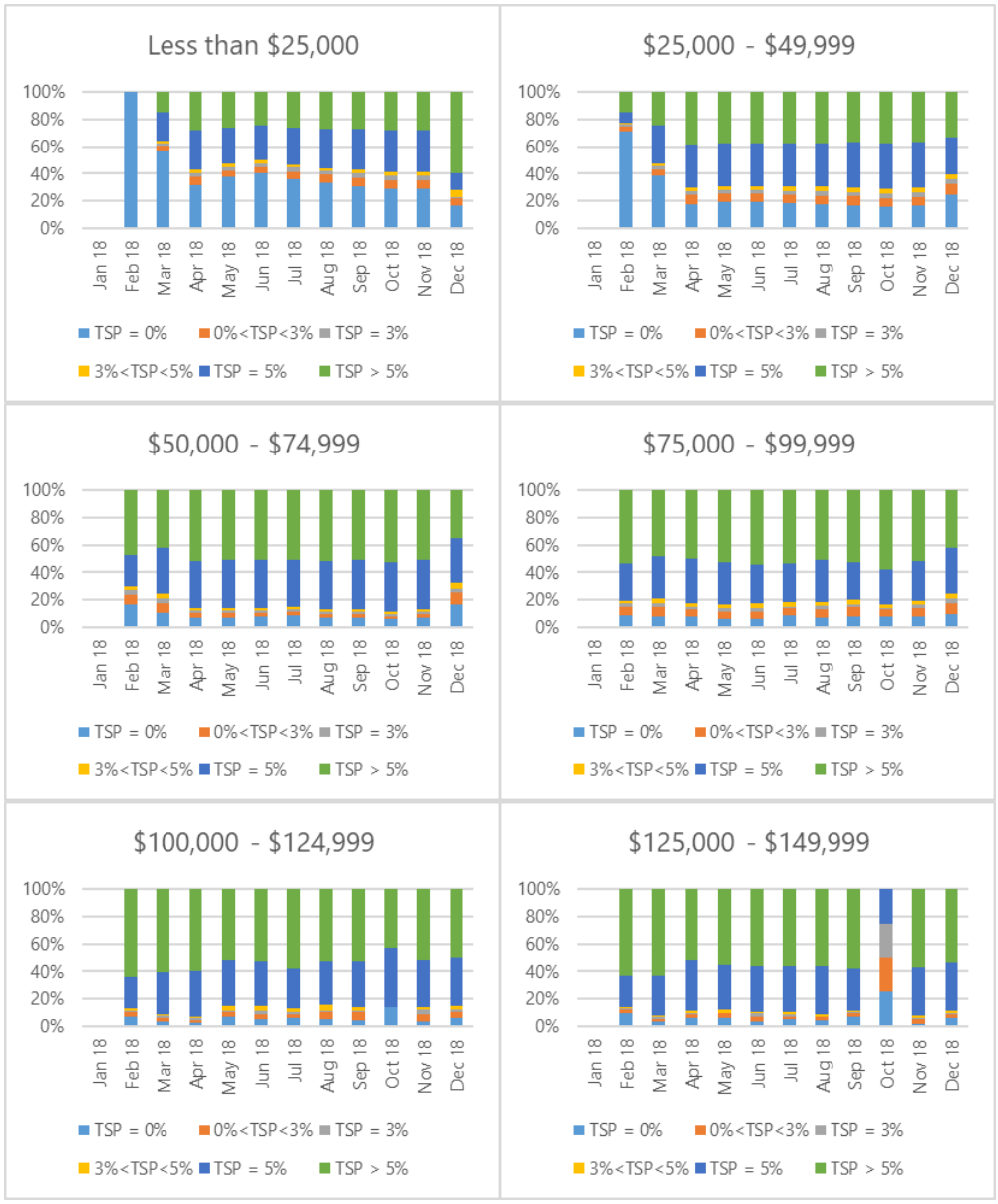
Notes: Sample sizes for Airmen earning less than $25,000 ranged from 48 (in May) to 5,512 (in November). Sample sizes for Airmen earning $25,000–$49,999 ranged from 1 (in April) to 7,257 (in December).
Source: TSP.

Opt-ins

Figure 43, Figure 44, and Figure 45 respectively show how Soldiers, Sailors, and Airmen who opted in to the BRS contributed to the TSP. As with auto-enrollees, these figures should be taken with caution. For example, many more Servicemembers had over $75,000 of annualized basic pay and many fewer had under $50,000 in annualized pay in March and in December than in any of the intervening months. Furthermore, as with auto-enrollees, there is a noticeable dip in the number of Servicemembers earning annualized basic pay over $100,000 in October relative to September or November. Any interpretation of patterns in the data should therefore focus primarily on April through September.

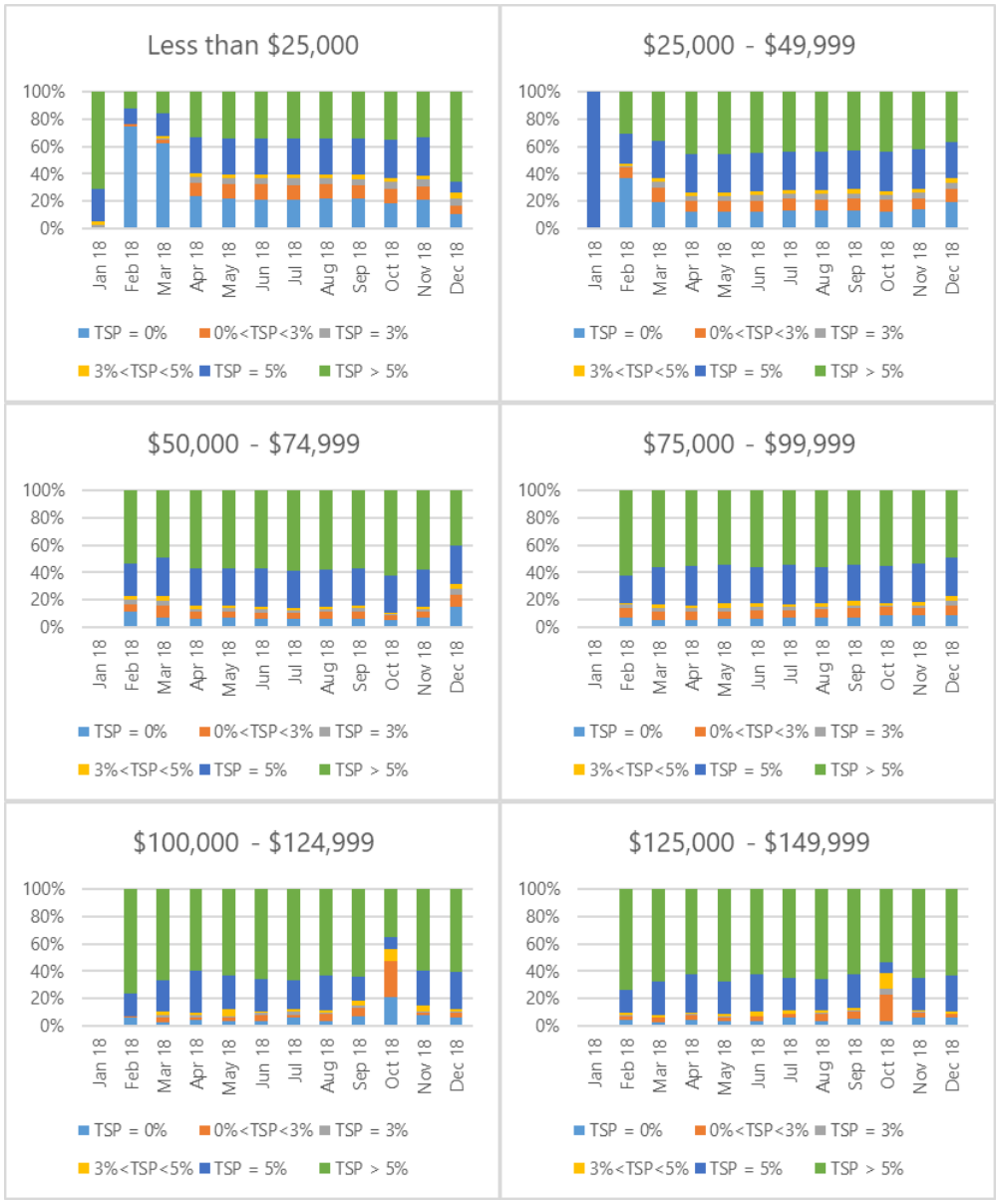
Opt-in Soldiers were less likely than Sailors or Airmen to make any contribution or to contribute over 5 percent to the TSP. Across all three Services, basic pay levels correlated with any contribution. Sailors were the most likely group across all income categories to contribute between 0 and 3 percent. These graphs do not show evidence of Servicemembers reaching the TSP contribution limit, which could reflect that many Soldiers, Sailors, and Airmen opted in over the course of the year, that contribution rates over 30 percent were flagged as potential errors, or other factors.

Figure 43. Army TSP contribution rates by annualized basic pay, opt-ins, 2018



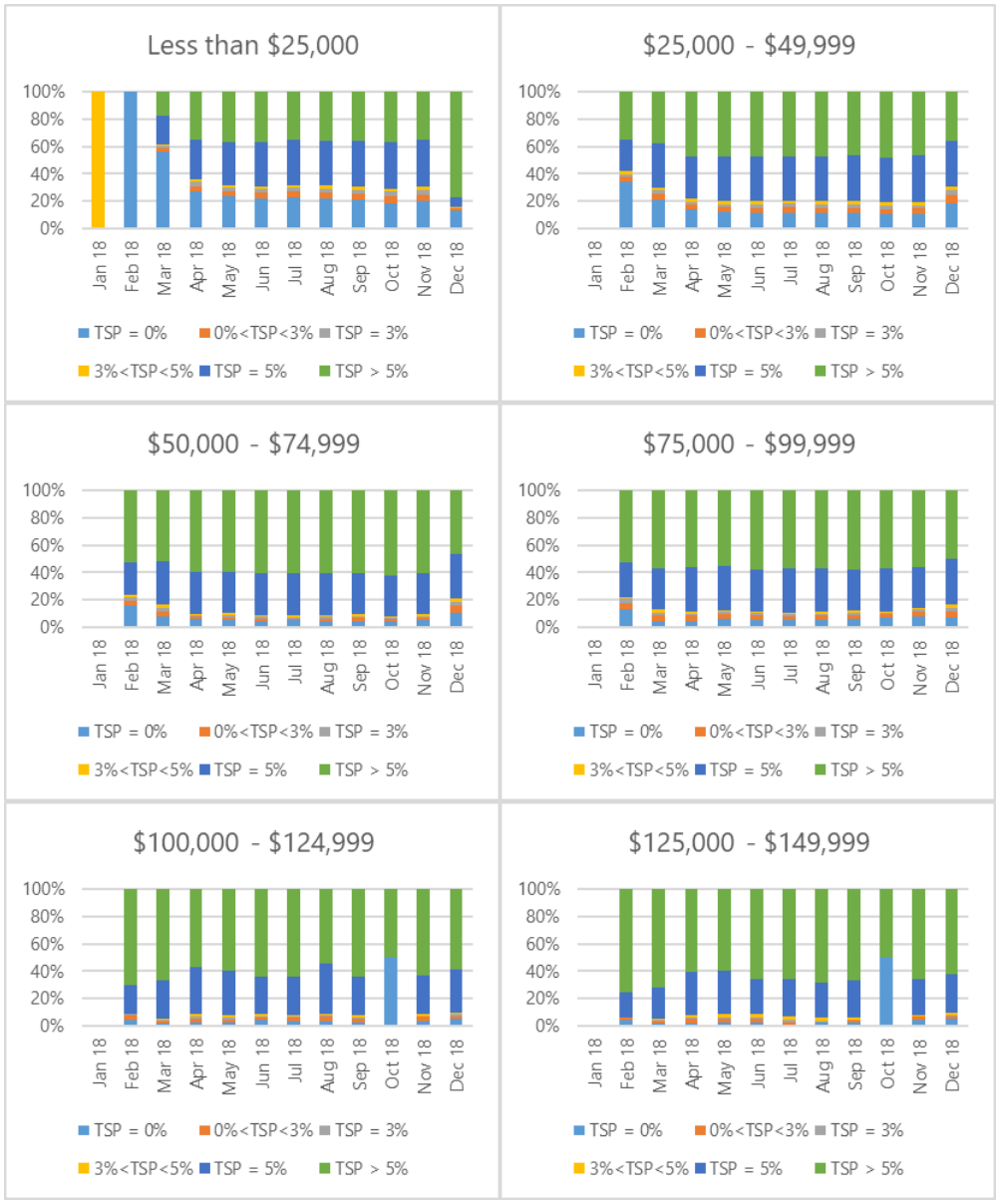
Notes: Between 72 (February) and 6,181 (November) Soldiers earned less than $25,000. Between 321 (February) and 31,627 (November) Soldiers earned $25,000–$49,999. Between 722 (February) and 23,642 (December) Soldiers earned $50,000–$74,999. Between 293 (February) and 10,452 (December) Soldiers earned $75,000–$99,999. Between 7 (October) and 4,856 (December) Soldiers earned $100,000–$124,999. Between 4 (October) and 6,266 (December) earned $125,000-$150,000.
Source: TSP.

Figure 44. Navy TSP contribution rates by annualized basic pay, opt-ins, 2018



Notes: Between 42 (January) and 28,338 (November) Sailors earned less than $25,000. Between 1 (January) and 62,139 (November) Sailors earned $25,000–$49,999. Between 757 (February) and 57,487 (December) Sailors earned $50,000–$74,999. Between 334 (February) and 13,678 (December) Sailors earned $75,000–$99,999. Between 34 (October) and 5,334 (December) Sailors earned $100,000–$124,999. Between 26 (October) and 7,105 (December) Sailors earned $125,000–$149,999.
Source: TSP.

Figure 45. Air Force TSP contribution rates by annualized basic pay, opt-ins, 2018



Notes: Between 1 (January) and 14,498 (November) Airmen earned less than $25,000. Between 252 (February) and 22,516 (November) Airmen earned $25,000–$49,999. Between 455 (February) and 19,788 (December) Airmen earned $50,000–$74,999. Between 164 (February) and 5,153 (December) Airmen earned $75,000–$99,999. Between 2 (October) and 2,924 (December) Airmen earned $100,000–$124,999. Between 2 (October) and 6,368 (December) Airmen earned $125,000–$149,999.
Source: TSP.

Figures

Abbreviations

AC	Active Component
AI/AN	American Indian/Alaska Native
BAH	Basic Allowance for Housing
BAS	Basic Allowance for Subsistence
BRS	Blended Retirement System
DFAS	Defense Finance and Accounting Services
DIEMS	Date of Initial Entry into Military Service
DIEUS	Date of Initial Entry to Uniformed Services
DMDC	Defense Manpower Data Center
DOD	Department of Defense
FMO	Force Management Objective
FRTIB	Federal Retirement Thrift Investment Board
LOS	Length of Service
MCRMC	Military Compensation and Retirement Modernization Commission
NDAA	National Defense Authorization Act
NH/PI	Native Hawai'ian/Pacific Islander
PDR	Personal Discount Rate
QRMC	Quadrennial Review of Military Compensation

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