Prior-Service Reserve Affiliation and Continuation Behavior
Volume 2– Continuation

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Photo credit line: Infantrymen with 2nd Battalion, 25th Marine Regiment dismount from an amphibious assault vehicle during annual reserve training, Jul 10 2012. The Marines participated in Exercise Javelin Thrust 2012, an annual large-scale exercise with 1st Marine Expeditionary Brigade at Marine Corps Air Ground Combat Center Twentynine Palms, California, which allows active and reserve Marines and sailors from 38 states to train together as a seamless Marine air-ground task force. (7/10/2012 By Sgt Deanne Hagstrom)

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Executive summary

In this paper, we examine the continuation behavior of prior-service (PS) Marines in the Marine Corps Selected Reserve (SelRes). We use Marine Corps Total Force System (MCTFS) data on Marine officers and enlisted Marines who left active duty and affiliated with the SelRes between October 2001 and April 2011 to look at how long Marines tend to affiliate with the SelRes and which Marines are most likely to leave the SelRes at any given point in their SelRes careers. We estimate the effects of Marine characteristics and service history (active duty and reserve) on PS Marines' decisions to leave the SelRes separately for never-activated and activated Marines. We summarize our findings in table 1.

Table 1.   Summary of PS SelRes continuation behavior for enlisted Marines and officers

Descriptive variables	PS enlisted Marines		PS officers	
	Never activated	Activated	Never activated	Activated
Time spent in the IRR before affiliation	The likelihood of leaving the SelRes increases the longer Marines are in the Individual Ready Reserve (IRR) before SelRes affiliation	Marines who spend 19 to 24 months in the IRR before affiliation are the most likely to leave after activation	The likelihood of leaving the SelRes increases the longer officers are in the IRR before affiliating with the SelRes	Officers who are in the IRR 7 to 18 months before affiliation are the most likely to leave the SelRes after activation
Months of SelRes experience before activation	Not applicable to this population	The likelihood of leaving the SelRes is lowest for those who are with the SelRes for at least 12 months before activation	Not applicable to this population	The likelihood of leaving the SelRes is lowest for those who are with the SelRes at least 12 months before activation
RC[a] activation and deployment history	Not applicable to this population	Marines activated between 13 and 24 months are the least likely to leave the SelRes after activation	Not applicable to this population	Officers activated between 13 and 24 months are the least likely to leave the SelRes after activation

Table 1.   Summary of PS SelRes continuation behavior for enlisted Marines and officers (continued)

Descriptive variables	PS enlisted Marines		PS officers	
	Never activated	Activated	Never activated	Activated
State unemployment rate	The likelihood of leaving the SelRes is *inversely* related to the unemployment rate	We find no significant effects	The likelihood of leaving the SelRes is *positively* related to the unemployment rate	We find no significant effects
Marine quality measures	High-quality and gold standard (GS) Marines are less likely to leave the SelRes than non-high-quality or non-GS Marines	Marines recommended and eligible for reenlistment are more likely to leave the SelRes than those with other reenlistment codes	We find no significant effects	We find no significant effects
Paygrade	The likelihood of leaving the SelRes is lowest for lance corporals followed by Marines ranked sergeant or higher	Lance corporals are the most likely to leave the SelRes after activation	The likelihood of leaving the Selres decreases as Marines move up in rank	Majors and lieutenant colonels are the least likely to leave the SelRes after activation
Geographic area	Marines in New England, Middle Atlantic, West-North Central, and West-South Central states are the most likely to leave the SelRes	Marines in New England are the most likely to leave the SelRes after activation	Officers in New England are the most likely to leave the SelRes	Officers in the Pacific area are the most likely to leave after activation
Gender, race/ethnicity, and education	The likelihood of leaving the SelRes is lowest among Hispanics and college graduates	We find no significant effect	We find no significant effects	Male officers are more likely than females to leave the SelRes after activation Officers who are a minority race other than black are the least likely to leave
AC[a] deployment history	We find no significant effects	The likelihood leaving the SelRes after activation *increases* with AC deployment experience	The likelihood leaving the SelRes after activation *decreases* with AC deployment experience	We find no significant effects

a. AC and RC abbreviate active component and reserve component.

One of our main findings is that SelRes retention is highest among Marines who spend more time interacting and working with other Marines. For never-activated Marines, this means spending less time in the IRR before affiliation because our models indicate that those who spend fewer months in the IRR before their first SelRes affiliation are less likely to leave than those who spend more time in the IRR. For activated Marines, we find that those who were with the SelRes for at least 12 months before activation are 30 to 50 percent less likely to leave after activation than Marines who were activated within one year of affiliation. The Marine Corps should continue in its efforts to recruit PS Marines to the SelRes close to their transition dates as well as to try to give their PS Marines adequate time with their SelRes units before they are deployed.

In addition, we find that activation decreases the likelihood of Marines leaving the SelRes after activation. With the recent end of the war in Iraq and the withdrawal of U.S. troops from Afghanistan, the role of reservists will likely change, and the Marine Corps might experience a change in Marines' SelRes behaviors. Therefore, we suggest that the Marine Corps continue to monitor SelRes affiliation and continuation rates not only for PS Marines but also for non-prior-service (NPS) Marines.

Several other factors influence PS enlisted Marines' decisions to leave the SelRes. For example, we find that high-quality and gold-standard (GS) Marines who are not activated tend to remain in the SelRes longer than their non-high-quality or non-GS counterparts. In terms of paygrade, we find the largest effects among lance corporals; never-activated lance corporals are the least likely to leave the SelRes, while *activated* lance corporals are the *most* likely to leave. Also, our estimates show that the likelihood of leaving the SelRes is inversely related to the state unemployment rate. When the unemployment rate is high, enlisted Marines are less likely to leave the SelRes, but they are more likely to leave when the unemployment rate is low.

Among PS officers, some of the factors that affect the decision to leave the SelRes include the state unemployment rate, active component (AC) deployment experience, and paygrade. Unlike enlisted Marines, never-activated PS officers are more likely to leave the

SelRes when the unemployment rate is high, suggesting that they might be concerned about keeping their civilian jobs rather than finding an additional source of income during poor economic times. Never-activated officers are also less likely to leave the SelRes if they had combat deployed while on AC duty, which means that the Marine Corps is able to retain experienced officers. Lastly, our estimates show that the decision to leave the SelRes is sensitive to officer paygrade; higher ranking officers are less likely to leave than lower ranking officers. In addition having already made significant career commitments to the Marine Corps, higher ranking officers may also stay in the SelRes to earn the ability to transfer their Post-9/11 GI Bill education benefits to their dependents.

In conclusion, we make the following four recommendations based on our analysis of SelRes continuation behavior among PS Marines:

1. To increase SelRes retention, the Marine Corps should continue its efforts to recruit PS Marines closer to their transition dates, educate them on the benefits of SelRes affiliation, and optimize recruiting Marines into reserve units that are not likely to be activated within the following year.

2. Because the unemployment rate affects continuation behavior, the Marine Corps may want to consider ways it can help Marines balance their military and civilian lives, perhaps as an extension of the current transitioning program. This might provide some Marines the support they need to remain in the SelRes.

3. Since higher ranking Marines, particularly officers, are most likely to stay in the SelRes, the Marine Corps should investigate the second-order effects on promotion opportunities this can have not only on future SelRes PS Marines but also on NPS Marines.

4. The Marine Corps should continuously monitor trends in SelRes affiliation and continuation for both PS and NPS Marines because their decisions may be sensitive to changes in the overall environment, such as the end of the war in Afghanistan, the reduction in AC component endstrength, and an improving economy.

Introduction

The continued reliance on reserve forces over the past decade has brought attention to the challenges in recruiting and retaining prior-service (PS) Marines to the Selected Reserve (SelRes).[1] Although the Marine Corps has information on basic trends in affiliation and continuation, it does not know what is influencing Marines' reserve affiliation and retention behavior. To develop an understanding of who affiliates with the SelRes, the Deputy Commandant, Manpower and Reserve Affairs (DC, M&RA) asked CNA to examine these issues for both Marine officers and enlisted Marines.[2]

We provide our study results in two reports. In our first report [1], we analyze affiliation trends among PS Marines. In this second report, we focus on PS SelRes continuation trends. Combined, these reports present an analysis of Marines who transition from active to reserve status and their decisions to affiliate with and continue in the SelRes as a member of a Selected Marine Corps Reserve (SMCR) unit or as an individual mobilization augmentee (IMA).

Past research has focused separately on patterns in end-of-active-service (EAS) separation rates and reservists' unit affiliation behavior. From recent research, we know that, for the FY00–FY07 period, over-all EAS separation rates were relatively static; however, separation rates were higher among Marines in combat occupations than among those in intelligence occupations [2]. Other research has shown that blacks and Hispanics tend to separate from the active component

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1. The Marine Corps' SelRes includes Active Reserve Marines, reservists in Selected Marine Corps Reserve units, and individual mobilization augmentees in active-duty units. We provide an overview of the USMC reserve organization in appendix A.

2. This study request was driven by discussions during the November 2010 Reserve General Officer offsite meeting in New Orleans.

(AC) at lower rates than whites [3]. With regard to SelRes retention, we know that, between FY00 and FY06, the increase in operational tempo generally had no effect on the likelihood of enlisted reservists maintaining their SelRes affiliation [4]. This study bridges these two branches of research.

Research issues

Our research focuses on the following questions:

1. Which Marines transitioning from the AC to the IRR are eligible for SelRes duty (see [1])?

2. Which transitioning Marines decide to affiliate with SMCR units or as IMAs, and what factors may be influencing their reserve affiliation decisions (see [1])?

3. Which Marines remain in the SelRes, for how long, and what factors may be influencing their retention decisions?

This study aims at informing SMCR and IMA recruiting and retention policies by examining the relationship between various individual characteristics and military career events and the probability of both affiliating with and continuing in the SelRes.

Specifically, in this report, we focus on the continuation behavior of PS Marines who left active duty and affiliated with the SelRes between October 2001 and April 2011 (see question 3 above). The timeframe allows us to examine SelRes continuation over a period of time in which the Marine Corps was faced with two wars, an increase in end-strength, and a decline in the U.S. economy. By identifying the traits of Marines who are most likely to leave the SelRes, the Marine Corps can inform its reserve PS retention strategies, better target its recruiting and reenlistment resources, and refine its personnel management policies and practices.

Data

To conduct our analysis of PS SelRes continuation behavior, we use individual-level data from the Marine Corps Total Force System

(MCTFS) end-of-month snapshots, maintained by Headquarters Marine Corps, Manpower and Reserve Affairs (HQMC M&RA). From MCTFS snapshots, we identify Marine officers and enlisted Marines who separated from the AC *and* affiliated with the SelRes between October 2001 and April 2011. For each group, we merge data on demographic and service characteristics with waiver data from the Marine Corps Recruit Information Support System (MCRISS) as well as AC and reserve component (RC) activation and deployment data from the Global War on Terrorism (GWOT) files and the Contingency Tracking System (CTS). To determine the effects of economic factors on SelRes continuation behavior, we incorporate state monthly unemployment rates, as reported by the Bureau of Labor Statistics (BLS).

Organization of this report

In the next section, we examine the size of the SelRes PS enlisted and officers populations. Next, we look at trends in the percentage of PS Marines who serve in the SelRes for at least six months. Then we model a Marine's decision to leave the SelRes and present findings from estimating our models for never-activated and activated PS enlisted Marines and officers. In the final section, we summarize our findings and make recommendations.

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The SelRes PS population

Our population of interest consists of Marines who transitioned from the AC to the RC *and* affiliated with the SelRes between October 2001 and April 2011.[3] During this period, 12,880 PS enlisted Marines and 2,180 PS officers affiliated with the SelRes. We chart the number of PS enlisted Marines and officers, by month, who affiliated with the SelRes in figures 1 and 2, respectively. For both populations, the number of Marines who affiliated with the SelRes (a) increased over the course of the period and (b) exhibit cyclical trends.

Figure 1.   PS enlisted Marines who affiliated with the SelRes, Oct. 2001 to Apr. 2011[a]
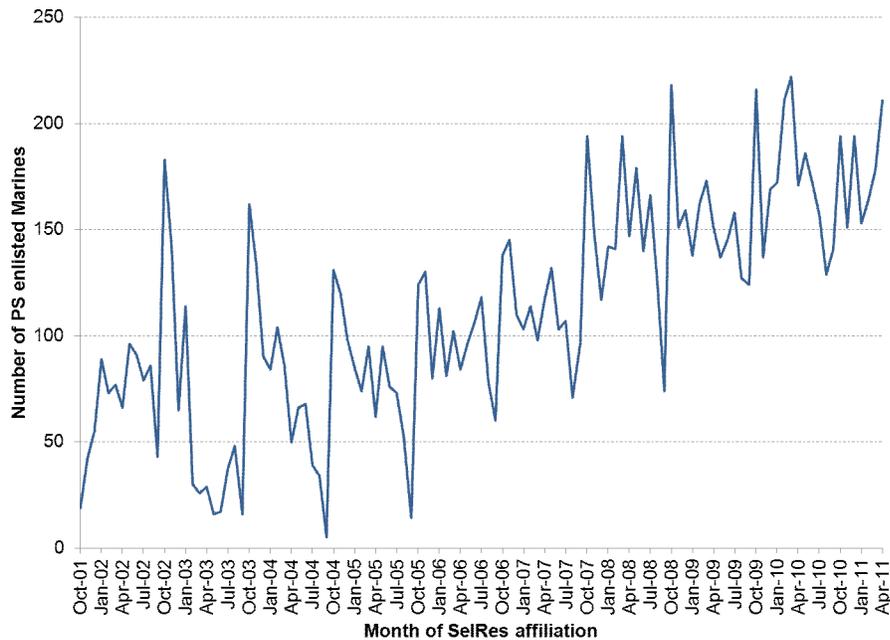
a. Source: MCTFS end-of-month snapshots, Oct. 2001 through Apr. 2011.

3.   We provide descriptive statistics of the SelRes PS enlisted and officer populations in tables 5 and 6 in appendix B.

Among PS enlisted Marines (see figure 1), the number who affiliated with SMCR units or as IMAs increased from roughly 800 in FY02 to over 2,000 in FY10; in the first half of FY11, some 1,250 Marines affiliated with the SelRes. The most notable increase occurred between FY07 and FY08, when affiliation increased from about 1,300 to 1,800—a 32.5-percent increase. At this time, the U.S. economy began to decline and unemployment rates began to rise. Also during this time, Reserve Affairs adjusted the planning model in such a way that the total reserve recruiting mission increased [5]. With respect to the cyclicality of PS enlisted SelRes affiliation, we find that most Marines affiliated in the first trimester of each fiscal year (October, November, December, and January). This follows from our previous findings that a large percentage of PS enlisted Marines transition to the RC in the summer and affiliate within 6 months of transitioning to the RC [1].[4]

When we examine the number of affiliating PS officers, we find similar patterns (see figure 2). Again, we see that the number of PS officers affiliating with SMCR units or IMA billets increased between October 2001 and April 2011. In this case, however, the largest increase occurred between FY05 and FY06 when the number of affiliating PS officers increased over 36 percent, going from 170 to 230; at this time, the PS officer recruiting mission increased [5]. Between FY08 and FY10, the number of PS officers affiliating with the SelRes declined as the Marine Corps increased its AC endstrength and fewer Marines left the AC [5, 6].

During this period, the Marine Corps activated many of its reserve forces to augment the AC during Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF). Overall, over 21 percent of PS enlisted Marines and 40 percent of PS officers were activated between October 2001 and April 2011. We show the percentage of PS enlisted Marines and PS officers who were activated by month in figure 3. Marines who affiliated with the SelRes early in the period, at the start of OIF and OEF, were more likely to have been activated than those who affiliated near the end of the period, when OIF ended and the U.S. began to draw out of Afghanistan.

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4. However, we do not find significant monthly trends in the likelihood of affiliating with the SelRes [1].

Figure 2.   PS officers who affiliated with the SelRes, Oct. 2001 to Apr. 2011[a]
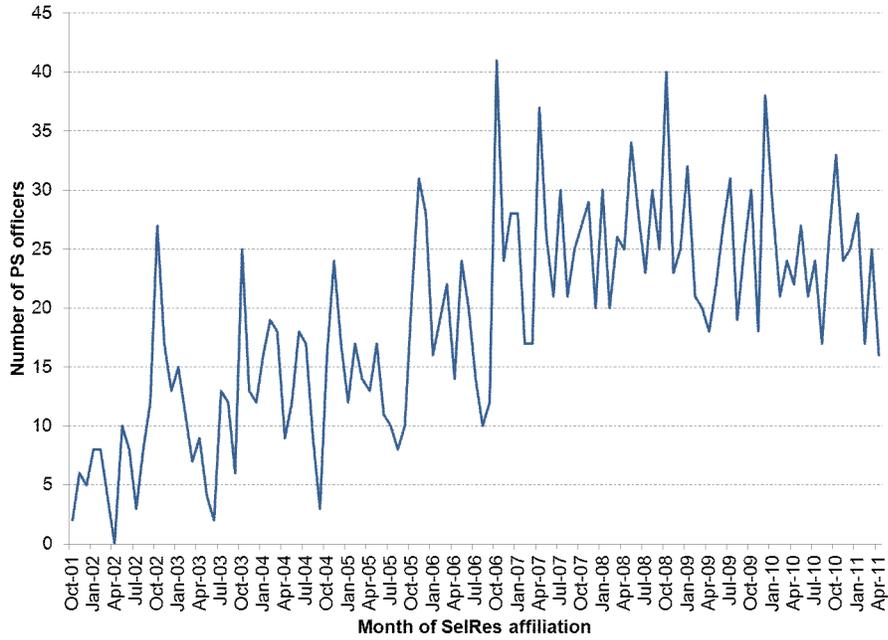
Figure 3.   PS enlisted and officer SelRes activation rates, by month, Oct. 2001 to Apr. 2011[a]
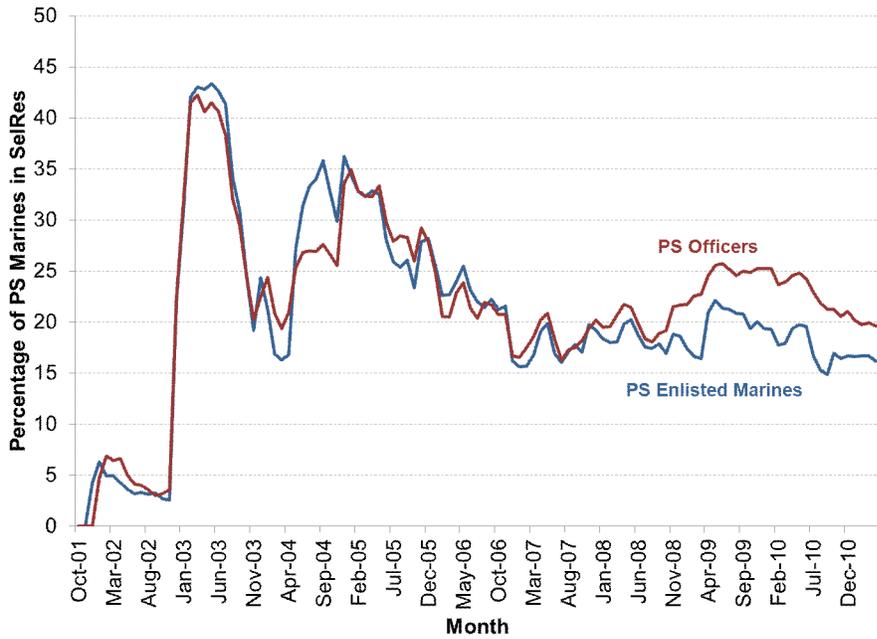
We identify activated PS Marines for one important reason: while activated, Marines are not able to leave the SelRes. In the remainder of this report, therefore, we analyze the behaviors of activated PS Marines separately from the behaviors of never-activated PS Marines. In the next section, we begin our analysis of PS SelRes continuation behavior by examining trends in average SelRes continuation rates.

SelRes continuation behavior

In this section, we look at trends in SelRes continuation rates among PS enlisted Marines and PS officers who entered the SelRes between October 2001 and April 2011. Specifically, we look at the six-month continuation rate—the percentage of Marines who stay in the SelRes for 6 months or more. Because Marines who are activated while in the SelRes are unable to leave, we separately look at the continuation rates of never-activated and activated PS Marines. For activated Marines, we examine continuation rates *after* activation.

In addition to six-month continuation rates, we look also at the total time Marines serve in the SelRes by paygrade. Then we examine the relationship between time-to-affiliation or time-to-activation and total months of SelRes service.

The SelRes continuation rate

General trends

Comparing enlisted and officer six-month continuation rates, we find that, in general, PS officers tend to remain in the SelRes longer than PS enlisted Marines. Overall, between October 2001 and April 2011, roughly 65 percent of never-activated PS enlisted Marines and 89 percent of never-activated PS officers spent 6 or more months in the SelRes. Among activated Marines, 38 percent of enlisted Marines and 45 percent of officers spent 6 months or more in the SelRes after activation.

We show, in figure 4, the six-month continuation rate for cohorts of never-activated PS enlisted Marines (blue line) and activated PS enlisted Marines (red line), by month, that affiliated with the SelRes between October 2001 and April 2011. The six-month continuation rates for never-activated PS enlisted Marines generally increased

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between FY02 and FY11. For example, just over 48 percent of the FY02 cohort remained in the SelRes for at least six months, whereas the continuation rate for those who affiliated in the first half of FY11 was almost 70 percent. During FY03 and FY03, the initial years of OIF and OEF, the continuation rate increased and was highest among those who affiliated in September 2004—at 100 percent. After September 2004, the SelRes continuation rate among never-activated enlisted Marines followed a generally increasing trend.

Figure 4.   SelRes six-month continuation rate for PS enlisted Marines,[a] by activation status,[b] Oct. 2001 to Apr. 2011
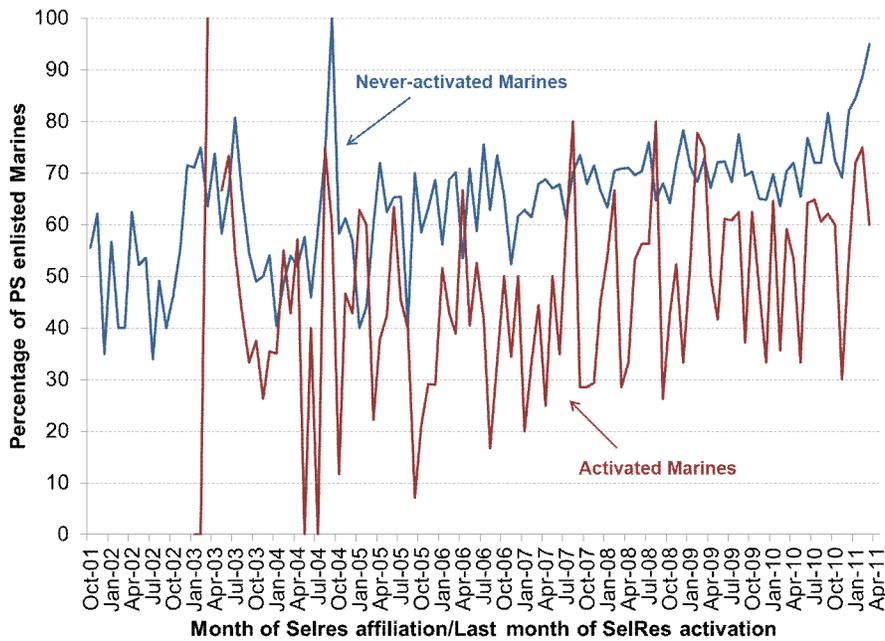
Turning to activated PS enlisted continuation rates, we find a similar, generally increasing trend in postactivation continuation rates. The variability in the activated PS enlisted continuation rate is caused, in part, by the small number of Marines whose activations ended in any

given month.[5] Despite its volatility, overall, the SelRes continuation rate for activated PS Marines tracks with the continuation rate of never-activated Marines. The continuation rate for activated PS enlisted decreased after June 2003 (73 percent), spiked in August 2004 (75 percent), and tended to slightly increase over each fiscal period after FY07.

Figure 5 shows the trend in the SelRes continuation rates for never-activated PS officers.[6] For most cohorts, the SelRes continuation rate is high—reaching 100 percent for 34 of 109 cohorts. The PS officer SelRes continuation rate was lowest for the cohort that affiliated in May 2004 (zero out of two officers). During the overall sample period, the never-activated PS officer continuation rate rose from 44 percent in FY03 to 92 percent in FY10.

Trends in continuation rates by Marine characteristics

To illustrate how the SelRes continuation rate differs across Marine characteristics, we compare the SelRes six-month continuation rate for never-activated PS Marines across education levels, gold-standard status, and occupations, respectively, in figures 6, 7, and 8.

As illustrated in figure 6, we find no clear evidence that PS Marines with more education are more likely to remain in the SelRes for six months or more. For PS officers, the FY02–FY11 continuation rate for those with bachelor's degrees and those with graduate or professional degrees were 89 and 90 percent, respectively. For PS enlisted Marines, the overall continuation rates for those with less than a high school diploma and those with at least a high school diploma are 64 and 65

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5. Some 2,800 PS enlisted Marines were activated between October 2001 and April 2011—an average of 24 per month. We do not observe Marines coming off activation orders before January 2003.

6. Only 888 PS officers were activated between October 2001 and April 2011, so for most months the six-month PS officer continuation rates after activation take on extreme values close to zero, or 100 percent, making it difficult to compare trends between never-activated and activated PS officer continuation rates. For this reason, we exclude activated officer continuation rates from the figure. However, activated PS officer continuation rates and never-activated continuation rates tend to increase and decrease in the same months.

Figure 5.   SelRes six-month continuation rate for never-activated PS officers, Oct. 2001 to Apr. 2011[a]
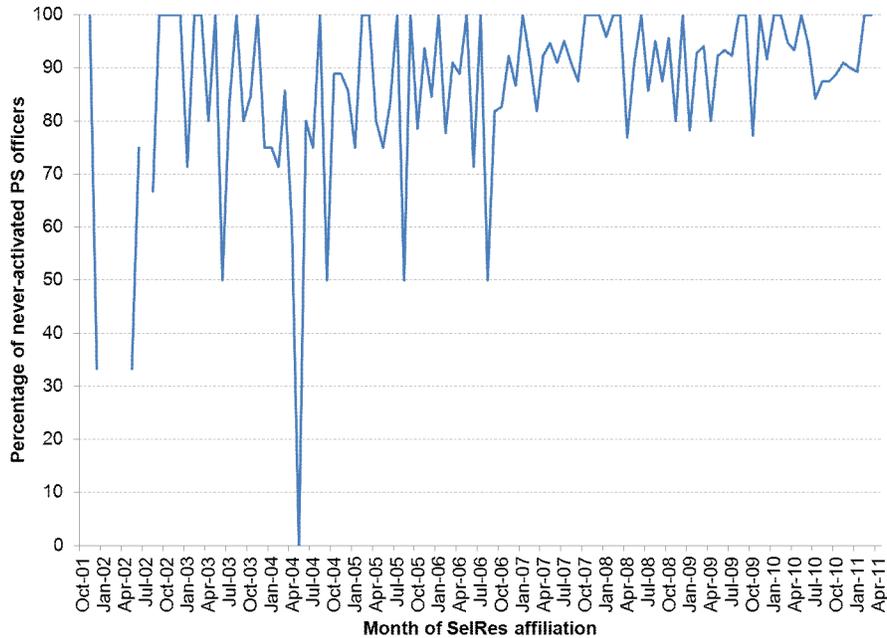
Figure 6.   SelRes six-month continuation rates by education level, never-activated PS enlisted Marines and PS officers[a]
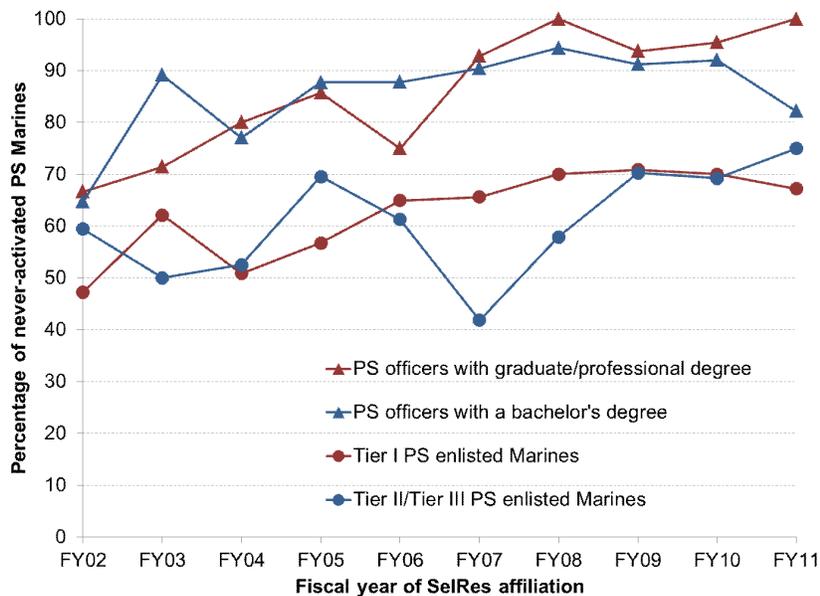
percent, respectively. These trends may suggest that civilian opportunities may not have as large an influence in SelRes continuation behavior as expected given our finding in [1] that education significantly affects the decision to affiliate with the SelRes.

In figure 7, we show the SelRes six-month continuation rate by gold-standard (GS) status for PS enlisted Marines and PS officers.[7]

Figure 7. SelRes six-month continuation rate by gold standard status, never-activated PS enlisted Marines and PS officers[a]
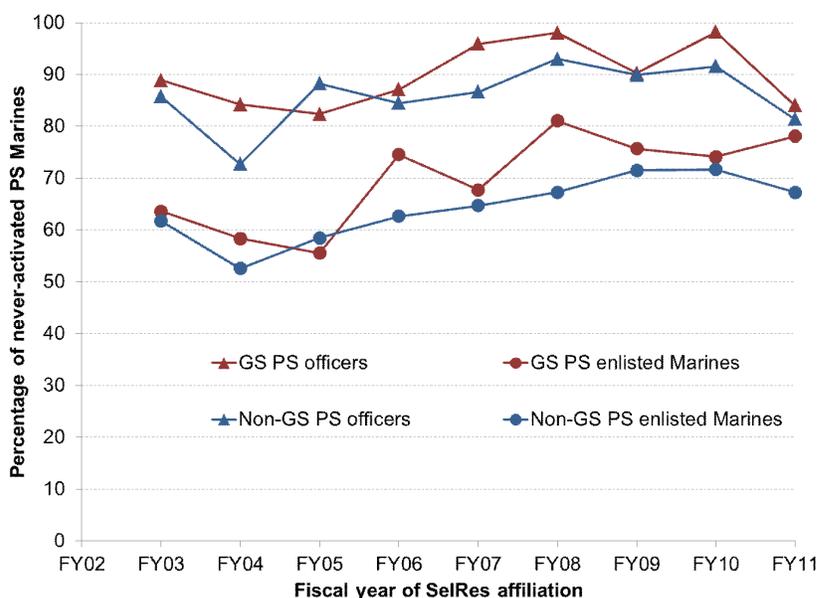
a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011. GS status cannot be determined for Marines who affiliated in FY02 because of missing PFT scores.

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7. GS is a quality measure we adopted from [7]. GS Marines are eligible for any chronically short or high-demand/low-density MOSs, and they are defined, in part, by their Armed Services Vocational Aptitude Battery (ASVAB) scores (general technical score of 110 or better, a mechanical maintenance score of 105 or better, and an electronics score of 115 or better) and by having at least a high school diploma, a class 1 Physical Fitness Test (PFT) score, no record of non-judicial punishments (NJPs) or courts-martial, and no drug, felony, or serious enlistment waivers.

Within both the enlisted and officer populations, the GS continuation rate is generally greater than the non-GS continuation rate. Overall, the PS enlisted GS and non-GS continuation rates are 73 and 66 percent, respectively; the officer continuation rates are 92 and 88 percent.

Six-month continuation rates also vary across occupations (see figure 8). Among both PS enlisted Marines and PS officers, those in aviation occupations had the highest continuation rates—overall, 69 percent for enlisted Marines and 93 percent for officers. Continuation rates tend to be similar for PS Marines in the combat arms and combat/ service support occupations. For never-activated enlisted Marines, the combat arms and combat/service support continuation rates were 61 and 66 percent, respectively; the continuation rates for PS officers were 89 and 87 percent.

Figure 8.   SelRes six-month continuation rate by occupation, never-activated PS enlisted Marines and PS officers[a]
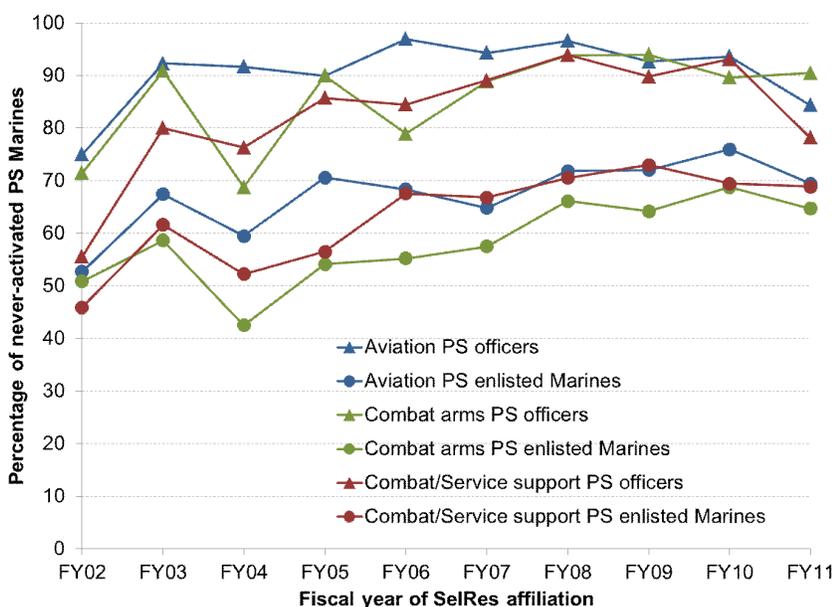
Time affiliated with the SelRes

In [1], we showed that higher ranking PS Marines tend to spend less time in the IRR before affiliating with the SelRes than lower ranking PS Marines. In a parallel analysis, we examine how SelRes tenure (months spent in the SelRes) is related to paygrade. In figure 9, we show months of SelRes service, by paygrade, for never-activated PS enlisted Marines. Overall, 41 percent of this population spent 1 to 6 months in the SelRes, but only 11 percent spent over two years in the SelRes. Looking across paygrades, on average, corporals tend to affiliate for the fewest months, while staff sergeants and higher affiliate the most. For example, 6 percent of corporals and over 17 percent of Marines ranked staff sergeant or higher remained in the SelRes for over two years.[8]

Figure 9.   Months of SelRes affiliation for never-activated PS enlisted Marines, by paygrade[a]
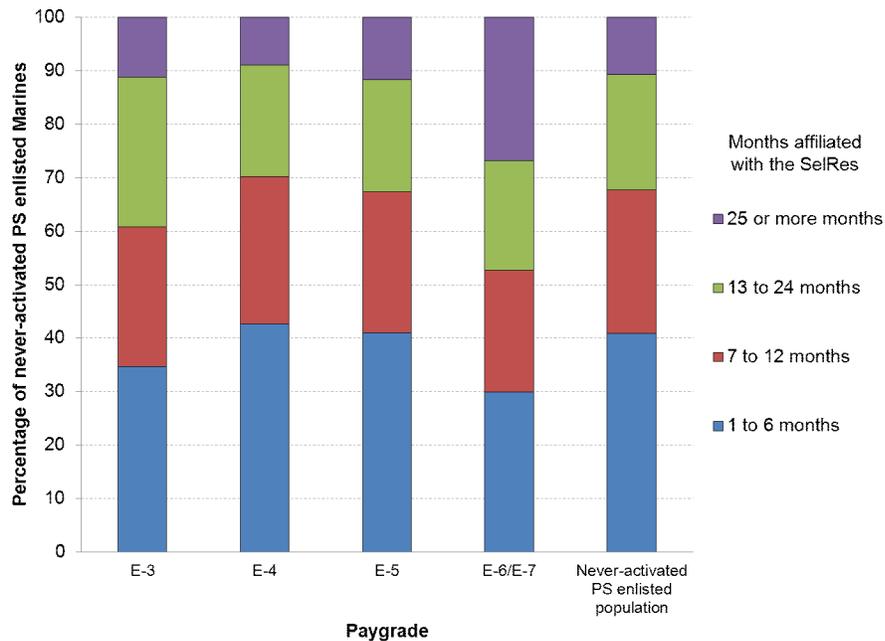
a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011.

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8.   We include transitioning E-1s and E-2s in our model, but we exclude them here because only 58 affiliated with the SelRes over this 10-year period.

The increasing SelRes tenure length across paygrades is more defini-tive among activated PS enlisted Marines (see figure 10). Overall, more than 65 percent of activated PS enlisted Marines spent six months or less in the SelRes after coming off activation; only 8 per-cent stayed for more than two years. On average, lance corporals have the shortest SelRes tenure after activation, followed by corporals, ser-geants, and staff sergeants and higher. Specifically, over 71 percent of lance corporals, 69 percent of corporals, 62 percent of sergeants, and 52 percent of staff sergeants and higher stayed in the SelRes up to six months after activation.

Figure 10. Months of SelRes affiliation among activated PS enlisted Marines,[a] by paygrade[b]
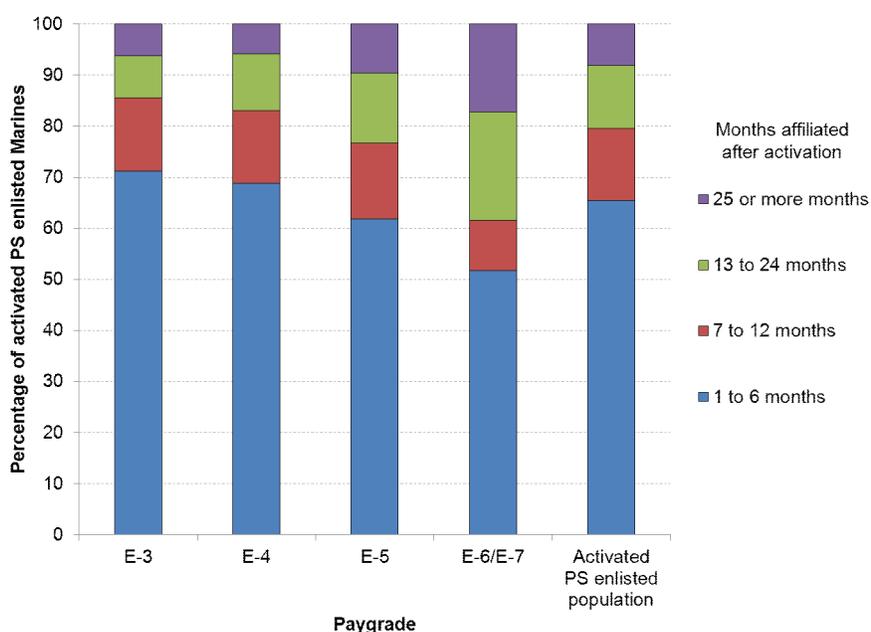
a. PS enlisted Marines are those who transitioned to the RC and affiliated with the SelRes.
b. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011.

In figures 11 and 12, we provide a corollary analysis for PS officers. Figure 11 graphs the percentage of never-activated PS officers by the number of months spent in the SelRes and paygrade; figure 12 does the same for activated PS officers. Among never-activated PS officers, only 15 percent affiliated with the SelRes for 1 to 6 months, 19 per-

Figure 11. Months of SelRes affiliation among never-activated PS officers, by paygrade[a]
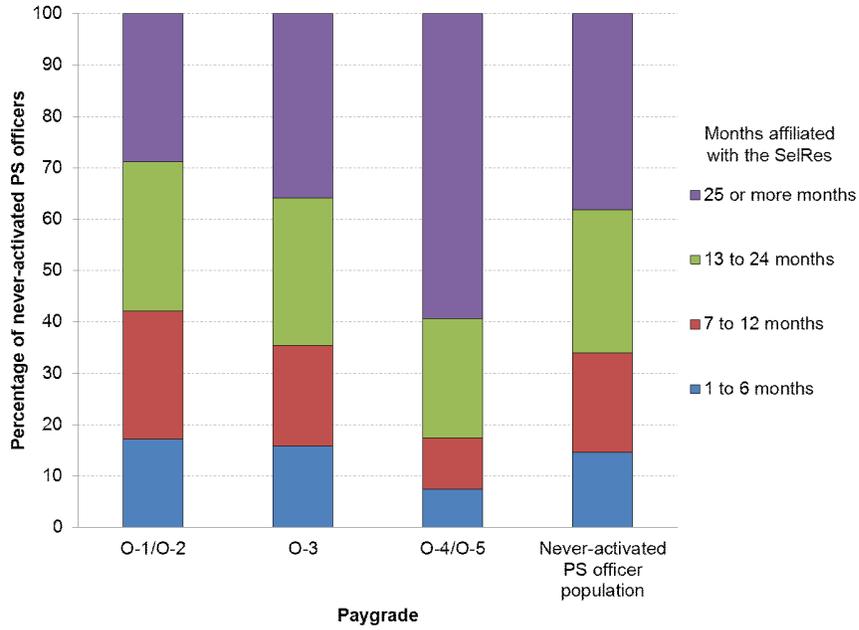
a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011.

Figure 12. Months of SelRes affiliation for activated PS officers, by paygrade[a]
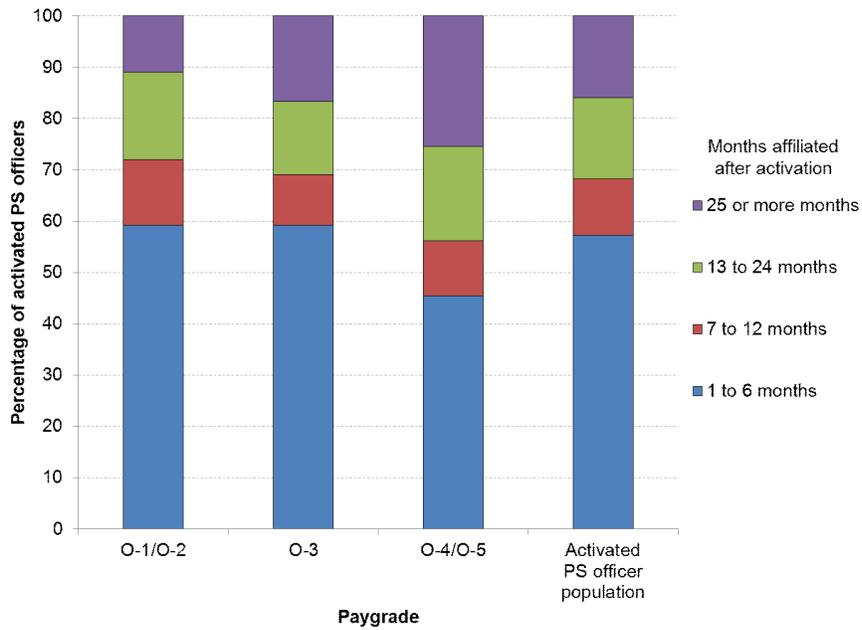
a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011.

cent affiliated for 7 to 12 months, 28 percent affiliated for 12 to 24 months, and 38 percent affiliated for 25 or more months. Looking across paygrades, there is a clear decreasing trend in SelRes tenure: time spent in the SelRes is lowest among first and second lieutenants (29 percent affiliated for more than two years) and highest among lieutenant colonels and colonels (59 percent affiliated for more than two years). The longer SelRes tenures among lieutenant colonels and colonels may not be surprising given that they have made more of a career commitment to the Marine Corps than more junior officers.

In figure 12, we find that 57 percent of activated PS officers remained in the SelRes 1 to 6 months after activation, while 16 percent remained an additional 13 to 24 months, 11 percent remained an additional 7 to 12 months, 16 percent remained 13 to 24 months, and another 16 percent remained an additional two years or more. Similar to the other PS populations, time spent in the SelRes after activation increases across paygrades. For example, 11 percent of first and second lieutenants spent more than two additional years in the SelRes, while 17 percent of captains and over 25 percent of lieutenant colonels and colonels served over two years.

The relationship between time-to-affiliation and time spent in the SelRes among never-activated PS Marines

In our previous report, [1], we found that the longer a PS Marine was in the IRR, the less likely he or she was to affiliate with the SelRes. We now ask: Do PS Marines who affiliate the quickest stay in the SelRes the longest? We expect this to be true if we believe that these Marines feel more connected to the Marine Corps. In figure 13, we explore the connection between time-to-affiliation and length of SelRes service for never-activated PS enlisted Marines and officers.

Figure 13 shows the time a never-activated PS Marine spent in the SelRes by the number of months he or she spent in the IRR before affiliating (time-to-affiliation). For both enlisted Marines and officers, those who affiliated within the same month as transitioning from the AC tended to stay in the SelRes the longest. Specifically, among Marines who affiliated within one month of transition, 18 percent of PS enlisted Marines and 44 percent of PS officers served in the SelRes for 25 or more months. Although Marines who took a month or more

to affiliate with the SelRes appear to have had shorter SelRes careers, we do not observe a strictly monotonic relationship between time-to-affiliate and SelRes tenure. On one hand, roughly 10 percent of enlisted Marines who spent a month or more in the IRR served in the SelRes for 25 or months, but the percentage who served 6 months or less declined from 45 to 37 percent. On the other hand, among never-activated PS officers, the percentage that served in the SelRes for 25 or months decreased with time spent in the IRR from 44 to 35 percent, while the percentage that served 6 months or less in the SelRes shows no consistent pattern.

Figure 13. The relationship between time-to-affiliation and months of SelRes service for never-activated PS enlisted Marines and PS officers[a]
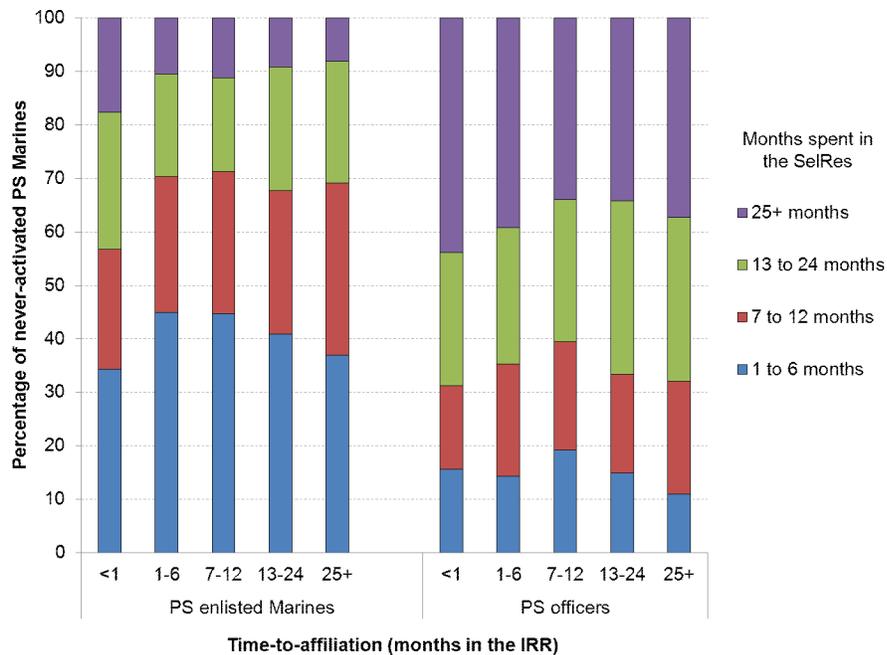
The relationship between time-to-activation and time to SelRes loss for activated PS Marines

Lastly, we examine the relationship between the amount of time a PS Marine was in the SelRes before activation (time-to-activation) and

the number of months of continued SelRes service after activation. Figure 14 shows that PS Marines—enlisted and officers—who were activated shortly after affiliating with the SelRes tend to leave closer to their month of deactivation than those who were with the SelRes longer before activation. For example, among activated PS enlisted Marines, those activated within 6 months of affiliation are the most likely to leave within 6 months after activation (67 percent), followed by those activated between 7 and 12 months after affiliation (59 percent), those activated 19 or more months after affiliation (55 percent), and those activated 13 to 18 months after affiliation (54 percent). A similar pattern exists among activated PS officers: 71 percent of officers activated within 6 months of affiliation left the SelRes within 6 months of activation, followed by those activated 7 to 12 months after affiliation (49 percent), 19 or more months (49 percent), and 13 to 18 months after affiliation (47 percent).

Figure 14. The relationship between time-to-activation and SelRes affiliation after activation for activated PS enlisted Marines and PS officers[a]

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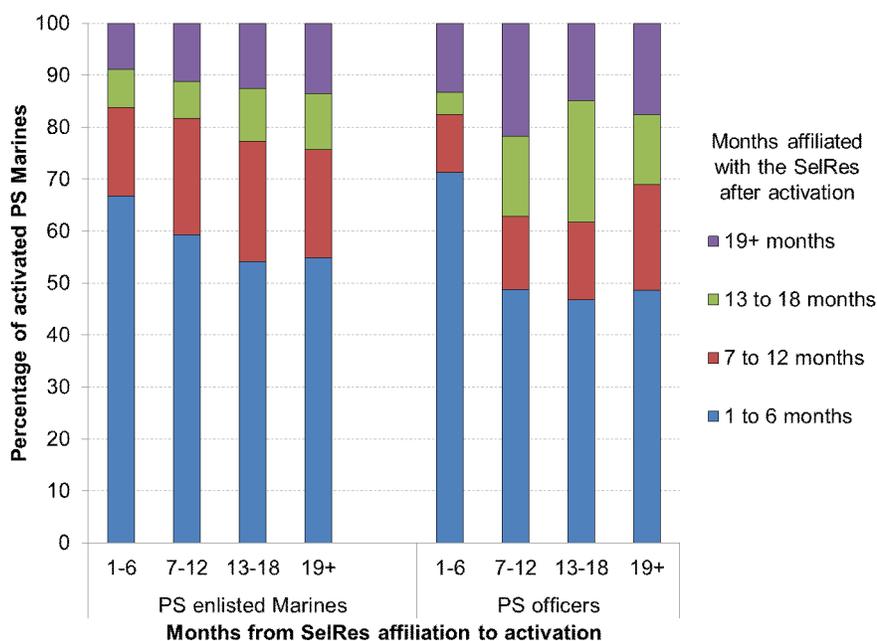
Summary

In this section, we examined the six-month continuation rates among PS enlisted Marines and PS officers. We looked separately at continuation rates among never-activated and activated Marines because activated Marines are unable to leave the SelRes until they come off activation orders. Overall, we find that PS officers are more likely to continue in the SelRes than enlisted Marines, and higher ranking Marines tend to serve in the SelRes longer than lower ranking Marines. In addition, never-activated Marines who spent fewer months in the IRR before affiliating with the SelRes tend to have longer SelRes careers than those who spent more time in the IRR. Among activated Marines, those with more months of SelRes service before activation tend to stay in the SelRes longer after activation than Marines with fewer months of pre-activation SelRes service.

We now turn our attention modeling SelRes continuation behavior. In the next section, we describe our modeling techniques.

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Modeling the decision to leave the SelRes

Our analysis of SelRes continuation behavior thus far has been limited to simple comparisons of average continuation rates. Although insightful, this type of analysis does not account for other factors that affect continuation behavior. We use survival analysis techniques to identify the independent effects of a number of Marine and environmental characteristics on the likelihood of leaving the SelRes.[9]

Our aim is to estimate the likelihood that PS Marines *leave* the SelRes at any given point in time. To this end, we estimate four separate models using the following four different PS populations:

- Never-activated PS enlisted Marines

- Activated PS enlisted Marines

- Never-activated PS officers

- Activated PS officers

We define a SelRes loss as the first time a Marine drops from the SelRes to IRR and remains in the IRR for at least another five months. That is, if a PS Marine enters the IRR in month *M*, we consider that Marine as a loss to the SelRes if he or she is still in the IRR in month *M*+5. This definition mitigates the problem of identifying whether a PS Marine has dropped to the IRR as an intermediary step to transferring units.

As for the explanatory variables that are included in our model, the first is the amount of time, *t,* that a PS Marine is affiliated with the SelRes—the number of months a PS Marine spent in the SelRes before either leaving the SelRes or the end of the sample period.

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9. We provide a more detailed explanation of survival analysis in appendix C.

In addition to months of SelRes service, our models account for differences in demographic and service characteristics as well as the state unemployment at the time of SelRes affiliation (for never-activated Marines) or deactivation (for activated Marines).[10] Also, we account for time-to-affiliation—and, for activated Marines, time-to-activation—to determine the effects of the IRR and SelRes service before activation on SelRes continuation behavior. All four models also include variables indicating the fiscal trimester in which the Marine affiliated with the SelRes (for never-activated Marines) or came off activation orders (for activated Marines). These indicators control for factors that we do not observe but are specific to a cohort, such as the wars in Iraq and Afghanistan, as well as the increase in active component endstrength.

We discus the results of estimating our SelRes loss models in the following four sections. The first set of estimates are for never-activated PS enlisted Marines, followed by those for activated PS enlisted Marines, never-activated PS officers, and, finally, activated PS officers.

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10. We provide definitions for all of the variables included in our models in table 8 in appendix D.

The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines

We begin by discussing the determinates of SelRes loss with the population of never-activated PS enlisted Marines. Figure 15 provides a graphical summary of the estimated relative likelihoods of leaving the SelRes associated with selected variables for never-activated PS enlisted Marines.[11] For categorical variables, the comparison group is represented with a black bar set to a value of 1.0. An estimate (blue bars) statistically greater than 1 (p-value of 0.10 or less) implies that Marines with that characteristic are more likely to leave the SelRes than those in the comparison group, while an estimate statistically smaller than 1 implies a lower likelihood of leaving. The estimates associated with continuous variables (i.e., the state unemployment rate) represent the difference in the likelihood of leaving the SelRes for a one-unit change in the variable (e.g., a 1-percentage-point change in the unemployment rate).

In the remainder of this section, we discuss our findings, relate them to our findings regarding trends in SelRes affiliation behavior, and evaluate their implications for Marine Corps policy and practices. We divide the discussion of our results into three subsections:

- The effects of demographic and service characteristics

- The effects of geographic location and unemployment rates

- The effect of time spent in the IRR before SelRes affiliation

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11. Full estimation results are available in table 9 in appendix E.

Figure 15. The relative likelihood of leaving the SelRes[a] for never-activated PS enlisted
Marines[b, c]
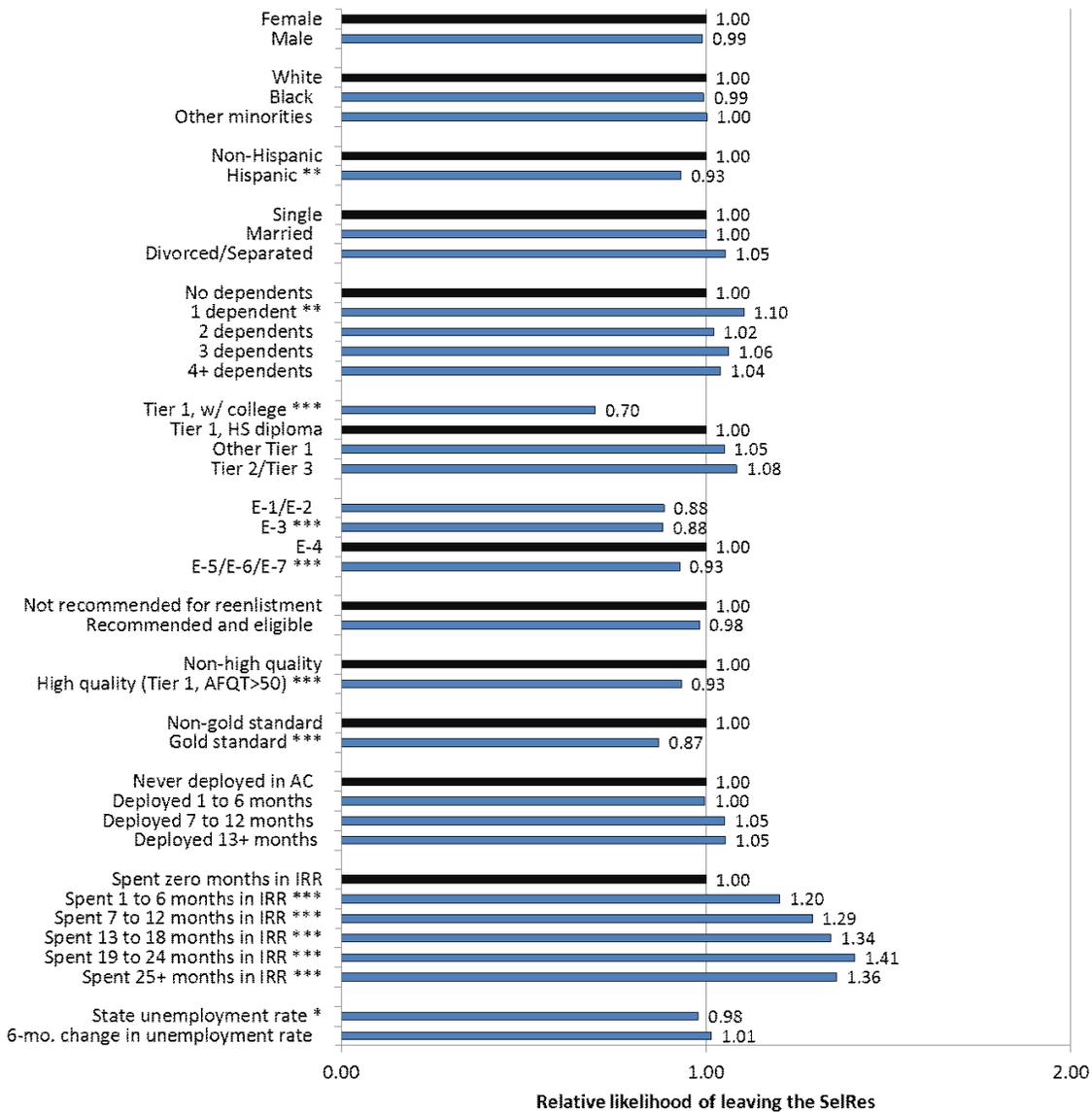
Effects of demographic and service characteristics

Our estimates for never-activated PS enlisted Marines show that some groups are more likely to leave the SelRes than others. Following are some of the trends in SelRes losses from our statistical model:

- Hispanics are less likely than whites to leave the SelRes.

- Marines with a college education are the least likely to leave.

- Lance corporals and Marines ranked sergeant or higher are the least likely to leave the SelRes.

- High-quality and GS Marines are less likely to leave the SelRes than non-high-quality or non-GS Marines.

In addition to providing more details about the degree to which these groups are more likely to leave the SelRes, we also examine trends in the likelihood of leaving across geographic areas and occfields in the discussion that follows.

Hispanics and Marines with college degrees least at risk of leaving the SelRes

Our analysis of SelRes affiliation behavior showed that racial and ethnic minorities are more likely than whites to affiliate with the SelRes [1]. Although we find that race does not have a statistically significant effect on the likelihood of leaving the SelRes, our estimates show that Hispanics are roughly 7 percent less likely than non-Hispanics to leave the SelRes. Similar to Hispanics in the AC, Hispanics in the SelRes are more likely to continue serving in the Marine Corps [3].

Although our affiliation analysis finds that college *and* non-high-school graduates are more likely than high school graduates to affiliate with the SelRes (see [1]), our continuation analysis shows that only college graduates leave the SelRes at a different rate than high school graduates. We find that never-activated PS Marines with a college degree are 30 percent less likely to leave the SelRes than Marines with traditional high school diplomas. One reason college graduates may be more likely to stay in the SelRes is because they are more

mature and adept at balancing their military and civilian careers. If college graduates are more able than non-college graduates, then college graduates may be more competitive for preferred SelRes positions or promotion and, therefore, may have fewer roadblocks to serving in the SelRes, thus decreasing the odds of leaving the SelRes.

Lance corporals and Marines ranked sergeant or higher least at risk of leaving the SelRes

Unlike the probability of affiliating with the SelRes, which increases with paygrade (see [1]), the likelihood of leaving the SelRes does not progressively increase or decrease across paygrades. Instead, our estimates indicate that, compared with corporals, lance corporal as well as sergeants, staff sergeants, and gunnery sergeants are less likely to leave the SelRes. Specifically, lance corporals are 12 percent less likely to leave, while sergeants, staff sergeants, and gunnery sergeants are all 7 percent less likely to leave than corporals.

These differences in the likelihood of leaving the SelRes can occur for different reasons. For instance, lance corporals may wish to stay affiliated with the SelRes while they go back to school. On the other hand, higher ranking Marines may be more likely to stay in the SelRes because they feel that they put in sufficient time already to continue for retirement eligibility. In addition, both groups may continue to serve in the SelRes in order to become eligible for Post-9/11 GI Bill education benefits, including the ability to transfer their benefits to their dependents [8].

High-quality and gold-standard PS enlisted Marines most likely to remain in the SelRes

In terms of quality, our results show that among those never activated, higher quality never-activated PS enlisted Marines are less likely to leave the SelRes. Specifically, high-quality PS enlisted Marines—those with Tier I education credentials and Armed Forces Qualification Test (AFQT) scores of 50 or higher—are 7 percent less than that of non-high-quality Marines. GS never-activated PS enlisted Marines also are less likely to leave the SelRes. Compared to non-GS PS enlisted Marines, GS Marines are 13 percent less likely to leave the SelRes. For

the Marine Corps as a whole, these estimates imply that, in addition to successfully recruiting GS enlisted Marines into the SelRes (see [1]), it is also able to successfully retain them. The Marine Corps may be able to get a larger investment from affiliation and reenlistment bonuses if they target them toward high-quality and GS Marines.

Intelligence PS enlisted Marines least likely to leave the SelRes

Relative to Marines in the infantry occfield (03XX), never-activated PS enlisted Marines in 16 other occupations are less likely to leave the SelRes. We show how much less likely—in percentage terms— Marines in these occfields are to leave in table 2. Marines in motor transport (35XX) are 7 percent less likely to leave the SelRes, while intelligence Marines (02XX and 26XX) are just over 40 percent less likely to leave the SelRes—two occfields with chronically short and high-demand/low-density (HD/LD) PMOSs [7].

Table 2.   Occfields with lower likelihood of leaving the SelRes than the infantry occfield, never-activated PS enlisted Marines[a]

Occfield	Percentage difference from infantry Marines[b]
26XX: Signals intelligence	-40.7
02XX: Intelligence	-40.3
44XX: Legal services	-33.0
43XX: Public affairs	-32.2
34XX: Financial management	-25.8
57XX: Nuclear, biological, and chemical defense	-23.5
60-73XX: Aviation	-21.2
23XX: Ammunition/explosive ordnance disposal	-17.9
18XX: Tank and assault amphibious vehicles	-17.4
33XX: Food service	-17.1
30XX: Supply, administration, and operations	-16.4
21XX: Ordnance	-15.0
06XX: Command and control systems	-12.6
58XX: Military police/corrections	-11.5
11XX/13XX: Utilities/engineer, construction, facilities, and equipment	-8.1
35XX: Motor transport	-7.0

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Hazard ratios are statistically significant at the 5-percent level except for 11XX/13XX, 34XX, and 35XX, which are significant at the 10-percent level.

Effects of geographic location and unemployment rates

Next, we turn to the effects of state of residence and the state unemployment rate.

PS enlisted Marines in the Middle Atlantic most likely to leave the SelRes

Comparing the risk of loss across geographic regions shows that there are four regions where the risk of SelRes loss is greater than in the South Atlantic area. The following are the areas in which PS enlisted Marines are more likely to leave the SelRes (in order of most to least at risk) than Marines in the South Atlantic:

- Middle Atlantic (14 percent more likely)

- West-North Central (13 percent more likely)

- New England (12 percent more likely)

- East-North Central (8 percent more likely)

One reason Marines in these areas are more likely to leave the SelRes might be that they have the lowest concentrations of SMCR units [9], so there is less opportunity for Marines to transfer if they wish to leave a particular unit. Another factor, particularly for Marines in the North Central areas, may be the distance they have to travel to get to their units as the units are more spread out throughout the region [9]. Further investigation into why these Marines are leaving their units is necessary to determine if the Marine Corps may be able to use incentives to increase continuation rates in these areas.

Inverse relationship of unemployment rate and likelihood of leaving the SelRes

Our estimates show that state unemployment rates and the risk of leaving the SelRes are inversely related. That is, in poor economic times, never-activated PS enlisted Marines prefer to remain in the SelRes, but they are more likely to leave in good economies. Specifically, a 1 percentage point change in the unemployment rate changes the likelihood of leaving the SelRes by about 2 percent.

Since PS enlisted Marines are also more likely to affiliate during poor economic times (see [1]), these findings suggest that the Marine Corps needs to be aware of the economic conditions its Marines face in the civilian world. Because our findings imply that recruitment and retention are more difficult in good economic times, the Marine Corps will need to use its array affiliation incentives (see [5]) more effectively and efficiently during these periods than when the economy is doing poorly.

Effect of time spent in the IRR before affiliation

Lastly we look at the independent effect of time-to-affiliation. Earlier, we showed that Marines who affiliated with the SelRes closest to their transition date tended to have longer SelRes careers than those who spent more time in the IRR. Our estimates provide further evidence of this relationship. We find that the risk of a never-activated PS enlisted Marine leaving the SelRes increases the longer he or she spends in the IRR. For example, relative to Marines who affiliated within the same month of transition, those who wait up to 6 months are 20 percent more likely to leave the SelRes, while those who affiliate 7 to 12 months after transition are 29 percent more likely, followed by those who affiliate 13 to 18 months after transition (34 percent), 25 or more months after transition (36 percent), and 19 to 24 months after transition (41 percent). These findings, along with the fact that Marines are less likely to affiliate with the SelRes the longer they are in the IRR (see [1]), suggest that the Marine Corps should recruit Marines as close as possible to their EAS—or even before EAS—to increase SelRes affiliation and continuation rates.

Summary

Overall, our estimates show that the risk of leaving the SelRes is lowest among never-activated PS enlisted Marines who are:

- Hispanic

- College graduates

- Lance corporals, sergeants, staff sergeants, or gunnery sergeants

- High quality or gold standard

- Not living in regions of the country with high concentrations of SMCR units

Also, the likelihood of leaving the SelRes depends on the number of months a Marine spent in the IRR before affiliating with the SelRes; those who affiliated closer to their transition date are the least likely to leave. In addition, our estimates show that the unemployment rate has a significant effect on SelRes continuation behavior. When the unemployment rate is high, Marines are less likely to leave the SelRes; the reverse is true when the unemployment rate is low.

In the next section, we present estimates from modeling postactivation SelRes continuation behavior among *activated* PS enlisted Marines.

The relative risk of leaving the SelRes among activated PS enlisted Marines

In the previous section, we modeled the SelRes continuation behavior of never-activated PS enlisted Marines; here we focus on the continuation behavior of *activated* PS enlisted Marines. Figure 16 provides a graphical summary of the estimated likelihood ratios associated with selected characteristics of activated PS enlisted Marines.[12] Similar to the previous section, the comparison groups are represented with black bars. Estimates (blue bars) statistically greater than 1 (p-value of 0.10 or less) imply a higher likelihood of leaving the SelRes, while estimates statistically smaller than 1 imply a lower likelihood.

Unlike our findings for never-activated PS enlisted Marines, our model indicates that there are fewer factors that influence activated PS enlisted Marines to leave (or stay in) the SelRes after activation. Similar to the last section, we first describe the effects of demographic and service characteristics on the likelihood of leaving the SelRes. From there, we examine the effects of AC combat deployment experience, time-to-activation, and length of activation.

Effects of demographic and service characteristics

In this subsection, we discuss the effects of demographic and service-related characteristics on the likelihood of an activated PS enlisted Marine leaving the SelRes after activation. Our model indicates that three service-related characteristics statistically affect the likelihood of leaving the SelRes: paygrade, being recommend and eligible for reenlistment at the time of transition, and occfield. In addition, dif-

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12. Full estimation results are available in table 10 in appendix E.

Figure 16. The relative likelihood of leaving the SelRes[a] among activated PS enlisted Marines[b,c]
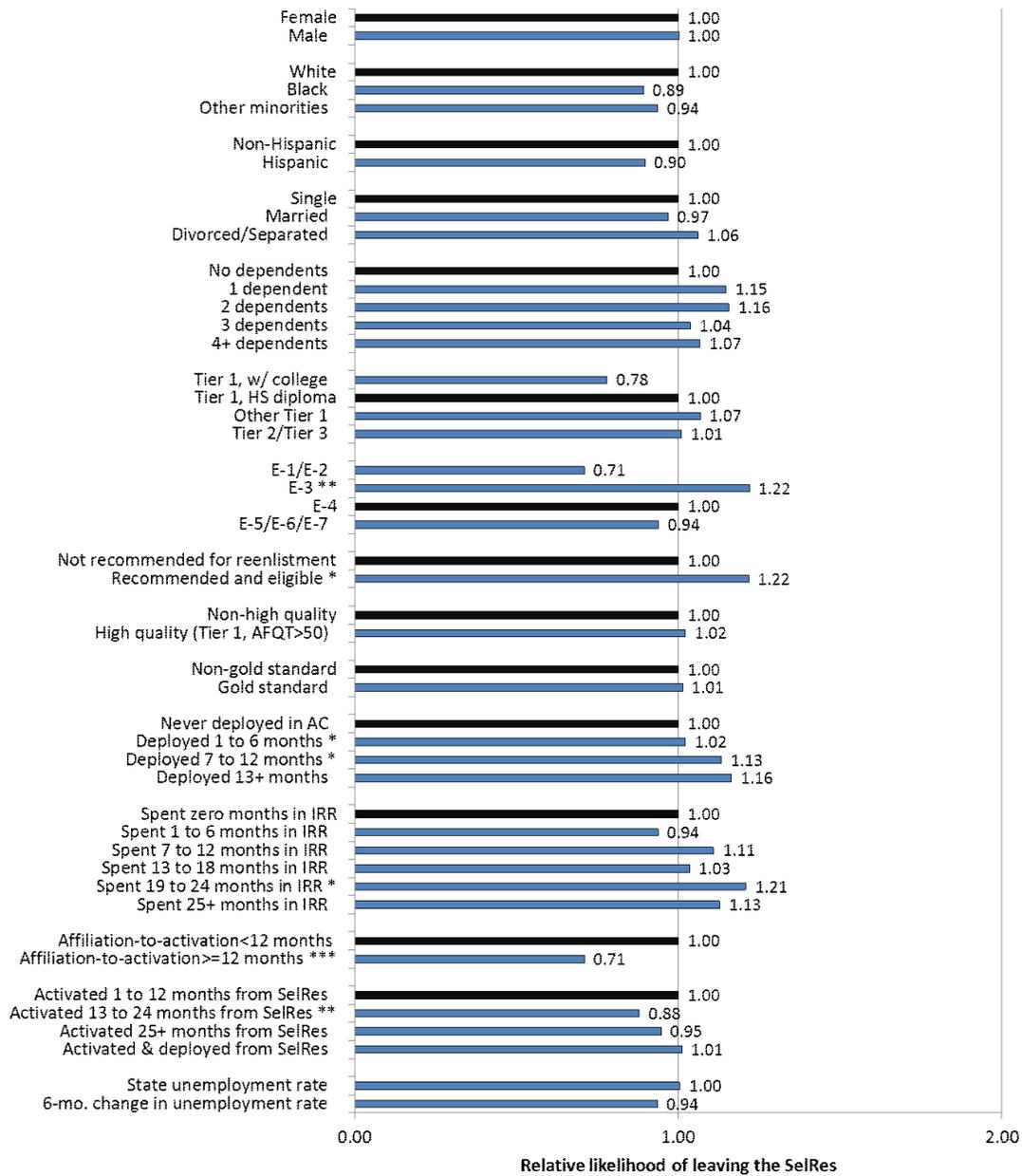
a. Significance levels are denoted as follows: * p-value < 0.1, ** p-value < 0.5, and *** p-value < 0.01.
b. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
c. For all categorical variables, the hazard ratio for the comparison group has been set to 1 and is represented with a black bar. The unemployment rate variables are continuous variables, so the hazard ratio represents the change in the likelihood of affiliation for a 1-percentage-point change in the unemployment rate.

ferences in SelRes continuation behavior exist across geographic areas. We provide more details of these effects below.

Lance corporals and Marines recommended and eligible for reenlistment most likely to leave the SelRes

We find that lance corporals are the most likely to leave the SelRes after activation. Specifically, lance corporals are an estimated 22 percent more likely than corporals to leave the SelRes after activation. Lance corporals might be more inclined to leave the SelRes after activation if they are less capable of handling the stresses associated with being activated than higher ranking and more mature Marines. With fewer years of service, lance corporals have also invested less time in the Marine Corps than other ranks, so they may not be as committed to the Marine Corps or their units. Lance corporals may also wish leave to go back to school in order to become more competitive when return to the SelRes at a later time.

In addition, our estimates indicate that activated PS enlisted Marines who were recommended and eligible for reenlistment while on active duty are 22 percent *more* likely to leave the SelRes after activation than those with other reenlistment codes. Though the estimate is significant, we caution the validity of it because there are few PS enlisted affiliated with the SelRes (4.3 percent) with other reenlistment codes.

Intelligence, utilities/facilities, ordnance, combat camera, and aviation Marines least likely to leave the SelRes

Our model identifies five occfields where the likelihood of leaving the SelRes after activation is lower than that of the infantry occfield. In table 3, we list these occfields (in order from least to most likely to leave after activation). Most of these estimates are significant because there are few Marines in these occfields, such as intelligence and combat camera; therefore, percentage differences represent relatively few Marines.

Table 3. Occfields with lower likelihoods of leaving the SelRes than the infantry occfield, activated PS enlisted Marines[a]

Occfield	Percentage difference in likelihood of leaving from infantry[b]
46XX: Combat camera	-69.8
21XX: Ordnance	-42.9
02XX: Intelligence	-42.2
60-73XX: Aviation	-22.5
11/13XX: Utilities/engineer, construction, facilities, and equipment	-22.1

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Hazard ratios are statistically significant at the 1-percent level except for 34XX, which is significant at the 5-percent level, and 46XX and 59XX, which are significant at the 10-percent level.

Activated PS enlisted Marines in New England most likely to leave the SelRes

Our model shows only one geographic area where the likelihood of leaving the SelRes is different from that for Marines living in the South Atlantic. Activated PS enlisted Marines living in New England are 24 percent more likely to leave the SelRes after activation than those living in the South Atlantic. Further research into why Marines in New England tend to leave the SelRes at higher rates than Marines in other regions should be done to determine if these losses stem from competition with the civilian sector, a lack of Marine Corps promotion opportunities, or a characteristic of leadership within these units.

Effects of AC deployment experience, activation length, and time-to-activation

There are three variables related to deployment or activation experience that affect the likelihood that PS enlisted Marines leave the SelRes after activation. These include months combat deployed while on active duty, months between affiliation and activation (how quickly a Marine was activated), and months a Marine was activated.

For activated PS enlisted Marines, our estimates indicate that those who deployed 7 to 12 months while on active duty are 13 percent more likely than those who were never deployed to leave the SelRes after activation. These Marines may want to leave the SelRes to be with their families or to work at putting their civilian careers back in order.

Although we find that AC deployment experience increases the likelihood of leaving the SelRes, we find the opposite is generally true of activation length. Our estimates indicate that PS enlisted Marines who were activated between 13 and 24 months are about 13 percent less likely to leave the SelRes after activation than those who were activated for shorter lengths of time. This is similar to what was found in [4] and shows that PS enlisted Marines activated from the SelRes are likely to stick around after they come off orders. One possible explanation for this finding might be that after being activated together, Marines are less likely to want to part with their fellow Marines. Another reason might be that activation motivates Marines to continue serving.

Summary

According to our model, fewer factors influence the decision to leave the SelRes among activated PS enlisted Marines than among never-activated PS enlisted Marines. Our estimates show that lance corporals and those who received a recommended and eligible reenlistment code are the most likely to leave the SelRes after activation. We also find that AC deployment experience increases the likelihood of activated enlisted Marines leaving the SelRes, but that activation length and time-to-activation decreases the likelihood of leaving.

This completes our analysis of SelRes continuation behavior among PS enlisted Marines. In the next section, we begin our analysis of officer behaviors, starting with officers who were never activated from the SelRes.

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The relative risk of leaving the SelRes among never-activated PS officers

In this section, we turn to the PS officer population and begin by analyzing the relative risk of SelRes loss among *never-activated* PS officers (see figure 17). As in previous sections, the black bars represent the comparison groups for the categorical variables. Estimates (blue bars) that are statistically greater than 1 imply that the likelihood of leaving the SelRes is higher than that of the comparison group, while estimates less than 1 imply a lower likelihood.[13]

Compared with never-activated PS enlisted Marines, we find few demographic or service-related characteristics that affect the likelihood of never-activated PS officers leaving the SelRes. We discuss the factors that significantly affect officers' decisions to leave the SelRes, focusing first on the effects of service characteristics, then on the effects of state of residence and the unemployment rate, and finally on the effect of time spent in the IRR before affiliating with the SelRes.

Effect of service-related characteristics

Our model shows that paygrade, AC deployment history, and occfield influence never-activated PS officers' decisions to leave the SelRes. We describe these effects, in order, in the subsections that follow.

Higher ranking officers least likely to leave the SelRes

Our estimates show that the likelihood of an officer leaving the SelRes decreases with paygrade. Compared with never-activated PS captains, first and second lieutenants are 31 percent more likely to leave the SelRes, while majors and lieutenant colonels are 27 percent

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13. Full estimation results are presented in table 11 in appendix F.

less likely. Higher ranking officers may be more inclined to stay in the SelRes because they have invested more time with the Marine Corps or to attain the Post-9/11 GI Bill transferability of education benefits [8]. Since majors and lieutenant colonels are guaranteed to be allowed to reach retirement eligibility [10], they have an incentive to continue serving in the SelRes until they reach that point.

Figure 17. The relative likelihood of leaving the SelRes[a] among never-activated PS officers[b, c]
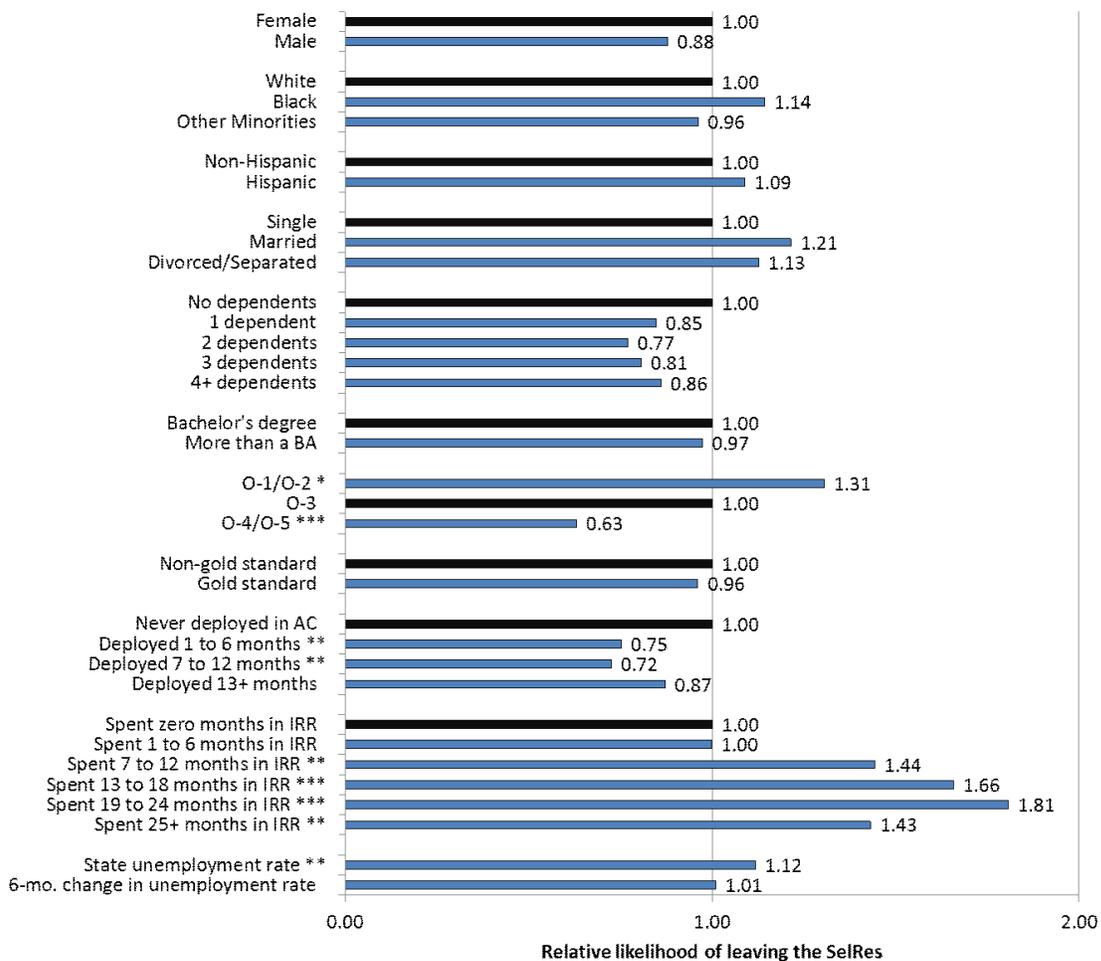
a. Significance levels are denoted as follows: * p-value < 0.1, ** p-value < 0.5, and *** p-value < 0.01.
b. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
c. For all categorical variables, the hazard ratio for the comparison group has been set to 1 and is represented with a black bar. The unemployment rate variables are continuous variables, so the hazard ratio represents the change in the likelihood of affiliation for a 1-percentage-point change in the unemployment rate.

AC combat deployment experience decreases likelihood of leaving the SelRes

Unlike PS enlisted Marines, never-activated PS officers who have AC deployment experience are less likely to leave the SelRes than those who were never combat deployed while on active duty. Compared with those who were never deployed, officers who were deployed 1–6 or 7–12 months are 25 and 28 percent less likely, respectively, to leave the SelRes. Although AC deployment experience does not influence officers' decisions to affiliate with the SelRes [1], these findings suggest that, once in the SelRes, the Marine Corps is able to retain the experienced officers and perhaps it should focus incentives on officers with combat experience to increase affiliation.

Engineer, construction, facilities, and equipment officers most likely to leave the SelRes

We find that there are three occfields that have a higher likelihood of SelRes loss than the infantry occfield. Compared with infantry officers, never-activated PS officers in the engineer, construction, facilities, and equipment (13XX) occfield are more than twice as likely to leave the SelRes, while field artillery officers are 47 percent more likely to leave, and legal officers are 69 percent more likely to leave. Although these estimates appear large, because of the size of the populations, these effects represent relatively small numbers of Marines. Further investigation into the career opportunities available to these Marines in the reserves is needed to determine why these occfields tend to have higher loss rates than others.

Effects of geographic location and unemployment rates

Our model shows that never-activated officers who live in New England are the most likely to leave the SelRes. These officers are roughly 50 percent more likely than officers in South Atlantic states to leave the SelRes. Further research into why Marines in New England tend to leave at higher rates than Marines in other regions should be done to determine if these losses stem from competition from the civilian sector or from lack of promotion opportunities or poor leadership with these units.

Unlike our finding for the never-activated PS enlisted population, the unemployment rate is positively related to the likelihood of leaving among never-activated PS officers. That is in poor economic times (high unemployment), the likelihood of leaving the SelRes is high, while in good economic times (low unemployment), the likelihood is low. Specifically, our estimates show that a 1-percentage-point increase in the state unemployment rate increases the likelihood of officers leaving the SelRes by 12 percent. One reason this may occur is because officers may feel that during poor economic times their commitments to the SelRes threaten their abilities to keep their civilian jobs. The Marine Corps may want to consider how it can help and council Marines balance their military and civilian lives.

Effect of time spent in the IRR before SelRes affiliation

Similar to our findings for the PS enlisted population, PS officers who spend more time in the IRR are more likely to leave the SelRes. Compared with never-activated PS officers who affiliate in the same month they transition from the AC, officers who spend 7 to 12 months in the IRR are 44 percent more likely to leave the SelRes, while officers who are in the IRR for 13 to 18 months are 66 percent more likely to leave, those who spend 19 to 24 months in the IRR are 81 percent more likely to leave, and those who spend more than 2 years in the IRR before affiliating are 43 percent more likely to leave. For PS recruiting, this implies that officers should be recruited for the SelRes closer to their transition dates to increase the likelihood of both affiliation (see [1]) and continuation in the SelRes.

Summary

To summarize, our results for never-activated PS officers show that the likelihood of leaving the SelRes is not affected by demographic characteristics, such as gender, race/ethnicity, or education. However, the likelihood of leaving the SelRes is affected by service-related characteristics, including paygrade, AC deployment history, and occfield. For example, we find that the likelihood of leaving the SelRes is lowest among lower ranking Marines and those with little AC combat deployment experience. Another important factor in the

decision to leave the SelRes is the amount of time never-activated PS officers spend in the IRR before affiliation. Our estimates indicate that the longer an officer is in the IRR, the more likely he or she is to leave the SelRes in any given month.

Next, we estimate the effects of characteristics of *activated* PS officers on their likelihood of leaving the SelRes *after activation.*

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The relative likelihood of leaving the SelRes among activated PS officers

In this section, we present our last set of estimates—those for PS officers who were activated from the SelRes. Figure 18 graphically presents the estimated relative likelihood of leaving the SelRes associated with activated PS officer characteristics. As before, comparison groups are indicated with black lines. Estimates (blue bars) that are statistically greater than 1 imply that these activated PS officers are more likely to leave the SelRes after activation; estimates that are statistically less than 1 imply a lower likelihood of leaving.[14]

The following discussion has two parts. In the first part, we describe the effects of demographic and service-related characteristics on the likelihood of leaving the SelRes. In the second part, we describe the effects of time spent in the IRR and the SelRes before activation as well as activation length.

Effects of demographic and service-related characteristics

Our estimates show that there are statistically significant differences in the likelihood of leaving the SelRes after activation for activated PS officers across genders, races, states of residence, paygrades, and occfields.

Men and racial minorities other than black least likely to leave

Unlike previous sections, our activated PS officer model indicates that gender is a significant factor in the likelihood of leaving the SelRes after activation. Our estimates show that men are 45.5 percent more likely than women to leave. Although this estimate is large, the

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14. Full estimation results are presented in table 12 in appendix F.

Figure 18. The relative likelihood of leaving the SelRes[a] among activated PS officers[b,c]
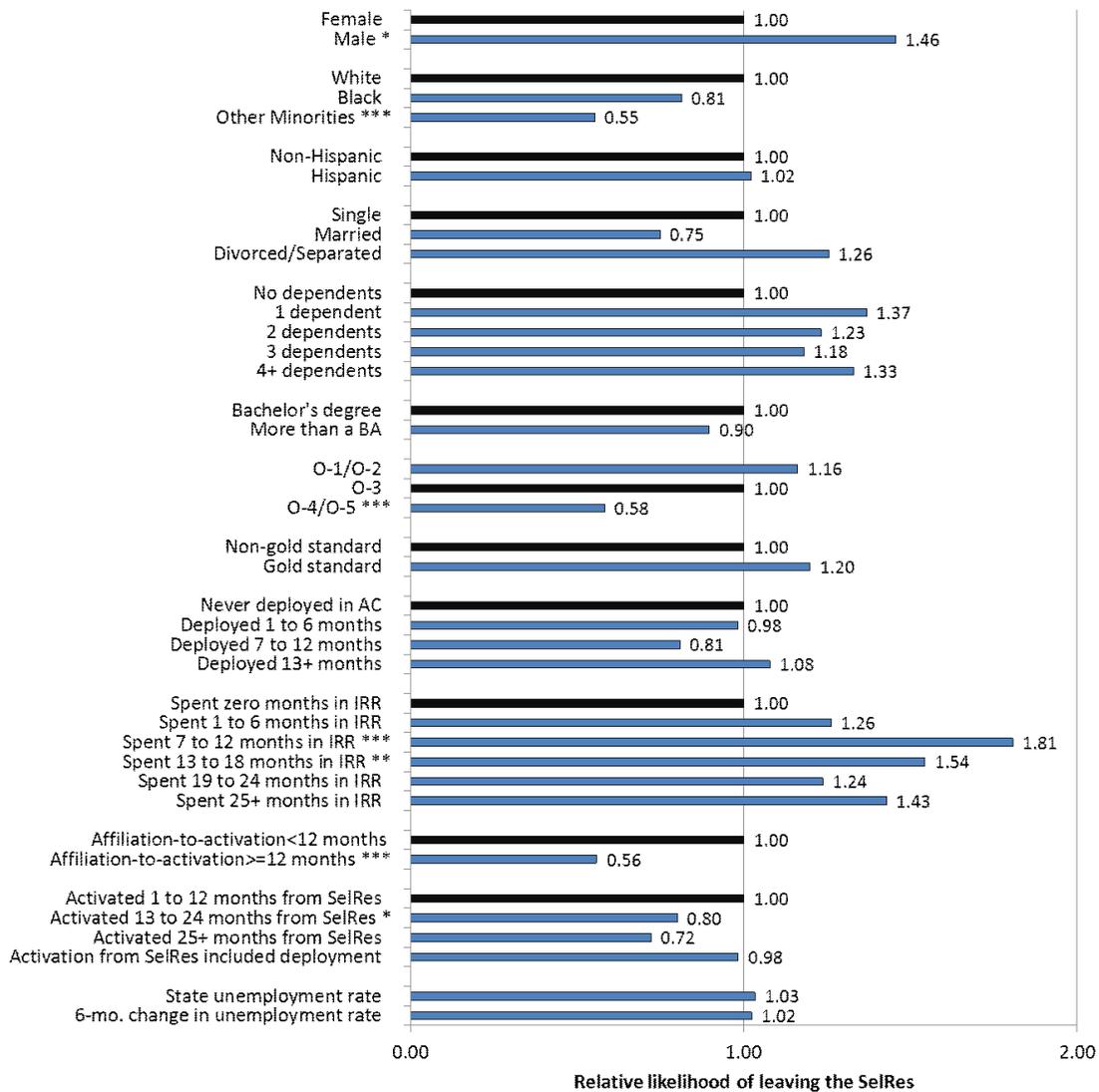
a. Significance levels are denoted as follows: * p-value < 0.1, ** p-value < 0.5, and *** p-value < 0.01.
b. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
c. For all categorical variables, the hazard ratio for the comparison group has been set to 1 and is represented with a black bar. The unemployment rate variables are continuous variables, so the hazard ratio represents the change in the likelihood of affiliation for a 1-percentage-point change in the unemployment rate.

level size of the effect (number of officers) is small because there are relatively few women in our population. In terms of PS recruiting and diversity in the SelRes, however, this finding suggests that risk of activation does not hamper female continuation.

Our estimates regarding the effects of race on the likelihood of PS officers leaving the SelRes after activation show that officers who are of a minority race other than black are the least likely to leave the SelRes. Specifically, we find that these officers are about 45 percent less likely to leave than white officers. However, as is the case for the effect of being male, this race effect translates into relatively few minority officers.

Officers in Pacific states most likely to leave

Our model shows that activated officers who live in the Pacific area (i.e., the west coast) are the most likely to leave the SelRes. Specifically, these officers are about 35 percent more likely than officers in South Atlantic states to leave the SelRes. To understand why activated officers from this region of the country—a region that has a high concentration of SMCR units (see [9])—are more prone to leave the SelRes than other officers, one must look at which units these officers are affiliated with and how competition from the civilian sector, unit-level activation rates, and unit leadership contribute to the higher rate of SelRes attrition.

Majors and lieutenant colonels least likely to leave

Similar to what we found among never-activated PS officers, higher ranking activated PS officers are the least likely to leave the SelRes after activation. Compared with activated captains, activated majors and lieutenant colonels are 42 percent less likely to leave the SelRes at any given point in time. Majors and lieutenant colonels are guaranteed to be allowed to reach retirement eligibility (see [10]), so these officers have an incentive to continue serving in the SelRes until they reach retirement eligibility.

Activated PS admin officers most likely to leave

Our estimates of the likelihood of leaving the SelRes across occfields show that activated PS officers in the personnel and administration (01XX), logistics (04XX), tank (18XX), and public affairs (43XX)

occfields are more at risk of leaving the SelRes than activated PS infantry officers. Compared with infantry officers, activated administrative officers are more than twice as likely to leave the SelRes. Public affairs and logistics PS officers are, respectively, 90.0 and 52.3 percent more likely to leave the SelRes.

Effects of time in the IRR and SelRes before activation and activation length

As we have found in all our previous estimates, activated PS officers who spend more months in the IRR before affiliating with the SelRes tend to spend less time in the SelRes. Specifically, our estimates show that, compared to activated officers who spend less than 1 month in the IRR, those who spend 7 to 12 months in the IRR before affiliation are 81 percent more likely to leave the SelRes after activation, while those who are in the IRR for 13 to 18 months are 81 percent more likely. This finding that long periods in the IRR between a Marine's transition date and his or her first SelRes affiliation increase the likelihood that he or she leaves the SelRes in any given month is true for all Marines. This implies that PS recruiters should target their efforts toward Marines who are just coming off active duty.

Another similarity between activated PS enlisted Marines and PS officers is that the likelihood of leaving after activation is inversely related to the months of SelRes experience Marines have before activation. In other words, the longer Marines are with the SelRes before activation, the less likely they are to leave after activation. Specifically, we find that PS officers who spend at least 12 months in the SelRes before activation are 44 percent less likely to leave after activation than officers who are activated within 1 year of affiliation. These findings regarding IRR and SelRes tenure before activation suggest that an important factor in a Marine's decision to stay affiliated with the SelRes may be staying connected and working with other Marines.

Lastly, we find that PS officers who were activated for more than 1 year are the least likely to leave the SelRes after activation. Relative to PS officers activated for up to 1 year, those activated for 13 to 24 months are 20 percent less likely to leave the SelRes. Our estimates

also show that activations that included a deployment do not significantly affect the likelihood of leaving the SelRes. These findings support early research that shows SelRes activations increase retention among PS officers [4].

Summary

In this section, we presented the effects of officer characteristics and deployment/activation history on the likelihood that PS officers leave the SelRes after activation. Our estimates show that women and minority officers other than blacks are the least likely to leave the SelRes, while officers in the Pacific area of the country are the most likely to leave the SelRes. In addition, our model shows that majors and lieutenant colonels (those guaranteed to be allowed to reach retirement eligibility) tend to stay affiliated with the SelRes longer than lower ranking officers.

Similar to other populations, the likelihood that an officer will decide to leave the SelRes after activation increases the longer he or she spends in the IRR before affiliation. In addition, our estimates indicate that officers who spend at least one year in the SelRes before activation are less likely to leave the SelRes than those who were activated within one year of affiliation. These findings suggest that an important factor in deciding to remain affiliated with the SelRes may be staying connected and working with other Marines.

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Conclusions and recommendations

Between October 2001 and April 2011, the rate of retention among PS officers in the SelRes was higher than that among PS enlisted Marines. Specifically, 65 percent of never-activated enlisted Marines and 89 percent of never-activated officers were in the SelRes for at least six months. Among *activated* Marines, the six-month continuation rates were 38 percent for enlisted Marines and 45 percent for officers.

One of the main findings from our models is that SelRes retention is highest among Marines who spend more time interacting and working with other Marines. For never-activated Marines, this means spending less time in the IRR before affiliation because our estimates indicate that those who spend fewer months in the IRR before their first SelRes affiliation are less likely to leave than those who spend more time in the IRR. For activated Marines, we find that those who were with the SelRes for at least 12 months before activation are 30 to 50 percent less likely to leave after activation than Marines who were activated within 1 year of affiliation. The Marine Corps should continue in its efforts to recruit Marines to the SelRes close to their transition dates and should optimize recruiting Marines into units that are not scheduled for activation within the following year.

In addition, we find that activation decreases the likelihood of Marines leaving the SelRes after activation. As a result of the recent end of the war in Iraq and the withdrawal of U.S. troops from Afghanistan, the role of reservists may change in the future, and the Marine Corps might experience a change in Marines' SelRes behaviors. Therefore, we suggest that the Marine Corps continue to monitor SelRes affiliation and continuation rates not only for PS Marines but also for NPS Marines.

Several other factors influence the decision to leave the SelRes for PS enlisted Marines. For example, we find that high-quality and gold-

standard Marines who are not activated tend to remain in the SelRes longer than their non-high-quality or non-GS counterparts. In terms of paygrade, we find the largest effects among lance corporals; never-activated lance corporals are the least likely to leave the SelRes, whereas *activated* lance corporals are the *most* likely to leave. Also, our estimates show that the likelihood of leaving the SelRes is inversely related to the state unemployment rate. That is, when the unemployment rate is high, enlisted Marines are less likely to leave the SelRes, but they are more likely to leave when the unemployment rate is low.

Among PS officers, some of the factors that affect the decision to leave the SelRes include the state unemployment rate, AC deployment experience, and paygrade. Unlike enlisted Marines, never-activated PS officers are more likely to leave the SelRes when the unemployment rate is high, suggesting that officers are more concerned with protecting their civilian jobs during poor economic times. Also, never-activated officers are less likely to leave the SelRes if they had combat deployed while on active duty, which means that the Marine Corps is able to retain experienced officers. Lastly, our estimates show that the decision to leave the SelRes is sensitive to officer paygrade—higher ranking officers are less likely to leave than lower ranking officers. In addition to establishing a career in the Marine Corps, higher ranking officers may also stay in the SelRes in order to earn the ability to transfer their Post-9/11 GI Bill education benefits to their dependents.

We summarize our findings in table 4. We list only the variables that significantly affect the likelihood leaving the SelRes. For each variable, we indicate the direction of the effect—positive or negative—on the likelihood of a PS enlisted Marine or PS officer leaving the SelRes.

In conclusion, we make the following four recommendations based on our analysis of SelRes continuation behavior among PS Marines:

1. To increase SelRes retention, the Marine Corps should continue its efforts to recruit PS Marines closer to their transition dates, educate them on the benefits of SelRes affiliation, and optimize recruiting them toward units that are not scheduled for activation within following year.

Table 4.   Summary of effects on the likelihood of leaving the SelRes[a]

Variable	Enlisted		Officer	
	Never-activated	Activated	Never-activated	Activated
Gender: male	NS	NS	NS	+
Race and ethnicity:				
Black	NS	NS	NS	NS
Other races	NS	NS	NS	–
Hispanic	–	NS	NS	NS
Education credential:				
Tier I, with a college degree	–	NS	na	na
Other Tier I credential	NS	NS	na	na
Tier II/Tier III	NS	NS	na	na
Graduate or professional degree	na	na	NS	NS
State unemployment rate in month of transition	–	NS	+	NS
Paygrade:				
E-1 or E-2	NS	NS	na	na
E-3	–	+	na	na
E-5 or E-6 or E-7	–	NS	na	na
O-1/O-2	na	na	+	NS
O-4/O-5	na	na	–	–
Quality measures:				
Recommended/eligible for reenlistment	NS	+	na	na
High-quality (Tier I & AFQT > 50)	–	NS	na	na
Gold standard	–	NS	NS	NS
Months deployed while in the AC:				
1 to 6	NS	NS	–	NS
7 to 12	NS	+	–	NS
13 or more	NS	NS	NS	NS
Months spent in the IRR before affiliation:				
1 to 6 months	+	NS	NS	NS
7 to 12 months	+	NS	+	+
13-18 months	+	NS	+	+
19-24 months	+	+	+	NS
25+ months	+	NS	+	NS
Activated from the SelRes:				
13-24 months	na	–	na	–
25+ months	na	NS	na	NS
Activation included deployment	na	NS	na	NS
12 or more months in the SelRes before activation	na	–	na	–

a. A plus (+) or minus (–) sign indicates the direction of the effect. A one-unit change in value of the variable increases (+) or decreases (–) the likelihood of affiliating with the SelRes. "NS" indicates that the estimate was not statistically significant, and "na" indicates that the variable was not included in the model.

2. Because the unemployment rate affects continuation behavior, the Marine Corps should consider instituting programs that help Marines balance their military and civilian careers, perhaps as an extension of the current transitioning program. This might provide some Marines the support they need in order to remain in the SelRes.

3. Since higher ranking Marines, particularly officers, are most likely to stay in the SelRes, the Marine Corps should investigate the second-order effects on promotion opportunities this can have not only on future PS Marines but also on NPS Marines.

4. The Marine Corps should continuously monitor trends in SelRes affiliation and continuation for both PS and NPS Marines because their decisions may be sensitive to changes in the overall environment, such as the end of the war in Afghanistan, the reduction in AC component endstrength, and an improving economy.

Appendix A: USMC reserve organization

Within the reserve component, the Marine Corps maintains the Ready Reserve, Standby Reserve, and Retired Reserve (see figure 19). The yellow portions of the figure represent reservists who count toward the endstrength of the Marine Corps Reserve.

Figure 19. Marine Corps Reserve[a]
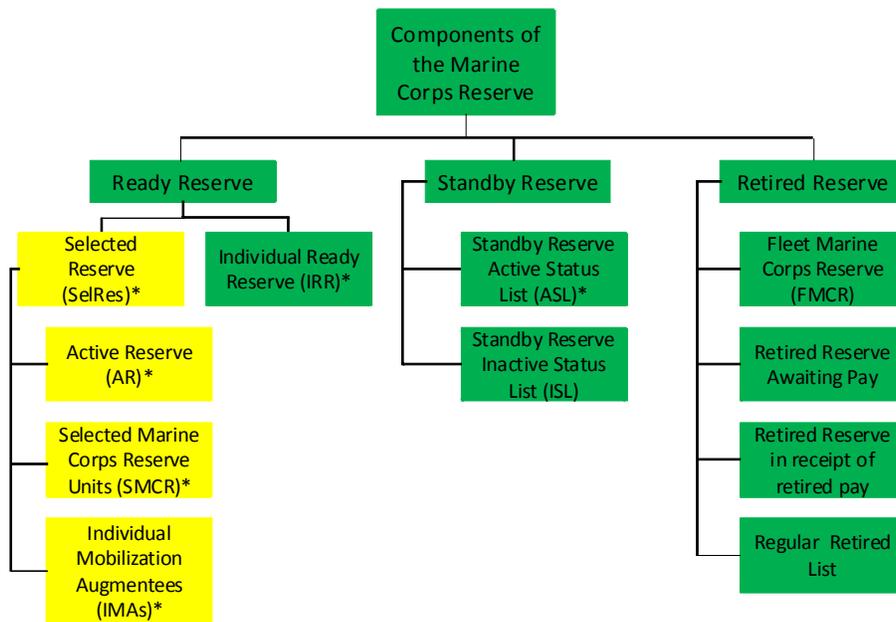
a. Source: [11], * denotes reserve categories that are considered Reserve Active Status.

The Ready Reserve is the Marine Corps' primary source of personnel to augment active forces for military contingency operations and wartime. It is made up of the Selected Reserve (SelRes) and the Individual Ready Reserve (IRR).

The SelRes includes the Active Reserve (AR), reservists in Selected Marine Corps Reserve (SMCR) units, and Individual Mobilization Augmentees (IMAs). For the most part, SelRes members are part-time, drilling, paid reservists, although ARs serve in a full-time capacity. SMCR Marines are traditional reservists who, at a minimum, drill one weekend a month and perform a two-week annual tour. IMAs augment active-duty units. They have drilling and annual training requirements similar to those of SMCR Marines but have the flexibility to arrange their annual training time. The IRR is composed of Marines who still have time left on their mandatory service obligations (MSOs) but are not associated with any other reserve category. They do not regularly train or receive pay; however, they muster once a year.

The Standby Reserve is made up of reservists who participate infrequently, do not receive pay, and would require significant training before deploying. The Standby Reserve-Active Status List includes reservists who would normally participate but temporarily cannot (because of family hardship, key civilian position, etc.). They are, however, eligible for promotion. The Standby Reserve-Inactive Status List includes Marines who are not eligible to participate or to receive pay or retirement credit, are not eligible for promotion consideration, and are not counted against reserve endstrength or controlled grades.

The Retired Reserve contains Marines in various stages of retirement, either awaiting or receiving retirement pay.

Appendix B: Descriptive statistics of the SelRes PS enlisted and officer populations and geographic region definitions

In this appendix, we provide mean characteristics for the SelRes PS enlisted and officer populations, as well as definitions of the geographic regions we use in our analysis.

Characteristics of the SelRes PS enlisted population

We provide mean statistics for the SelRes PS enlisted population in the first data column of table 5. To provide a sense of how the population changed over time, we show the means for the FY02 and FY10 affiliation cohorts in the second and third columns.

Table 5.   Mean characteristics of the SelRes PS enlisted population, Oct. 2001 to Apr. 2011

Characteristic	All	FY02[a]	FY10[a]
Gender: Male	92.1%	92.0%	92.5%
Race/ethnicity			
White	72.4%	60.0%	74.4%
Black	9.9%	14.6%	8.7%
Other race	4.3%	3.4%	5.2%
Hispanic	13.4%	24.9%	19.2%
Marital status			
Single	51.9%	55.4%	48.7%
Married	43.5%	41.1%	46.1%
Divorced/separated	4.6%	3.6%	5.2%
Dependents			
Presence of dependents	44.2%	42.8%	45.8%
Number of dependents, if present	1.7	1.8	1.6
Education[b]			
Tier I, traditional high school (HS) diploma	91.4%	90.0%	92.4%
Tier I, college degree	3.2%	3.9%	2.7%

Table 5.   Mean characteristics of the SelRes PS enlisted population, Oct. 2001 to Apr. 2011

Characteristic	All	FY02[a]	FY10[a]
Other Tier I	2.5%	3.1%	2.4%
Tier II	2.7%	2.7%	2.4%
Tier III	0.3%	0.4%	0.1%
State of residence (by Census area)[c]			
New England	4.3%	3.9%	4.7%
Middle Atlantic	12.7%	12.0%	12.3%
East-North Central	13.3%	9.3%	13.2%
West-North Central	4.7%	4.8%	4.7%
South Atlantic	20.3%	15.8%	21.4%
East-South Central	4.3%	4.4%	3.9%
West-South Central	15.1%	19.6%	15.1%
Mountain	6.4%	6.4%	6.6%
Pacific	19.0%	23.7%	18.1%
Paygrade			
E-1	0.1%	0.4%	0.0%
E-2	0.3%	0.9%	0.0%
E-3	7.2%	6.4%	7.5%
E-4	43.6%	40.6%	48.2%
E-5	43.2%	44.4%	39.1%
E-6	5.1%	7.0%	5.0%
E-7	0.4%	0.5%	0.2%
Marine quality			
Recommended and eligible for reenlistment	96.7%	97.1%	96.8%
High-quality (Tier I w/ AFQT>50)	64.7%	61.2%	64.6%
Gold standard[d]	8.4%	7.7%	9.0%
Months of AC combat deployment			
Zero months	41.5%	97.9%	23.1%
1 to 6 months	13.3%	1.5%	7.6%
7 to 12 months	24.8%	0.6%	33.5%
13 or more months	20.4%	0.0%	35.7%
Population size	12,880	816	2,083

a. Marines who affiliated with the SelRes in FY02 or FY10.
b. Education classifications follow: Tier I, HS diploma Marines, hold traditional HS diplomas; Tier I with college Marines have associate, nursing, bachelor, graduate, or professional degrees; Other Tier I includes Marines with one semester of college or an adult education diploma; Tier II Marines hold a correspondence diploma, GED, home study degree, or other nontraditional HS-equivalent degree; Tier III Marines have no HS credential.
c. We define geographic regions using the Census Bureau's classification scheme (see table 7).
d. The definition of gold-standard (GS) Marines comes from [7]. GS enlisted Marines have scored 110 or higher on the general technical portion of the ASVAB, 105 or higher on the mechanical maintenance portion, and 115 or higher on the electrical portion. GS Marines also have at least a traditional HS diploma; are recommended and eligible for reenlistment; have no felony, serious, or drug waivers; have a class 1 physical fitness test (PFT) score, and have no non-judicial punishments (NJPs) or courts-martial on their records.

Characteristics of the SelRes PS officer population

We provide mean statistics for the SelRes PS officer population in the first data column of table 6. To provide a sense of how the population changed over time, we show the means for the FY02 and FY10 affiliation cohorts in the second and third columns.

Table 6.   Mean characteristics of the SelRes PS officer population, Oct. 2001 to Apr. 2011

Characteristic	All	FY02[a]	FY10[a]
<u>Gender:</u> Male	90.4%	93.2%	87.25%
<u>Race/ethnicity</u>			
White	84.2%	81.1%	86.5%
Black	5.6%	9.5%	5.4%
Other race	4.4%	1.4%	3.7%
Hispanic	5.9%	5.4%	4.7%
<u>Marital status</u>			
Single	37.1%	36.5%	36.4%
Married	58.6%	58.1%	59.9%
Divorced/separated	4.4%	5.4%	4.0%
<u>Dependents</u>			
Presence of dependents	89.8%	90.5%	91.2%
Number of dependents, if present	2.1	1.9	2.0
<u>Education</u>			
Bachelor's degree	90.6%	90.5%	91.6%
Graduate/professional degree	9.4%	9.5%	8.4%
<u>State of residence (by Census area)</u>[b]			
New England	4.4%	4.1%	6.1%
Middle Atlantic	10.0%	2.7%	8.8%
East-North Central	8.0%	9.5%	8.1%
West-North Central	3.2%	1.4%	3.0%
South Atlantic	34.5%	25.7%	36.0%
East-South Central	3.4%	6.8%	3.4%
West-South Central	11.2%	9.5%	8.8%
Mountain	5.3%	4.1%	4.4%
Pacific	19.7%	36.5%	21.2%
<u>Paygrade</u>			
O-1	2.3%	1.4%	0.3%
O-2	9.8%	13.5%	9.1%

Table 6.　Mean characteristics of the SelRes PS officer population, Oct. 2001 to Apr. 2011 (continued)

Characteristic	All	FY02[a]	FY10[a]
O-3	65.2%	68.9%	70.0%
O-4	22.0%	16.2%	19.5%
O-5	0.7%	0.0%	1.0%
O-6	0.1%	0.0%	0.0%
Marine quality: Gold standard[c]	30.5%	57.1%	30.8%
Months of AC combat deployment			
Zero months	38.0%	100.0%	13.8%
1 to 6 months	15.2%	0.0%	12.8%
7 to 12 months	26.8%	0.0%	37.4%
13 or more months	19.9%	0.0%	36.0%
Population size	2,181	74	297

a. Marines who affiliated with the SelRes in FY02 or FY10.
b. We define geographic regions using the Census Bureau's classification scheme (see table 7).
c. The definition of gold standard (GS) Marines comes from [7]. GS enlisted Marines have scored 110 or higher on the general technical portion of the ASVAB, 105 or higher on the mechanical maintenance portion, and 115 or higher on the electrical portion. GS Marines also have at least a traditional high school diploma; are recommended and eligible for reenlistment; have no felony, serious, or drug waivers; have a class 1 physical fitness test (PFT) score, and have no non-judicial punishments (NJPs) or courts-martial on their records.

Geographic regions

In this report, we use the Census Bureau's definitions to refer to U.S. geographic regions. The Census Bureau broadly defines four regions of the United States: the Northeast, the Midwest, the South, and the West. The Census Bureau further stratifies each region into one of nine divisions. We provide the Census Bureau's region and division definitions in table 7.

Table 7.   Census regions and divisions

Region	Divisions		
Northeast	*New England* Connecticut Maine Massachusetts New Hampshire Rhode Island	*Middle Atlantic* New Jersey New York Pennsylvania	
Midwest	*East-North Central* Indiana Illinois Michigan Ohio Wisconsin	*West-North Central* Iowa Kansas Minnesota Missouri Nebraska North Dakota South Dakota	
South	*South Atlantic* Delaware District of Columbia Florida Georgia Maryland North Carolina South Carolina Virginia West Virginia	*East-South Central* Alabama Kentucky Mississippi Tennessee	*West-South Central* Arkansas Louisiana Oklahoma Texas
West	*Mountain* Arizona Colorado Idaho Montana Nevada New Mexico Utah Wyoming	*Pacific* Alaska California Hawaii Oregon Washington	

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Appendix C: Survival analysis

Using typical linear regression methods to explain duration (i.e., months of SelRes service) data presents a number of practical problems [1, 4, 12, 13]. The key issue with duration data is that the event (i.e., leaving the SelRes) and the characteristics that explain the likelihood of that event (i.e., some Marine characteristics) may be changing over time (i.e., while a Marine is in the SelRes).

Survival analysis is a statistical technique developed specifically to handle duration data. These models are used in a variety of professional fields [12]. Three examples follow:

- Industrial engineers use survival models to explain time-to-failure of equipment and machines.

- In medicine, survival models are employed to explain survival time after diagnosis or medical treatment.

- Economists have employed these models to explain the time people spend on unemployment.

In the context of our study, survival analysis techniques allow us to model the likelihood that a particular Marine will leave an SMCR unit or IMA billet, given that other Marines at the same point in their SelRes careers remain.

The proportional hazard model[15]

The basis of survival analysis is the *hazard function*. For our purpose, the hazard function models the likelihood of leaving the SelRes at time t for Marine j as a function of time and personal and environmental characteristics:

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15. The discussion summarizes the technical descriptions of survival analysis provided by [12] and [13].

$h_j(t) = g(t, b_0 + b_1 x_{1j} + \ldots + b_k x_{kj})$.

We use a semiparametric form of the hazard function, the Cox proportional hazard function, which allows the characteristics (X_j) to shift the baseline hazard rate, $h_0(t)$—a probability of leaving the SelRes that is common to all individuals and is a function of only time (months of SelRes service)—up or down in a multiplicative manner:

$h_j(t|x_j) = h_0(t) \exp(X_j B_x)$

The advantage of the Cox proportional hazard model is that it leaves the baseline hazard rate, $h_0(t)$, unspecified and unestimated. This implies that we do not have to know the exact functional form or constrain the shape of the baseline hazard function to be able to estimate the effect that observable characteristics (the x_j variables) have on the probability of leaving the SelRes. We determine how observable characteristics are associated with the likelihood of affiliation by choosing values for the coefficients (B_x) in the model that best fit the data. Specifically, we want coefficients that maximize the likelihood of observing the losses that actually occurred at each point in time in our data.

Hazard models are preferred to alternative statistical techniques when dealing with duration data because they are better able to address the various issues that arise when using duration data. Specific reasons follow:

- Hazard rate models explicitly represent the stochastic process underlying survival times. The assumptions behind ordinary least squares, probit, logit, and censored region models are not suitable for explaining time spent in the SelRes. To be more precise, estimates from hazard rate models compare the likelihood of an event occurring for two otherwise identical individuals or groups (i.e., males versus females) at the same point in time.

- Hazard models address data-censoring problems. Specifically, our data exhibit right-censoring since the sample period ends before we can observe some Marines leaving the SelRes. Hazard models account for these observations and, therefore, avoid biased estimates.

- Hazard models may be used to deal with time-varying characteristics. Time-to-affiliation is likely to depend on a set of personal characteristics and events that may change over time. In hazard models, a Marine's characteristics can be reevaluated at each point in time that a SelRes loss occurs.

Interpretation of results

Our hazard model estimates the likelihood of leaving the SelRes as a function of a set of demographic, service, and environment-related variables. Results of estimating the hazard model are expressed as *hazard ratios*—the ratio of two hazard rates. Hazard ratios compare the likelihood of leaving the SelRes for two Marines who are the same except for a one-unit change in the variable of interest.

The hazard ratio is easiest to interpret for categorical variables. For instance, we include a gender variable in our model that is equal to 1 if the Marine is male and 0 is the Marine is female. For this gender variable, the hazard ratio is the male-to-female ratio of the likelihood of leaving the SelRes, holding all other variables at their sample averages. Specifically, for categorical variables:

- A hazard ratio equal to (or close to) 1 indicates that there is no considerable difference in the likelihood of leaving the SelRes for Marines with the characteristic relative to those without it. For example, if being male has a hazard ratio of 1, this implies that male Marines are no more likely than female Marines to leave the SelRes.

- A hazard ratio less than 1 implies that Marines with the characteristic have a lower likelihood of leaving the SelRes relative to those without the characteristic. (That is, if being male has a hazard ratio of 0.7, this implies that male Marines are 30 percent less likely than female Marines to leave the SelRes.)

- A hazard ratio greater than 1 implies that Marines with the characteristic are more likely to leave relative to those without. (That is, if being male has a hazard ratio of 1.7, this implies that male Marines are 70 percent more likely than female Marines to leave the SelRes.)

The hazard ratios for continuous variables express differences in the relative magnitudes of the likelihood of leaving the SelRes for a one-unit change in the value of the continuous variable. For example, in the case of the state unemployment rate *(r),* the hazard ratio expresses the ratio of the likelihood of leaving the SelRes when the state unemployment rate is $r + 1$ percent to the likelihood of leaving when the unemployment rate is *r.*

When interpreting estimation results, it is also important to consider the *p-value* of the estimate. The p-value measures the smallest significance level at which we can reject that the estimated hazard ratio is equal to 1. It measures the degree to which we can say with certainty that the likelihoods of leaving the SelRes for Marines with and without a particular characteristic (holding all else constant) are different. Typically, researchers consider p-values of 0.10 or less to indicate statistical significance. Going back to our example of the relative likelihood of leaving the SelRes between male and female Marines, if the p-value associated with the hazard rate is equal to 0.05, we can claim with 95-percent accuracy that the likelihood of leaving among male Marines is different from that for female Marines.

Appendix D: The SelRes continuation model

We want to estimate the independent effects of Marine characteristics and environmental factors on the probability that a PS Marine leaves the SelRes. Because the enlisted and officer populations are inherently different (e.g., high school versus college graduates), they face different incentives in and out of the Marine Corps and, therefore, likely respond differently to changes in their environment. To this end, we estimate separate hazard models for PS enlisted Marines and PS officers.

Once in the RC, a Marine is free to flow in and out of the SelRes— with the exception of activated Marines who are under orders and, therefore, unable to leave the SelRes. As a result, an individual Marine may have multiple points of affiliation with SMCR units or IMA billets.[16] For our analysis of SelRes continuation behavior, we focus on Marines' first SelRes loss. We define a SelRes loss as the first time a Marine drops from the SelRes to the IRR and remains in the IRR for at least five additional months. That is, if a PS Marine enters the IRR in month M, we consider that Marine as a loss to the SelRes if he or she is still in the IRR in month M+5. This definition mitigates the problem of identifying if a PS Marine has dropped to the IRR as an intermediary step to transferring units.

As mentioned above, Marines who are under activation orders are under stop-loss and may not leave the SelRes. This implies that, if we combine activated Marines with never-activated Marines, our estimates will be biased toward finding a lower likelihood of loss. Therefore, to reduce bias, we estimate separate models for never-activated and activated Marines for both the enlisted and officer populations.

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16. A Marine might enter the IRR after transitioning, then affiliate with an SMCR unit, leave the unit, and go back into the IRR, only to decide later to go into an IMA billet. For this Marine, the month of SelRes affiliation coincides with the month that he or she affiliated with an SMCR unit.

We present full estimation results for PS enlisted Marines in appendix E and for officer in appendix F.

Because we want to make comparisons between Marines with the same amount of SelRes experience, the time dimension of our survival models is the number of months Marines' spent in the SelRes. For never-activated PS Marines, time spent in the SelRes is the number of months between affiliation and loss (or the end of the sample period in cases where we do not observe a loss). For activated Marines, we calculate time spent in the SelRes as the number of months between deactivation and loss or the end of the sample period, whichever comes first.

In addition to time spent in the SelRes, our models include the demographic and service-related characteristics as well as the state unemployment rate and fiscal trimester of affiliation/deactivation (see table 8). Our empirical model makes comparisons for Marines who have the same number of months in the SelRes and who affiliated (or came off activation orders) in the same trimester of the fiscal year.

Table 8.   Variable definitions for SelRes loss models

Variable[a]	Variable description
Dependent variable	
SelRes loss	1 if Marine leaves the SelRes and remains gone for at least six months; otherwise the variable takes on the value 0
Independent variables	
Male	1 if Marine is male; 0 if Marine is female
Race	Two 0/1 variables indicating if the Marine is black or another minority race (white is the omitted category)
Ethnicity	1 if Marine is Hispanic, 0 if Marine is non-Hispanic
Marital status	Two 0/1 variables indicating if the Marine is married or divorced/ separated (single is the omitted category)
Number of dependents	Four 0/1 variables indicating if the Marine has 1, 2, 3, or 4 or more dependents (no dependents is the omitted category)
Enlisted education level	Three 0/1 variables indicating if the enlisted Marine is Tier I with a college degree, other Tier I, or Tier II/Tier III (Tier I with a traditional high school diploma is the omitted category)
Officer education level	1 if officer has a graduate or professional degree; 0 if officer has a bachelor's degree

Table 8.   Variable definitions for SelRes loss models (continued)

Variable[a]	Variable description
Geographic region	Eight 0/1 variables that indicate the Marine's geographic area of residence based on his or her state of residence at affiliation or deactivation (South Atlantic is the omitted category)[b]
State unemployment rate	Continuous variable indicating the unemployment rate in the Marine's state of residence
Change in state unemployment rate	The change in the unemployment rate of the Marine's state of residence in the six months prior to affiliation/deactivation.
Paygrade	Set of 3 variables for enlisted Marines (E1/E2, E3, and E5/E6/E7; E4 is the omitted paygrade) and 2 variables for officers (O1/O2 and O4/O5; O3 is the omitted paygrade) equal to 1 if the Marine is in the specified grade
Recommended and eligible	1 if enlisted Marine was recommended and eligible for reenlistment at separation; else 0
High-quality	1 if enlisted Marine is considered high-quality; else 0
Gold standard	1 if Marine is considered gold standard; else 0
Months combat deployed while in the AC	Three 0/1 variables indicating if the Marine was deployed for 1–6, 7–12, or 13 or more months while in the AC (never combat deployed is the omitted category)
Months spent in the IRR prior to first SelRes affiliation	Five 0/1 variables indicating if the Marine spent 1–6, 7–12, 13–18, 19–24, or 25 or more months in the IRR prior to affiliating with the SelRes.
Months activated from SelRes	Two 0/1 variables indicating if the Marine was activated from the SelRes for 13–24, or 25 or more months (activated 1-12 months is the omitted category)
SelRes activation included deployment	1 if SelRes activation included a deployment; else 0
Military occfield	Set of 26 variables for enlisted Marines and a set of 16 variables for officers indicating the Marine's 2-digit occfield (03XX, infantry, is the omitted category)
Trimester/fiscal year of affiliation or deactivation[c]	Thirty variables indicating the combined trimester (ONDJ, FMAM, JJAS) a Marine affiliated or come off activation orders (First trimester of the sample period is the omitted category)

a. Defined at the time of affiliation for never-activated Marines or at the time of deactivation for activated Marines.
b. Geographic regions are defined in appendix B.
c. Trimesters are defined as follows: October, November, December, and January (ONDJ); February, March, April, and May (FMAM); and June, July, August, and September (JJAS).

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Appendix E: Analysis of SelRes continuation behavior among PS enlisted Marines

In this appendix we present the full set of estimates from estimating the survival model using the PS enlisted population. We first present the results for never-activated PS enlisted Marines and then we present the estimates for activated PS enlisted Marines.

We show the full results of estimating the SelRes loss model for *never-activated* PS enlisted Marines in table 9. The first data column shows the results of estimating the relative likelihood of leaving the SelRes for all never-activated PS enlisted Marines, no matter which category, SMCR or IMA, a Marine first entered. The second column shows estimates for the population of Marines who first entered the SelRes by joining an SMCR unit, while the third column presents estimates for Marines who first went into IMA billets. Almost 90 percent of PS enlisted Marines enter the SelRes by joining SMCR units, so the results in column one are similar to those in column two.

Table 9. The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines,[a] by SelRes category[b,c]

| Variable | First SelRes category | | |
	SelRes (SMCR or IMA)	SMCR	IMA
Gender			
Female	**1.000**	**1.000**	**1.000**
Male	0.989	0.983	0.880
Race			
White	**1.000**	**1.000**	**1.000**
Black	0.994	0.992	1.322**
Other races	1.002	0.979	1.116
Ethnicity			
Non-Hispanic	**1.000**	**1.000**	**1.000**
Hispanic	0.931**	0.931**	1.001

Table 9.   The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

| | First SelRes category | | |
	SelRes (SMCR or IMA)	SMCR	IMA
Marital status			
Single	**1.000**	**1.000**	**1.000**
Married	1.000	1.042	1.005
Divorced/separated	1.052	1.080	1.112
Number of dependents			
Zero	**1.000**	**1.000**	**1.000**
One	1.103**	1.066	1.117
Two	1.021	0.970	1.221
Three	1.062	1.034	1.365
Four or more	1.040	1.064	0.946
Education credential			
Tier I, with a high school diploma	**1.000**	**1.000**	**1.000**
Tier I, with a college degree	0.696***	0.732***	0.587**
Other Tier I credential	1.050	1.048	0.878
Tier II/Tier III	1.085	1.097	1.177
Geographic area			
South Atlantic	**1.000**	**1.000**	**1.000**
New England	1.117*	1.043	2.282**
Middle Atlantic	1.141***	1.074*	1.567**
East-North Central	1.079*	1.040	1.135
West-North Central	1.132**	1.064	1.565**
East-South Central	1.076	1.048	1.024
West-South Central	1.059*	1.024	1.150
Mountain	1.009	0.993	1.105
Pacific	1.017	1.025	1.012
State unemployment rate			
Unemployment rate in month of transition	0.978*	0.967***	1.064
6-mo change in unemployment rate	1.015	1.021	0.903
Paygrade			
E-1 or E-2	0.855	0.871	–
E-3	0.881***	0.845***	1.285
E-4	**1.000**	**1.000**	**1.000**
E-5 or E-6 or E-7	0.928***	0.963	0.836*
Quality Measures			
Recommended and eligible for reenlistment	0.982	0.948	1.049
Other reenlistment code	**1.000**	**1.000**	**1.000**

Table 9.   The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Variable	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Non-high-quality	**1.000**	**1.000**	**1.000**
High-quality (Tier I & AFQT>50)	0.932***	0.946**	0.749***
Non-gold standard	**1.000**	**1.000**	**1.000**
Gold standard	0.870***	0.840***	1.036
Gold standard status is missing	0.977	0.973	1.056
Months deployed while in the AC			
Zero	**1.000**	**1.000**	**1.000**
1 to 6	0.996	0.971	1.141
7 to 12	1.051	1.042	1.039
13 or more	1.053	1.033	1.040
Months spent in the IRR prior to SelRes affiliation			
Zero	**1.000**	**1.000**	**1.000**
1 to 6 months	1.202***	1.197***	1.215
7 to 12 months	1.291***	1.298***	1.088
13 to 18 months	1.342***	1.329***	1.386**
19 to 24 months	1.408***	1.368***	1.716***
25 or months	1.358***	1.295***	1.945***
Occfield			
01XX: Personnel, administration, retention	0.954	1.022	0.946
02XX: Intelligence	0.597***	0.678***	0.621*
03XX: Infantry	**1.000**	**1.000**	**1.000**
04XX: Logistics	0.954	0.968	1.003
05XX: MAGTF planning	0.982	0.948	2.079**
06XX: Command and control systems	0.874***	0.909**	0.687*
08XX: Field artillery	0.957	0.939	1.084
11/13XX: Utilities/Engineer, construction, facilities, and equipment	0.919*	0.906**	1.102
18XX: Tank and assault amphibious vehicles	0.826**	0.831*	0.681
21XX: Ordnance	0.850**	0.847**	0.971
23XX: Ammunition/explosive ordnance disposal	0.821**	0.803**	1.064
26XX: Signals intelligence	0.593***	1.071	0.643*
28XX: Ground electronics and maintenance	0.918	0.914	0.937
30XX: Supply administration and operations	0.836***	0.854***	0.740
31XX: Traffic management	0.881	0.996	0.417*
33XX: Food service	0.829**	0.813**	1.624
34XX: Financial management	0.742*	0.727	1.303

Table 9.   The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Variable	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
35XX: Motor transport	0.930*	0.926*	0.883
43XX: Public affairs	0.678**	0.906	1.031
44XX: Legal services	0.670**	0.743	0.371
46XX: Combat camera	1.013	1.290	0.585
57XX: Nuclear, biological, and chemical defense	0.765***	0.748***	1.529
58XX:Military police/corrections	0.885**	1.020	0.911
59XX: Electronics maintenance	0.778	0.769	0.989
Aviation occfields (60XX–73XX)[d]	0.788***	0.798***	0.890
Other occfields	0.760	0.719	0.998
Trimester of transition[e]			
ONDJ FY02	**1.000**	**1.000**	
FMAM FY02	1.066	1.115	**1.000**
JJAS FY02	1.047	1.078	4.468***
ONDJ FY03	0.930	0.978	0.794
FMAM FY03	0.688***	0.728***	0.709
JJAS FY03	0.747**	0.819*	0.431**
ONDJ FY04	0.839*	0.932	0.615
FMAM FY04	0.770**	0.851	0.586
JJAS FY04	0.765*	0.804	1.456
ONDJ FY05	0.764***	0.866	0.562*
FMAM FY05	0.728***	0.796**	0.488*
JJAS FY05	0.716***	0.801*	0.242***
ONDJ FY06	0.665***	0.735***	0.658
FMAM FY06	0.661***	0.727***	0.630
JJAS FY06	0.610***	0.676***	0.666
ONDJ FY07	0.667***	0.790**	0.813
FMAM FY07	0.576***	0.642***	0.707
JJAS FY07	0.592***	0.636***	0.782
ONDJ FY08	0.508***	0.553***	0.630
FMAM FY08	0.485***	0.538***	0.493**
JJAS FY08	0.500***	0.562***	0.466**
ONDJ FY09	0.439***	0.481***	0.495*
FMAM FY09	0.431***	0.477***	0.483*
JJAS FY09	0.428***	0.488***	0.412**

Table 9.   The relative likelihood of leaving the SelRes among never-activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Variable	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
ONDJ FY10	0.458***	0.539***	0.224***
FMAM FY10	0.452***	0.557***	0.247***
JJAS FY10	0.307***	0.348***	0.270***
ONDJ FY11	0.228***	0.260***	0.208***
FMAM FY11	0.051***	0.061***	–
Number of observations	9,955	8,989	951

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Statistical significance designated as follows: * p-value < 0.1; ** p-value < 0.05, and *** p-value < 0.01.
c. For categorical variables, the hazard ratio for the comparison group has been set to 1 and bolded.
d. We combined all aviation occfields (60XX through 73XX) in our statistical models. When entered separately, the estimated hazard ratios associated with the individual aviation occfields are similar in magnitude and significance to each other.
e. Trimesters of the fiscal year are October, November, December, and January (ONDJ); February, March, April, and May (FMAM); and June, July, August, and September (JJAS).

We show the full results of estimating the SelRes loss model for *activated* PS enlisted Marines in table 10. The first data column shows the results of estimating the relative likelihood of leaving the SelRes for all activated PS enlisted Marines, no matter which category, SMCR or IMA a Marine first entered. The second column shows estimates for the population of activated PS enlisted Marines who first entered the SelRes by joining an SMCR unit, while the third column of estimates are for those Marines who went into IMA billets. Almost 80 percent of activated PS enlisted Marines enter the SelRes by joining SMCR units, and the results in column one are similar to those in column two.

Table 10. The relative likelihood of leaving the SelRes among activated PS enlisted Marines,[a] by SelRes category[b,c]

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Gender			
Female	**1.000**	**1.000**	**1.000**
Male	1.002	0.914	0.938
Race			
White	**1.000**	**1.000**	**1.000**
Black	0.892	0.856*	1.071
Other races	0.936	0.894	1.195
Ethnicity			
Non-Hispanic	**1.000**	**1.000**	**1.000**
Hispanic	0.897	0.918	0.714*
Marital status			
Single	**1.000**	**1.000**	**1.000**
Married	0.968	0.998	0.825
Divorced/separated	1.061	1.000	1.439
Number of dependents			
Zero	**1.000**	**1.000**	**1.000**
One	1.147	1.110	1.109
Two	1.157	1.072	1.469
Three	1.037	0.985	1.445
Four or more	1.067	1.018	1.398
Education credential			
Tier I, with a high school diploma	**1.000**	**1.000**	**1.000**
Tier I, with a college degree	0.779	0.774	0.781
Other Tier I credential	1.068	1.054	1.396
Tier II/Tier III	1.010	1.044	0.957
Geographic area			
South Atlantic	**1.000**	**1.000**	**1.000**
New England	1.241**	1.379***	0.199***
Middle Atlantic	1.000	1.0137	0.766
East-North Central	0.994	1.054	0.467**
West-North Central	1.016	1.069	0.479*
East-South Central	0.903	0.922	1.512
West-South Central	0.955	0.964	1.230
Mountain	1.116	1.169	1.064
Pacific	1.045	1.129	0.726*

Table 10. The relative likelihood of leaving the SelRes among activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
State unemployment rate			
Unemployment rate in month of transition	1.005	1.008	0.962
6-mo change in unemployment rate	0.935	0.885	1.152
Paygrade			
E-1 or E-2	0.709	0.735	-
E-3	1.220**	1.174*	1.413
E-4	**1.000**	**1.000**	**1.000**
E-5 or E-6 or E-7	0.939	0.943	0.826
Quality Measures			
Recommended and eligible for reenlistment	1.218*	1.235*	1.066
Other reenlistment code	**1.000**	**1.000**	**1.000**
Non-high-quality	**1.000**	**1.000**	**1.000**
High-quality (Tier I & AFQT>50)	1.021	1.006	1.125
Non-gold standard	**1.000**	**1.000**	**1.000**
Gold standard	1.014	1.076	0.606
Gold standard status is missing	0.929	0.944	0.913
Months deployed while in the AC			
Zero	**1.000**	**1.000**	**1.000**
1 to 6	1.022	0.965	1.607**
7 to 12	1.133*	1.088	1.445*
13 or more	1.164	1.123	1.544**
Months spent in the IRR prior to SelRes affiliation			
Zero	**1.000**	**1.000**	**1.000**
1 to 6 months	0.938	0.943	0.813
7 to 12 months	1.109	1.116	1.038
13 to 18 months	1.035	1.071	1.085
19 to 24 months	1.210*	1.272**	1.024
25 or months	1.128	1.149	0.927
Months activated from the SelRes			
1 to 12 months	**1.000**	**1.000**	**1.000**
13 to 24 months	0.879**	0.876**	0.765*
25 or more months	0.947	0.875	1.274*
Activation included a deployment	1.011	1.022	0.752
Months between affiliation and activation			
Less than 12 months	**1.000**	**1.000**	**1.000**
12 or more months	0.709***	0.712***	0.780

Table 10. The relative likelihood of leaving the SelRes among activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Characteristic	SelRes (SMCR or IMA)	SMCR	IMA
First SelRes category			
Occfield			
01XX: Personnel, administration, retention	1.091	1.076	1.036
02XX: Intelligence	0.579***	0.493***	0.896
03XX: Infantry	**1.000**	**1.000**	**1.000**
04XX: Logistics	0.963	0.973	1.129
05XX: MAGTF planning	1.257	1.089	5.966***
06XX: Command and control systems	1.013	0.976	2.627***
08XX: Field artillery	0.809	0.855	0.385
11/13XX: Utilities/Engineer, construction, facilities, and equipment	0.779***	0.798***	0.535
18XX: Tank and assault amphibious vehicles	0.825	0.849	
21XX: Ordnance	0.571***	0.619***	0.230*
23XX: Ammunition/explosive ordnance disposal	1.209	1.086	2.699***
26XX: Signals intelligence	0.784	1.648	0.731
28XX: Ground electronics and maintenance	0.610	0.600	0.600
30XX: Supply administration and operations	1.059	1.136	0.927
31XX: Traffic management	1.356	1.463	3.725***
33XX: Food service	0.775	0.727*	3.074***
34XX: Financial management	1.326	1.577*	1.994**
35XX: Motor transport	1.054	1.086	1.025
43XX: Public affairs	0.714	0.556	0.651
44XX: Legal services	0.964	1.099	0.741
46XX: Combat camera	0.302***	0.527***	0.171***
57XX: Nuclear, biological, and chemical defense	0.661	0.648	0.887
58XX:Military police/corrections	0.910	1.153	0.618*
59XX: Electronics maintenance	0.304*	0.171	0.391
Aviation occfields (60XX–73XX)[d]	0.775***	0.796**	0.917
Other occfields	0.923	0.546	1.996*
Trimester of transition[e]			
JJAS FY02	**1.000**	**1.000**	**1.000**
ONDJ FY03	2.144***	1.868**	-
FMAM FY03	0.697	0.689	-
JJAS FY03	0.599**	0.586*	0.928
ONDJ FY04	0.667	0.635	1.113
FMAM FY04	0.657	0.617	0.732

Table 10. The relative likelihood of leaving the SelRes among activated PS enlisted Marines,[a] by SelRes category[b,c] (continued)

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
JJAS FY04	0.588	0.561	2.635**
ONDJ FY05	0.732	0.676	11.372***
FMAM FY05	0.756	0.698	2.082
JJAS FY05	0.799	0.767	3.180***
ONDJ FY06	0.694	0.672	2.258*
FMAM FY06	0.623*	0.614*	1.123
JJAS FY06	0.711	0.674	1.916
ONDJ FY07	0.669	0.633	1.314
FMAM FY07	0.605*	0.572*	1.194
JJAS FY07	0.603*	0.717	1.013
ONDJ FY08	0.577*	0.553*	0.884
FMAM FY08	0.541**	0.517**	1.283
JJAS FY08	0.567**	0.611	0.710
ONDJ FY09	0.553**	0.639	0.651
FMAM FY09	0.457**	0.624	0.281**
JJAS FY09	0.471**	0.477**	1.172
ONDJ FY10	0.366***	0.333***	1.325
FMAM FY10	0.497**	0.509**	0.995
JJAS FY10	0.293***	0.253***	1.095
ONDJ FY11	0.262***	0.169***	1.145
FMAM FY11	0.011***	0.010***	0.030***
Number of observations	2,726	2,170	545

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Statistical significance designated as follows: * p-value < 0.1; ** p-value < 0.05, and *** p-value < 0.01.
c. For categorical variables, the hazard ratio for the comparison group has been set to 1 and bolded.
d. We combined all aviation occfields (60XX through 73XX) in our statistical models. When entered separately, the estimated hazard ratios associated with the individual aviation occfields are similar in magnitude and significance to each other.
e. Trimesters of the fiscal year are October, November, December, and January (ONDJ); February, March, April, and May (FMAM); and June, July, August, and September (JJAS).

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Appendix F: Analysis of SelRes continuation behavior among PS officers

In this appendix we present the full set of estimates from estimating the survival model using the PS officer population. We first present the results for never-activated PS officer and then we present the estimates for activated PS officers.

We present the estimation results for *never-activated* PS officers in table 11. Similar to the previous table, the first data column shows the results of estimating the relative likelihood of leaving the SelRes for all officers, no matter which SelRes category a Marine first entered. PS officers are more evenly split between SMCR and IMA positions than enlisted Marines; 60 percent of officers joined SMCR units, while the other 40 percent filled IMA billets. Given this split between SMCR and IMA positions, we estimate the relative likelihood of leaving the SelRes for those officers who went into SMCR positions in the second column and for those who filled IMA billets in the third column.

Table 11. The relative likelihood of leaving the SelRes among never-activated PS officers,[a] by SelRes category[b,c]

| | First SelRes category | | |
Variable	SelRes (SMCR or IMA)	SMCR	IMA
<u>Gender</u>			
Female	**1.000**	**1.000**	**1.000**
Male	0.877	0.826	0.868
<u>Race</u>			
White	**1.000**	**1.000**	**1.000**
Black	1.142	0.893	1.328
Other races	0.962	0.607**	1.462
<u>Ethnicity</u>			
Non-Hispanic	**1.000**	**1.000**	**1.000**
Hispanic	1.089	1.116	1.560

Table 11. The relative likelihood of leaving the SelRes among never-activated PS officers,[a] by SelRes category[b,c] (continued)

Variable	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Marital status			
Single	**1.000**	**1.000**	**1.000**
Married	1.214	1.166	1.538
Divorced/separated	1.127	1.098	1.208
Number of dependents			
Zero	**1.000**	**1.000**	**1.000**
One	0.847	0.776	0.791
Two	0.770	0.718	0.568
Three	0.805	1.101	0.402**
Four or more	0.860	1.078	0.578
Education credential			
Bachelor's degree	**1.000**	**1.000**	**1.000**
Graduate or professional degree	0.972	0.881	0.845
Geographic area			
South Atlantic	**1.000**	**1.000**	**1.000**
New England	1.503**	1.325	1.694
Mid Atlantic	0.978	0.781	1.412
East-North Central	1.073	1.002	0.976
West-North Central	1.105	1.200	1.282
East-South Central	0.817	0.533	1.541
West-South Central	1.065	1.026	1.172
Mountain	0.790	0.783	0.683
Pacific	0.781	0.777	0.664
State unemployment rate			
Unemployment rate in month of transition	1.118**	1.095	1.159
6-mo change in unemployment rate	1.010	0.969	0.996
Paygrade			
O-1 or O-2	1.306*	1.302	1.997*
O-3	**1.000**	**1.000**	**1.000**
O-4 or O-5	0.629***	0.640**	0.668*
Quality Measures			
Non-gold standard	**1.000**	**1.000**	**1.000**
Gold standard	0.961	0.895	1.188
Gold standard status is missing	1.052	1.151	0.996

Table 11. The relative likelihood of leaving the SelRes among never-activated PS officers,[a] by SelRes category[b,c] (continued)

Variable	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Months deployed while in the AC			
Zero	**1.000**	**1.000**	**1.000**
1 to 6	0.752**	0.883	0.540**
7 to 12	0.724**	0.742	0.821
13 or more	0.871	0.890	0.882
Months spent in the IRR prior to SelRes affiliation			
Zero	**1.000**	**1.000**	**1.000**
1 to 6 months	0.997	1.040	0.951
7 to 12 months	1.443**	1.423*	1.587
13 to 18 months	1.658***	2.208***	1.360
19 to 24 months	1.806***	1.922**	2.274**
25 or months	1.431**	1.715**	1.045
Occfield			
01XX: Personnel, administration, and retention	1.240	1.189	1.626
02XX: Intelligence	0.852	1.546	0.686
03XX: Infantry	**1.000**	**1.000**	**1.000**
04XX: Logistics	1.305	1.504**	0.920
06XX: Command and control systems	1.165	1.167	1.145
08XX: Field artillery	1.469*	1.604*	1.546
13XX:Engineer, construction, facilities, and equipment	2.201***	4.221***	1.226
18XX: Tank and assault amphibious vehicles	0.608	0.660	0.468
30XX: Supply administration and operations	1.168	1.674**	0.783
34XX: Financial management	1.133	1.359	1.340
43XX: Public affairs	0.719	0.567	0.993
44XX: Legal services	0.694*	1.339	0.501*
58XX:Military police/corrections	1.484	1.236	2.019
Aviation occfields (60XX–75XX)[d]	0.799	0.814	0.874
Other occfields	2.148	1.956	5.460**
Trimester of transition[e]			
ONDJ FY02	**1.000**	**1.000**	
FMAM FY02	2.964**	3.699**	
JJAS FY02	0.277***	0.538	**1.000**
ONDJ FY03	0.481**	0.564	3.335**
FMAM FY03	0.524	0.683	5.990***
JJAS FY03	0.287***	0.335**	1.969

Table 11. The relative likelihood of leaving the SelRes among never-activated PS officers,[a] by SelRes category[b,c] (continued)

| | First SelRes category | | |
Variable	SelRes (SMCR or IMA)	SMCR	IMA
ONDJ FY04	0.548	0.841	2.387*
FMAM FY04	0.392*	0.784	1.416
JJAS FY04	0.357*	0.442	-
ONDJ FY05	0.385**	0.358**	4.160***
FMAM FY05	0.272***	0.307**	2.215*
JJAS FY05	0.149***	0.167**	1.026
ONDJ FY06	0.301***	0.389*	1.706
FMAM FY06	0.239***	0.313**	1.131
JJAS FY06	0.259***	0.284**	1.412
ONDJ FY07	0.321***	0.310**	2.236
FMAM FY07	0.276***	0.319**	1.659
JJAS FY07	0.251***	0.268***	1.315
ONDJ FY08	0.132***	0.133***	0.847
FMAM FY08	0.130***	0.175***	1.000
JJAS FY08	0.187***	0.273***	0.941
ONDJ FY09	0.167***	0.224***	1.077
FMAM FY09	0.082***	0.091***	0.567
JJAS FY09	0.053***	0.059***	0.439
ONDJ FY10	0.101***	0.155***	0.538
FMAM FY10	0.059***	0.094***	0.294*
JJAS FY10	0.101***	0.120***	0.404
ONDJ FY11	-	0.060***	0.193
FMAM FY11	-	-	-
Number of observations	1,190	711	476

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Statistical significance designated as follows: * p-value < 0.1; ** p-value < 0.05, and *** p-value < 0.01.
c. For categorical variables, the hazard ratio for the comparison group has been set to 1 and bolded.
d. We combined all aviation occfields (60XX through 73XX) in our statistical models. When entered separately, the estimated hazard ratios associated with the individual aviation occfields are similar in magnitude and significance to each other.
e. Trimesters of the fiscal year are October, November, December, and January (ONDJ); February, March, April, and May (FMAM); and June, July, August, and September (JJAS).

We present the estimation results for *activated* PS officers in table 12. Similar to the previous table, the first data column shows the results of estimating the relative likelihood of leaving the SelRes for all officers, no matter which SelRes category he or she first entered. PS officers are more evenly split between SMCR and IMA positions than enlisted Marines; almost 66percent of officers joined SMCR units, while the other 34 percent went into IMA billets. Given this split between SMCR and IMA positions, we estimate the relative likelihood of leaving the SelRes for those officers who went into SMCR positions in the second column and for those who filled IMA billets in the third column.

Table 12. The relative likelihood of leaving the SelRes among activated PS officers,[a] by SelRes category[b,c]

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Gender			
Female	**1.000**	**1.000**	**1.000**
Male	1.455*	1.088	1.745
Race			
White	**1.000**	**1.000**	**1.000**
Black	0.814	0.729	1.685
Other races	0.553*	0.799	0.221
Ethnicity			
Non-Hispanic	**1.000**	**1.000**	**1.000**
Hispanic	1.021	0.991	0.908
Marital status			
Single	**1.000**	**1.000**	**1.000**
Married	0.748	0.637	1.265
Divorced/separated	1.255	1.563	3.654*
Number of dependents			
Zero	**1.000**	**1.000**	**1.000**
One	1.369	1.446	1.839
Two	1.232	1.446	0.451
Three	1.180	1.449	1.345
Four or more	1.329	0.917	2.504
Education credential			
Bachelor's degree	**1.000**	**1.000**	**1.000**
Graduate or professional degree	0.896	0.979	0.258**

Table 12. The relative likelihood of leaving the SelRes among activated PS officers,[a] by SelRes category[b,c] (continued)

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
Geographic area			
South Atlantic	**1.000**	**1.000**	**1.000**
New England	0.891	0.649	1.251
Mid Atlantic	1.225	1.485*	0.510
East-North Central	1.147	1.252	0.936
West-North Central	1.253	0.958	1.068
East-South Central	0.782	0.905	1.067
West-South Central	0.951	0.677	1.514
Mountain	1.136	1.098	1.717
Pacific	1.348*	1.530**	0.897
State unemployment rate			
Unemployment rate in month of transition	1.034	0.925	1.128
6-mo change in unemployment rate	1.024	1.000	0.935
Paygrade			
O-1 or O-2	1.162	1.135	1.628
O-3	**1.000**	**1.000**	**1.000**
O-4 or O-5	0.583*	0.549**	0.935
Quality Measures			
Non-gold standard	**1.000**	**1.000**	**1.000**
Gold standard	1.199	1.172	3.018***
Gold standard status is missing	1.177	1.170	2.451***
Months deployed while in the AC			
Zero	**1.000**	**1.000**	**1.000**
1 to 6	0.982	1.356	0.290**
7 to 12	0.809	0.727	0.595
13 or more	1.079	1.308	0.470
Months spent in the IRR prior to SelRes affiliation			
Zero	**1.000**	**1.000**	**1.000**
1 to 6 months	1.262	1.203	2.597
7 to 12 months	1.807***	1.582**	4.382**
13 to 18 months	1.544**	1.447	2.456
19 to 24 months	1.237	1.630	0.654
25 or months	1.429	1.365	1.686
Months activated from the SelRes			
1 to 12 months	**1.000**	**1.000**	**1.000**
13 to 24 months	0.800*	0.745**	0.716

Table 12. The relative likelihood of leaving the SelRes among activated PS officers,[a] by SelRes category[b,c] (continued)

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
25 or more months	0.721	0.501**	1.140
Activation included a deployment	0.983	1.176	1.614
Months between affiliation and activation			
Less than 12 months	**1.000**	**1.000**	**1.000**
12 or more months	0.559***	0.509***	0.920
Occfield			
01XX: Personnel, administration, and retention	1.970***	1.472	1.106
02XX: Intelligence	1.044	1.325	0.709
03XX: Infantry	**1.000**	**1.000**	**1.000**
04XX: Logistics	1.415**	1.220	1.369
06XX: Command and control systems	1.268	1.030	1.419
08XX: Field artillery	0.926	1.088	0.439
13XX:Engineer, construction, facilities, and equipment	0.685	0.648	0.982
18XX: Tank and assault amphibious vehicles	1.559*	1.664*	3.016
30XX: Supply administration and operations	1.146	1.260	0.935
34XX: Financial management	1.558	1.813	0.343
43XX: Public affairs	1.691*	2.044	0.496
44XX: Legal services	0.679	0.600	0.563
58XX:Military police/corrections	0.570	0.991	-
Aviation occfields (60XX–75XX)[d]	0.787	0.824	1.192
Other occfields	0.234***	0.138**	-
Trimester of transition[e]			
ONDJ FY02	**1.000**	**1.000**	**1.000**
FMAM FY02			
JJAS FY02			
ONDJ FY03			
FMAM FY03			
JJAS FY03	0.610	0.751	
ONDJ FY04	0.560	0.737	0.445
FMAM FY04	0.472	0.421	4.876*
JJAS FY04	1.336	1.229	18.662**
ONDJ FY05	0.732	0.587	5.028*
FMAM FY05	0.624	0.615	1.888
JJAS FY05	1.349	1.265	22.226***
ONDJ FY06	0.524*	0.503	-

Table 12. The relative likelihood of leaving the SelRes among activated PS officers,[a] by SelRes category[b,c] (continued)

Characteristic	First SelRes category		
	SelRes (SMCR or IMA)	SMCR	IMA
FMAM FY06	0.714	0.653	8.064**
JJAS FY06	0.901	0.701	6.171**
ONDJ FY07	0.974	0.691	14.513***
FMAM FY07	0.667	0.478	11.043***
JJAS FY07	0.720	0.563	27.397***
ONDJ FY08	0.498	0.468	11.156**
FMAM FY08	0.620	0.646	6.130
JJAS FY08	1.160	0.833	16.736***
ONDJ FY09	0.577	0.445	22.350**
FMAM FY09	0.447	0.812	4.472
JJAS FY09	0.486	0.744	4.298
ONDJ FY10	0.464*	0.681	5.220*
FMAM FY10	0.389*	0.192*	7.498**
JJAS FY10	0.341**	0.496	6.277*
ONDJ FY11	0.264**	0.443	1.246
FMAM FY11	0.034***	0.068***	0.196
Number of observations	791	522	255

a. Source: MCTFS end-of-month snapshots, Oct. 2001 to Apr. 2011, merged with data from MCRISS, the GWOT deployment file, RC CTS, and unemployment data from the BLS.
b. Statistical significance designated as follows: * p-value < 0.1; ** p-value < 0.05, and *** p-value < 0.01.
c. For categorical variables, the hazard ratio for the comparison group has been set to 1 and bolded.
d. We combined all aviation occfields (60XX through 73XX) in our statistical models. When entered separately, the estimated hazard ratios associated with the individual aviation occfields are similar in magnitude and significance to each other.
e. Trimesters of the fiscal year are October, November, December, and January (ONDJ); February, March, April, and May (FMAM); and June, July, August, and September (JJAS).

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