

# Estimating the Effects of the Post-9/11 GI Bill for the Marine Corps

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Brian Friend (left), an Iraq war veteran who is a business major at Portland State University, talks about student services for vets with Robert Hindahl, a PSU veterans certification officer. Friend plans to use the new Post-9/11 GI Bill to pay for a master's degree in business.

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# Contents

Executive summary .....	1
Introduction and background .....	3
Post-9/11 GI Bill eligibility .....	3
Benefit .....	4
Comparison with the Montgomery GI Bill .....	4
Evidence from Post-9/11 GI Bill use.....	6
First-term reenlistment .....	9
Modeling reenlistment .....	9
Education benefits as part of discounted civilian earnings .....	10
Estimates based on Montgomery GI Bill experience .....	10
Benchmark model estimation results .....	11
Tuition vs. stipend.....	12
Subpopulations with disproportionate reenlistment effects.....	14
Transferability .....	16
Reenlistment evidence from the Enlisted Retention Survey.....	17
Transferability evidence from the ERS.....	19
Reserve affiliation evidence from the ERS .....	20
Summary.....	20
Officer retention .....	23
Recruitment.....	27
Background .....	27
Approach .....	30
High-quality recruits .....	31
Hispanic high-quality recruits .....	32
Black high-quality recruits .....	33
Tuition Assistance use.....	35
Background on TA.....	35

Empirical results.....	37
Evidence from the ERS.....	38
Conclusion .....	39
Appendix A: Enlisted retention regression results .....	41
Appendix B: Officer retention regression results .....	43
Appendix C: Recruitment regression results.....	47
Appendix D: Tuition assistance regression results.....	49
References .....	53
List of figures.....	55
List of tables.....	57

## Executive summary

The Post-9/11 GI Bill significantly increases education benefits available to military members who have served since September 11, 2001. For the first time, servicemembers who meet eligibility criteria also can transfer their benefits to dependents. The Marine Corps asked CNA to investigate the potential behavioral impacts of the new education benefit, particularly on recruitment, retention, and the use of in-service Tuition Assistance education benefits.

In this report, we describe the results of our analysis. Highlights from this report follow:

- The Post-9/11 GI Bill represents an average increase of about \$25,000 (in FY09 dollars) over its predecessor, the Montgomery GI Bill (MGIB).
- A statistical analysis of reenlistment behavior during the MGIB era suggests that this increase will reduce the Corps' first-term reenlistment rate 1.5 percentage points. To put this in perspective, this is about the same reenlistment change that would result from a \$6,500 decrease in the Selective Reenlistment Bonus (SRB) or a 3.8-percentage-point decline in the unemployment rate. Without transferability, the drop would be about 50 percent larger, or 2.2 percentage points.
- Controlling for other reenlistment determinants, we estimate that the reenlistment probability decrease (before accounting for transferability) will be larger for those with dependents, those who are older at their first reenlistment point, those who hold security clearances, and those in primary military occupational specialties (PMOSs) with above-average training times. The drop in reenlistment probability will be smaller than average for blacks and Hispanics.
- We examine reenlistment behavior of Marines who were residents of states offering free tuition to veterans under the

MGIB. For lower quality Marines, defined as those with an Armed Forces Qualification Test (AFQT) score of below 50 and/or without a high-school diploma, we find some evidence that tuition subsidies decrease reenlistment probability more strongly than equivalent cash stipends. Adjusting for this differential response results in an additional 0.3-percentage-point decline in first-term reenlistment.

- In the FY11 End of Active Service (EAS) Enlisted Retention Survey (ERS) conducted in 2010, 33 percent indicated that the Post-9/11 GI Bill is an influence to stay, while 37 percent responded that it is an influence to leave.
- The FY11 EAS ERS suggests that the Post-9/11 GI Bill's transferability feature may almost double the rate of Selected Reserve affiliation among separating enlisted Marines E5 and above who have 6 or more years of service.
- There is little historical evidence from the MGIB era that suggests an adverse officer retention effect of higher GI Bill benefits. As a result, we expect officer retention to increase due to the transferability feature of the Post-9/11 GI Bill.
- We examine effects on high-quality recruits, defined as those who are high-school graduates and have a score of 50 or more on the AFQT. We estimate that the Post-9/11 GI Bill will increase the share of high-quality recruits by 10 percent. We find larger percentage increases in high-quality black and Hispanic recruits.
- We estimate that demand for Tuition Assistance (TA), the Marine Corps' in-service education benefit program, will increase by about 6 percent as a result of the Post-9/11 GI Bill. To put this effect in perspective, it is equivalent in magnitude to the *decrease* in demand for TA that we estimate would result if the individual tuition copayment rate for TA coursework were raised from 0 to 5 percent.

## **Introduction and background**

The Post-9/11 GI Bill became law in June 2008 and took effect on August 1, 2009. This bill expands the postservice education benefit available to members of the armed forces. Those who have served at least 3 years on active duty since September 11, 2001, are eligible to use this full benefit after separation from the military. In addition, personnel who have served on active duty a minimum of 6 years since September 11, 2001, and who agree to serve an additional 4 years, are eligible to transfer the full education benefit to a dependent spouse and/or children. The benefit provides free tuition up to the highest in-state public level and, in most cases, a living stipend of about \$1,100 per month for up to 36 months of schooling.

In this report, we detail the findings of our study for the Marine Corps examining the likely effects of the Post-9/11 GI Bill on Marines' recruitment, retention, and use of other education benefits.

In an earlier report, we provided a detailed description of the Post-9/11 GI Bill benefit, compared its value with that of the MGIB (the previous education benefit available to veterans), and reviewed the literature on the effects of the GI Bill on recruiting and retention [1]. In this section, we summarize our findings from that report as a brief background on the Post-9/11 GI Bill benefit.

### **Post-9/11 GI Bill eligibility**

The Post-9/11 GI Bill is available to anyone who has served on active duty for at least 90 days since September 11, 2001. Those who have served on active duty for 3 years are entitled to the full benefit amount, whereas those who have served less time are eligible for a prorated benefit. Eligibility applies to active-duty and Selected Reserve personnel.

Those who are eligible for the full benefit, who have served at least 6 years active duty, and who agree to serve 4 additional years (either on active duty or in the Selected Reserve) are eligible to transfer any

part of their benefit to any of their dependents (spouse and/or children).

## Benefit

The Post-9/11 GI Bill pays up to 36 months (4 academic years) of tuition and fees directly to institutions of higher learning (degree-granting colleges and universities) in which veterans have enrolled. The benefit pays full tuition at the veteran's university, up to a maximum amount determined each year by the Department of Veterans Affairs (VA) to be equal to the highest rate charged to residents at any public 4-year university in the state of the veteran's university.

Furthermore, the benefit pays up to 36 months of a living stipend, equal to the DoD's annually updated basic allowance for housing (BAH) for an E5 with dependents. This allowance accounts for geographic variation in the cost of living and is determined by the ZIP code of the student's school. In 2009, the average stipend was about \$1,100 per month. In addition, the Post-9/11 GI Bill pays a \$1,000 annual book stipend. Servicemembers can receive higher benefit amounts if they were awarded a Marine Corps College Fund at the time of enlistment.<sup>1</sup>

## Comparison with the Montgomery GI Bill

The MGIB went into law in 1985 and remains in effect alongside the Post-9/11 GI Bill. The key difference between the two is that the MGIB offers a fixed cash payment to all students (currently \$1,368 per month) and makes no tuition payments to universities. Another difference is that the MGIB requires a \$1,200 enrollment fee paid during the first year of service; no payment is required for access to the Post-9/11 GI Bill benefit. The MGIB offers a "buy-up" option

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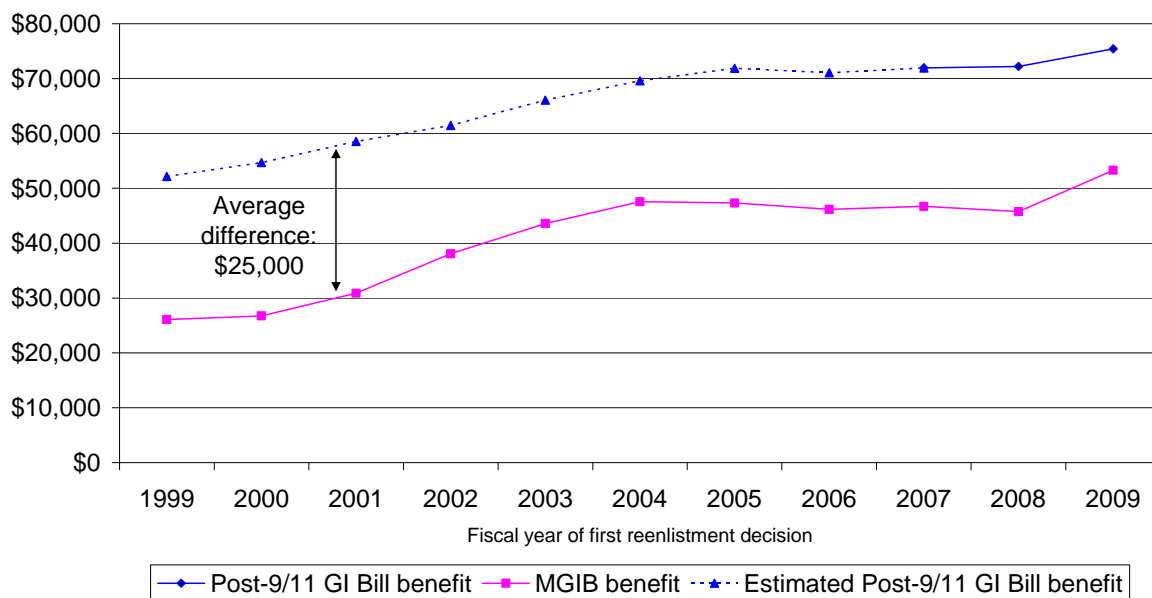
<sup>1</sup> The Marine Corps College Fund adds \$450 per month to the regular GI Bill benefit. To be eligible, a Marine applicant must be Tier 1 (mostly high school diploma graduates), have a minimum score of 50 on the AFQT and 100 on the General Technical composite score, and have no drug or moral waiver above the recruiting station (RS) level.



during the first year of service to pay additional enrollment fees for up to \$150 per month in extra benefits. Whereas the Post-9/11 GI Bill can be applied only toward programs at degree-granting institutions, the MGIB can be used for non-degree-granting programs, such as apprenticeships and vocational training. Finally, the MGIB is not transferable.

Figure 1 compares the value that recent cohorts of Marines *would have had* under the Post-9/11 GI Bill with what they *did have* under the Montgomery GI Bill, at the time of their reenlistment decisions. We use the cohort that is recommended and eligible for first-term reenlistment in each fiscal year, from 1999 to 2009. For each Marine, we can identify whether he or she opted for the basic MGIB and/or buy-up amount, and how much of a Marine Corps College Fund kicker was awarded at the time of enlistment. Our data sources are (1) the MGIB Chapter 30 program file provided by the Defense Manpower Data Center (DMDC) (current through February 2010) and (2) the Marine Corps' enlisted personnel records.

Figure 1. Comparing average MGIB and hypothetical Post-9/11 GI Bill benefits over time, USMC recommended and eligible first-term reenlistment candidates (FY09 dollars)



We calculate the potential full value of a Marine's MGIB benefit (over the maximum 36 months of use) as the value of the MGIB plus MGIB buy-up, if any, in the year of reenlistment, plus the amount of the college fund he or she was awarded at enlistment. For those living in states offering free or discounted tuition at public universities, we also include the average value of these tuition subsidies, weighted by enrollment shares across public universities in the state.<sup>2</sup>

For the Post-9/11 GI Bill, we assume that the Marine would have received the E5-with-dependents BAH in effect during that year, plus the \$1,000/year book stipend, plus an "average" tuition subsidy based on his or her home-of-record state. Average in-state tuition and fees, as well as the average value of the tuition subsidy, are calculated as enrollment-weighted averages over all schools in the Marine's home state tracked in the IPEDS database for that year.

We convert all then-year dollars to FY09 dollars using the consumer price index (CPI). As our measure of the increase in benefit value provided by the Post-9/11 GI Bill, we use the average difference between what Marines eligible for reenlistment would have had under the Post-9/11 GI Bill and what they did have under the MGIB between FY99 and FY07. This amount is \$24,933.

## Evidence from Post-9/11 GI Bill use

One indicator of the popularity of the Post-9/11 GI Bill is the extent to which MGIB registrations have fallen since June 2008. Many recently separated veterans are eligible for both the MGIB and the Post-9/11 GI Bill, and they can choose which program to use. Apparently, many have been opting for the Post-9/11 GI Bill.

In figure 2, we use MGIB claims data provided by the VA to DMDC to measure the number of Marines receiving their first monthly MGIB benefit payment over time. There has been a downward trend in MGIB users since shortly after the Post-9/11 GI Bill was

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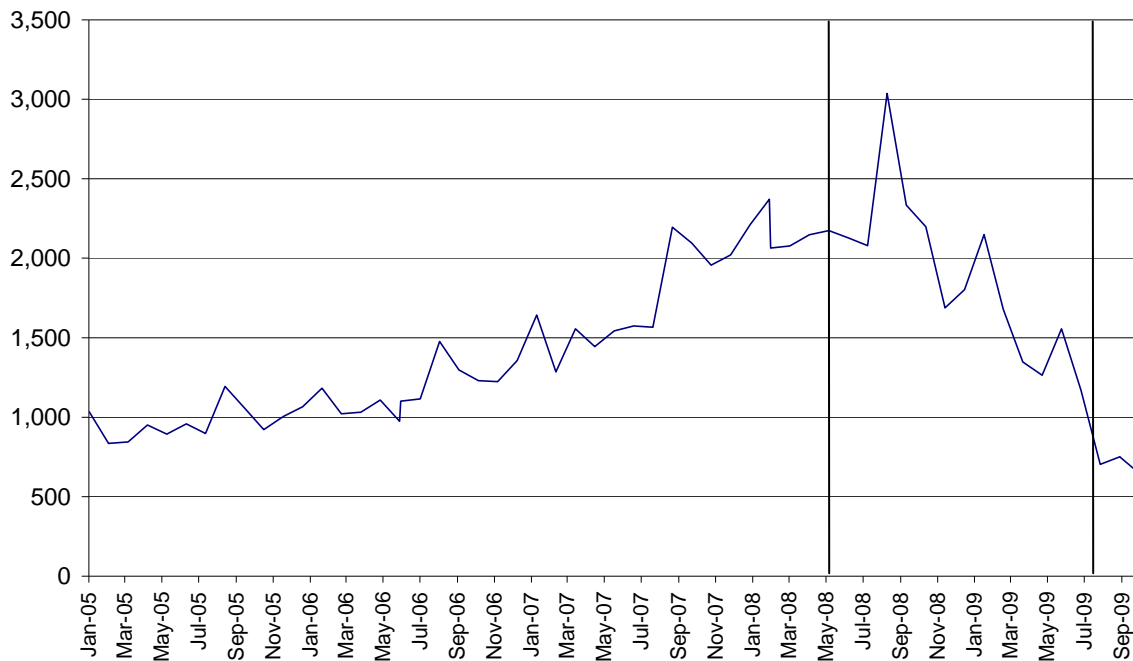
<sup>2</sup>

Enrollment and tuition cost data were obtained from the Integrated Postsecondary Education Data System (IPEDS) database provided by the National Center on Education Statistics (NCES).

signed into law, suggesting that new users of the education benefit opted to receive the latter benefit.<sup>3</sup> The first vertical line indicates June 2008, when the Post-9/11 GI Bill was signed into law. The second vertical line indicates August 2009, the date at which people could start using the Post-9/11 GI Bill. The immediate spike in MGIB users following the passage of the Post-9/11 GI Bill may reflect those who decided to begin using their MGIB benefits in anticipation of later switching to the more generous Post-9/11 GI Bill.

In the remaining sections of this report, we examine the effect of the large increase in GI Bill benefits on recruiting, retention, and the demand for alternative education benefits.

Figure 2. Number of USMC beneficiaries receiving their first MGIB payment by month, 2005–2009



<sup>3</sup> Part of the recent drop in MGIB users may be attributable to higher reenlistment rates (hence, fewer separations).

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# First-term reenlistment

In this section, we present our methodology and estimates of the effect of the Post-9/11 GI Bill on USMC first-term reenlistments.

## Modeling reenlistment

A theoretical model of the reenlistment decision is useful for identifying factors that matter to the decision and key tradeoffs involved. In the dynamic reenlistment model of [2], the reenlistment decision compares the discounted expected value of earnings differences between staying in the military and leaving for a civilian career, incorporating one's uncertainty about a future leave date. Related models, known as the total cost of leaving (TCOL) or annualized cost of leaving (ACOL), also reduce this decision to a comparison of civilian-military discounted earnings streams, though they assume no uncertainty over one's optimal future leave date. Despite the theoretical appeal of these models, a significant obstacle to direct estimation is the lack of accurate estimates of a service-member's future potential civilian earnings.

Previous analyses of USMC reenlistment decisions have adopted modified versions of these models. In [3] and [4], rather than use the entire future stream of estimated military and civilian earnings to construct an actual TCOL or ACOL variable, the authors use proxies that are arguably less prone to measurement error—even if less appealing on theoretical grounds. These proxies, presumed to capture much of the variation in future earning opportunities (military or civilian), include race, current paygrade, home state, current military/civilian relative wage, and a cohort variable.

We adopt a similar modeling approach to proxy for future civilian earnings. Because we are not directly interested in the effects of future expected pay on reenlistment, we assume that these are subsumed in the other variables. This follows the approach of several earlier studies, including [3], [4], and [5].

## Education benefits as part of discounted civilian earnings

In standard reenlistment models, a servicemember compares the discounted future stream of payments from continuing in military service with that of separating and becoming a civilian. A postservice education benefit would increase the stream of civilian payments for those who separate and pursue further education. To gauge how much the Post-9/11 GI Bill might increase this amount, we estimated discounted civilian earnings in constant dollars for someone age 22 deciding at the first reenlistment point whether to separate and obtain 4 additional years of education or continue in service.<sup>4</sup>

A large increase in the education benefit (table 1, row 7) may have a much smaller effect on the future stream of discounted earnings (row 8). We show the calculations for two different assumed discount rates. If we factor in that only about 50 percent of those separating pursue further education, the net effect of the Post-9/11 GI Bill on discounted civilian earnings will be about half that shown.

Table 1. Share of education benefits in discounted civilian income

	Discount rate: 10%	Discount rate: 25%
(1) Discounted civilian earnings for male with Bachelor's degree age 26-65	\$357,436	\$72,461
(2) Discounted total cost of 4-year college education	\$20,968	\$15,621
(3) Discounted value of MGIB	\$39,027	\$29,076
(4) Discounted value of Post-9/11 GI Bill	\$58,370	\$43,487
(5) (1) + (3) - (2): Net discounted income under MGIB	\$375,495	\$85,916
(6) (1) + (4) - (2): Net discounted income under Post-9/11 GI Bill	\$394,838	\$100,327
(7) [(4) - (3)]/(3): Percentage increase in value of GI Bill	50%	50%
(8) [(6) - (5)]/(5): Percentage increase in discounted civilian income	5%	17%

## Estimates based on Montgomery GI Bill experience

We use variation in the GI Bill benefit available to Marines under the MGIB to estimate how it affects reenlistment. Applying these parameter estimates to our estimated value of the benefit under the Post-9/11 GI Bill allows us to predict the bill's effect on reenlist-

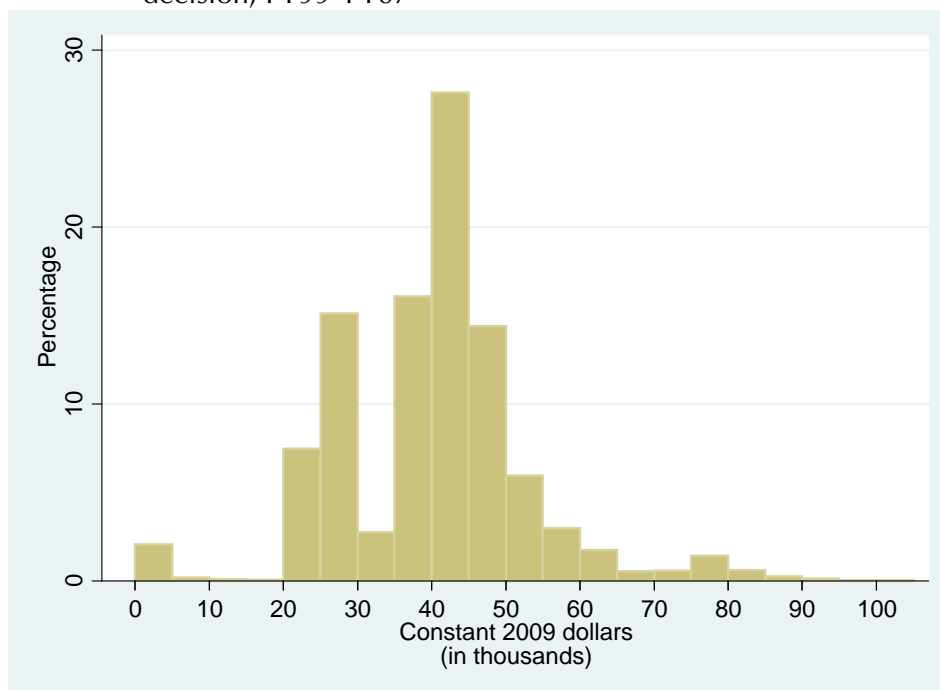
<sup>4</sup> Our earnings measure is taken from the December 2009 Current Population Survey and is simply an average for the entire U.S. working population of those age 26 to 65 who hold Bachelor's degrees.

ment before accounting for transferability. We address two other questions: (1) Is reenlistment behavior more or less responsive to GI Bill benefits among subgroups of interest than among the population as a whole? (2) Does the mix of tuition and stipend matter?

## Benchmark model estimation results

The first model combines the GI Bill cash benefit and the tuition subsidy into a single amount as the benefit's value to someone certain to use it. We are able to construct the actual dollar value of GI Bill benefits available to each Marine at the time of the reenlistment decision. This amount may be zero if the Marine declined the MGIB or significantly more if he or she received the MGIB buy-up and a college fund. Furthermore, those living in certain states may have been eligible for free public tuition as veterans. Figure 3 displays the variation in MGIB benefits observed in our sample. Note that the range of benefits observed in our data contains the median benefit under the Post-9/11 GI Bill, which is close to \$75,000.

Figure 3. Distribution of MGIB benefits available to Marines facing their first reenlistment decision, FY99–FY07



Column 1 of table 7 in appendix A presents selected estimation results from our model of actual reenlistment decisions observed for Marines recommended and eligible for reenlistment whose first reenlistment point was between FY99 and FY07. The full model includes fiscal year, state, and PMOS variables to proxy for economic conditions not picked up by the unemployment rate. We see that the MGIB has a statistically significant negative effect on reenlistment. An additional \$10,000 in GI Bill benefits is associated with a 0.9-percentage-point decrease in first-term reenlistment probability. Extending this effect to the increase in benefits that the Post-9/11 GI Bill implies, we estimate an overall 2.2-percentage-point decrease in first-term reenlistment before accounting for transferability.

We should note that this estimate, though small in magnitude, is still likely to be an overestimate because a Marine's own choices partly determine his or her total benefit under the MGIB. For instance, Marines could choose whether to enroll in the MGIB (though in later years of the program they had to actively opt out). They also could choose, for example, whether to purchase the buy-up or accept a college fund enlistment incentive instead of an enlistment bonus. We would expect that those who are more inclined to separate and use their GI Bill benefits would have opted for higher benefit levels. Any such selection effects, because of the positive correlation between separation probability and benefit level selected, would overestimate the reenlistment effect we might expect from the Post-9/11 GI Bill.

## **Tuition vs. stipend**

The second model we use separates the cash benefit from the tuition subsidy, allowing each to have a distinct effect on reenlistment. Because the tuition subsidy is paid directly to the school and is not refundable, beneficiaries may place less value on an additional dollar of tuition subsidy than on a dollar of cash benefit. At the same time, tuition costs represent a large upfront investment that may be difficult to finance for veterans who are unable or unwilling to borrow. As such, large tuition discounts may be valued more than an equivalent dollar amount of stipend that is paid over 36 months. Under the MGIB, this distinction between tuition subsidy and cash



stipend mattered only to veterans living in the handful of states offering free tuition to veterans at public universities.<sup>5</sup> Under the Post-9/11 GI Bill, however, the major increase in the benefit is in the form of a tuition subsidy (see figure 4). This subsidy is paid directly to the university.

Column 2 of table 7 in appendix A contains the estimation results when we allow cash stipend and tuition subsidy to have differing effects on reenlistment. We observe that Marines living in states with full public tuition subsidies are 2.6 percentage points less likely to reenlist. By comparison, a \$10,000 increase in the MGIB stipend is associated with a 0.6-percentage-point decrease in reenlistment. Free tuition, therefore, has the same negative reenlistment effect as \$43,333 in total stipend.

To put this value in context, we compare it with actual in-state public university tuition costs in free-tuition states during the MGIB era. For a lower bound estimate, we calculate average tuition weighted by actual enrollment at each public 4-year university in the state. Under a free tuition policy, however, Marines may anticipate enrolling at the most expensive public university. For an upper bound estimate, therefore, we use the maximum tuition at any public 4-year university in the state. These estimates provide a range for the value of these subsidies between \$21,600 and \$28,800—both below our estimate of Marines’ implied value for free tuition of \$43,333. These estimates suggest that tuition subsidies may have a greater effect on reenlistment than equivalent stipends (by a factor of 1.5 to 2).

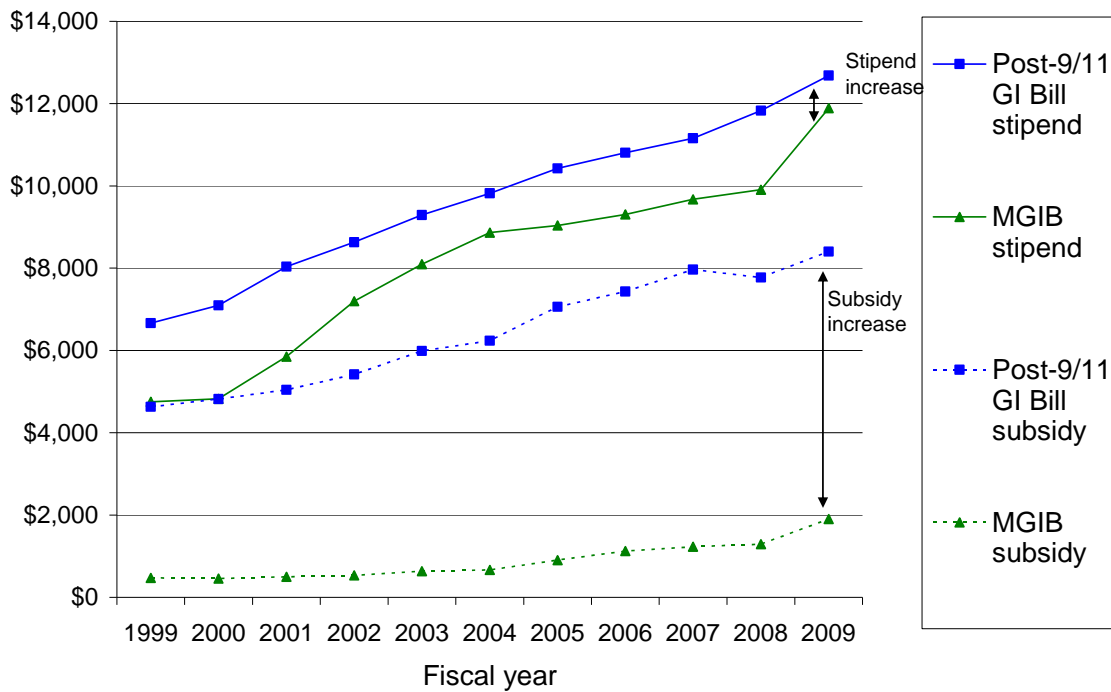
Note that, among high-quality Marines (those with an AFQT score of 50 or more and a high-school diploma), we estimate the implied value of the tuition subsidy (based on their reenlistment decisions) to be \$26,250. This is in line with the actual costs of public 4-year universities. For these Marines, a given increase in the stipend would apparently have the same reenlistment effect as an equivalent increase in the tuition subsidy.

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5. Unlike the Post-9/11 GI Bill, the MGIB itself has no tuition subsidy component. However, at various times between FY99 and FY07, a number of states offered partial or full tuition discounts to resident veterans. The states included Illinois, Texas, Wisconsin, Connecticut, Massachusetts, Wyoming, and New York.

We estimate that 75 percent of the \$25,000 overall increase in education benefits due to the Post-9/11 GI Bill is in the form of higher tuition subsidies. Accounting for this mix, and for the fact that about 20 percent of Marines come from states that already offered free tuition to public universities, we estimate that overall first-term reenlistment may decrease by up to 2.5 percentage points (before accounting for transferability), somewhat larger than our initial estimate of 2.2 percentage points.

Figure 4. Decomposition of benefit between tuition subsidy and cash stipend: Post-9/11 GI Bill and MGIB, FY99–FY09



### Subpopulations with disproportionate reenlistment effects

We also test whether certain subgroups have higher or lower reenlistment responses to education benefits. Table 2 summarizes these results.

Table 2. Differential effects of GI Bill benefits on various subgroups

Subgroup	Baseline reenlistment rate under MGIB FY99–FY07	Estimated change in reenlistment rate due to \$25,000 GI Bill increase (percentage points)
All	25%	-2
With dependent	39%	-8
Age (effect of additional year)	25%	-4
Security clearance	51%	-15
PMOS training time (effect of 50 additional training days)	55%	-3
Black	34%	+7
Hispanic	25%	+2

In table 2, we report the baseline reenlistment rate for each group as well. In many cases, the group has an above-average first-term reenlistment rate, even though members of the group may have a larger reenlistment response to a given increase in education benefits. The estimated reenlistment change we report for each group represents a statistically significant (at the 95-percent confidence level) difference from the population average of -2 percentage points.

We find that the reenlistment probabilities of blacks and Hispanics do not fall in response to increases in education benefits. This suggests that the Post-9/11 GI Bill may further raise their representation within the career force.

Those with security clearances or who are in primary occupational specialties (PMOSs) requiring longer training times tend to have greater-than-average declines in reenlistment in response to GI Bill increases. This may reflect a relatively greater taste for education among these groups.

Those with dependents also have a greater-than-average decline in reenlistment probability with increases in education benefits. This may be attributable to the flexibility of having a spouse who can work while the veteran pursues education. Also, those with dependents are likely making a joint household-level decision about reenlistment and further education. The return to education may be a more important factor for households with dependents because it is enjoyed by more than one person in the household.

## Transferability

In this subsection, we estimate the reenlistment effect of transferability. Transferability provides an incentive to stay in the Marine Corps. To transfer the GI Bill benefit, Marines must first be eligible to use the benefit themselves—that is, have at least 3 years’ active-duty service since September 11, 2001. In addition, they must be on active duty on or after August 1, 2009, have at least 6 years of service on active duty or in the Selected Reserve, agree to 4 additional years on active duty or in the Selected Reserve, and have dependent(s) (spouse or children) who can be named as recipients of the GI Bill benefits. Table 3 estimates the number of active-duty Marine Corps personnel by paygrade who meet the eligibility criteria, and also reports approved Post-9/11 transferability applications during the first 6 months of the program (through January 2010) as a percentage of this number.

Table 3. USMC Post-9/11 GI Bill transfer applications, August 2009 through January 2010

Grade	Number eligible to transfer <sup>a</sup>	Approved transfer applications as a percentage of the number eligible	Average annual retention rate before Post-9/11 GI Bill (among those with 6+ years of service)
E5	10,926	1%	85%
E6	13,405	1%	93%
E7	8,001	3%	90%
E8	3,568	11%	83%
E9	1,530	20%	81%
O3	3,350	4%	92%
O4	3,387	11%	93%
O5	1,803	24%	88%
O6	663	29%	85%
O7–O9	116	28%	89%

Source: Marine Corps Lifelong Learning, USMC Personal and Family Readiness Division.

a. We estimated the number eligible as those with 6 or more years of service who have at least 1 dependent.

We see that, in the first 6 months of the transferability program, officers have been more likely than enlisted to transfer. Also, it is unclear how much retention the Marine Corps is gaining from the transferability program directly (in other words, 4-year service commitments). As seen in table 3, the average continuation rates among these groups were high before the Post-9/11 GI Bill took effect.

The main retention effect of transferability will likely come from influencing junior members to commit to additional service instead of

separating for civilian life. Although a first-term reenlistment candidate may not be immediately eligible for the transferability benefit, he or she may assign some value to becoming eligible after just one more reenlistment. For someone who is facing a near-term (i.e., within 5 years) and relatively certain prospect of paying college tuition for a child, the transferability feature is practically equivalent to a deferred reenlistment bonus of \$75,000.

To estimate the effect of transferability on first-term reenlistments, we assume that it would affect only those with dependents. We allow GI Bill benefits to have different effects on those with and without dependents, before and after the passage of the Post-9/11 GI Bill. In other words, did those with dependents have a greater reenlistment probability relative to those without dependents, over and above what they would have had in the time period before transferability?

Controlling for other factors, we find a 1.5-percentage-point increase in the reenlistment rate gap between those with and without dependents. Since we assume that this effect applies only to Marines with dependents, we multiply this figure by the percentage of first-term reenlistment-eligible Marines who have dependents, 44 percent in 2009, to calculate an overall effect. The overall estimate of the transferability effect on the first-term reenlistment rate is an increase of 0.7 percentage point.

Although we attribute the entire measured difference to the transferability effect, we cannot rule out that there may be unobserved factors in FY08 and FY09 driving a widening of the reenlistment gap between those with and without dependents.

## **Reenlistment evidence from the Enlisted Retention Survey**

From January through March 2010, the USMC conducted an online survey of its enlisted population with an EAS in FY11. One survey section covered the Post-9/11 GI Bill. Respondents were asked how the Post-9/11 GI Bill influenced their reenlistment intentions. In table 4, we present a cross-tabulation of these results with respect to overall reenlistment intention for those in paygrades E4 and below.

Table 4. Responses to questions about influence of the Post-9/11 GI Bill and the intent to reenlist, 2010 ERS, paygrades E4 and below (percentages of total in parentheses)<sup>a</sup>

	Intend to stay	Neutral	Intend to leave
GI Bill influence to stay	640 (23%)	48 (2%)	220 (8%)
No influence	286 (10%)	83 (3%)	475 (17%)
GI Bill influence to leave	163 (6%)	61 (2%)	786 (28%)
Overall	1,089 (39%)	192 (7%)	1,481 (54%)

\*Percentages in table may not sum to total because of rounding.

Our approach to estimating the first-term reenlistment effect is to relate the probability of reporting an intent to stay (or to reenlist) to responding either that the Post-9/11 GI Bill is an influence to stay or an influence to leave, after controlling for demographic variables, paygrade, and PMOS. Among all responders in paygrades E4 and below, 33 percent said that the Post-9/11 GI Bill was an influence to stay, while 37 percent reported that it was an influence to leave.

We find that those who say that the Post-9/11 GI Bill is an influence to leave do, in fact, have a 30-percentage-point lower probability of intending to stay than average, after controlling for individual characteristics. Similarly, those who report that the GI Bill is an influence to stay have a 36-percentage-point higher probability of reporting that they intend to stay.<sup>6</sup> Multiplying these effects by the groups' respective shares among all responders and netting out the offsetting effects yields an overall 2.2-percentage-point increase in the intent to stay.

This effect is not directly comparable to the first-term reenlistment effect we estimated from MGIB-era data because (1) it excludes the effects of many reenlistment determinants that we incorporated in our analysis of the MGIB-era data, (2) it represents reported intent vs. actual behavior, and (3) it includes the effect of transferability. To obtain a slightly more comparable estimate (before accounting for transferability), we limit the sample of responses to those who have no dependents. We assume that these servicemembers will

<sup>6</sup> These estimates were obtained from a probit regression of the intent-to-stay variable on the Post-9/11 GI Bill influence-to-stay and influence-to-leave variables, and a set of demographic control variables available in the ERS.

have little value for transferability. Limiting the sample of responses to those in paygrades E4 and below without dependents yields an estimated overall first-term increase in the intent to stay of 0.1 percentage point.

## **Transferability evidence from the ERS**

The 2010 ERS also asked how servicemembers intend to use their Post-9/11 GI Bill benefit, including their intent to transfer. Among all responders, 27 percent reported an intent to transfer. Among those in paygrades E4 and below, 16 percent intended to transfer. Those who reported an intent to transfer were significantly more likely to be parents, married, black, and Hispanic. This suggests that the transferability feature may increase the representation of individuals with these characteristics as they serve additional 4-year commitments.

Controlling for other factors reported in the survey, including age, marital status, number of children, race/ethnicity, and paygrade, we estimate that reporting an intent to transfer is associated with a statistically significant 30-percentage-point higher probability of reporting an intent to stay in the Corps. If we apply this relationship to the 27-percent share of Marines reporting intent to transfer, we estimate an overall 8.1-percentage-point higher average intent to stay associated with an intent to transfer. Applying the same method only to those in paygrades E4 and below, we estimate a 5.9-percentage-point higher average intent to stay associated with transferability.

From the ERS data, we are unable to identify the causal effect of transferability on reenlistment. We observe only the degree to which transfer and reenlistment intentions are statistically related. For some Marines the intent to stay likely is caused by some unobserved factor, and the intent to transfer the benefit simply follows from the intent to stay. Such Marines would have intended to stay even in the absence of transferability. In these cases, it would be incorrect to conclude that reenlistment intentions were “caused” by transferability, even though we would observe a strong statistical association between intent to transfer and intent to reenlist.

## Reserve affiliation evidence from the ERS

An issue related to the transferability feature of the Post-9/11 GI Bill is how many servicemembers with 6 or more years of service will separate from active duty and join a Selected Reserve unit for their 4-year commitment under the transferability rules.<sup>7</sup>

The ERS asked personnel how likely they would be to affiliate with a Selected Reserve unit after separation in order to preserve their GI Bill transferability. Among respondents E5 and above who intend to leave the Marine Corps, 22 percent said they would be likely to join a Selected Reserve unit. This probability compares favorably with historic trends in reserve affiliation among this group. Table 5 shows, by paygrade, the percentage of members of each separating cohort since FY00 who have ever affiliated with the Selected Marine Corps Reserves.

Table 5. Selected Marine Corps Reserve affiliation by all E5–E9s eligible for reenlistment who leave active duty

FY in which left active duty	Count	Percentage affiliating with the Selected Marine Corps Reserve
2000	7,828	11.6%
2001	8,077	10.4%
2002	7,439	9.0%
2003	7,488	7.7%
2004	7,045	5.5%
2005	6,814	5.4%
2006	7,403	7.4%
2007	7,779	7.5%
2008	6,190	5.5%
2009	4,930	4.1%

## Summary

In this section, we reported our findings concerning the effect of the Post-9/11 GI Bill on Marine Corps first-term reenlistments, as well as reserve affiliation. Holding constant other determinants of reenlistment, we estimate that the Post-9/11 GI Bill will decrease

<sup>7</sup> The law allows the 4-year additional commitment to be served either on active duty or in the Selected Reserve.



first-term reenlistment by 2.2 percentage points, before accounting for transferability. Using differential responses to the Post-9/11 GI Bill between those with and without dependents, we estimated that the transferability feature of the Post-9/11 GI Bill has increased overall first-term reenlistment by about 0.7 percentage point. Including the transferability effect, we estimate the net effect of the Post-9/11 GI Bill to be a decrease of 1.5 percentage points in the first-term reenlistment rate. To provide some perspective, the Post-9/11 GI Bill has approximately the same reenlistment effect as a 3.8 percentage-point decrease in the unemployment rate. Our estimates suggest that it would require an increase of almost \$6,500 in the average SRB to offset this reenlistment effect.

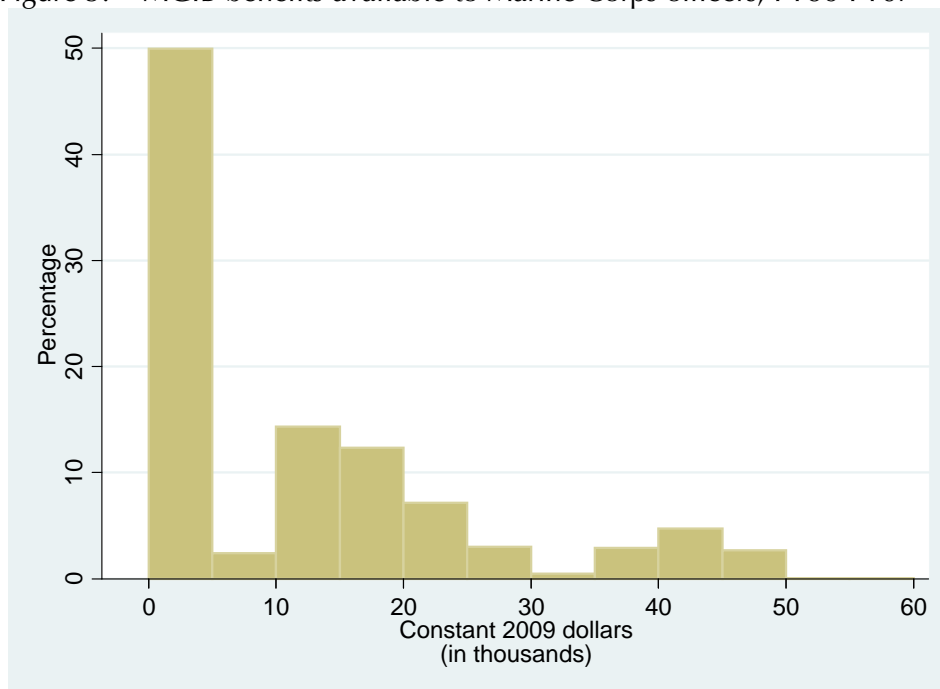
We also found that GI Bill benefits in the form of free tuition (vs. monthly cash payments to the Marine) have slightly greater reenlistment effects per dollar of benefit, but only for those with AFQT scores below 50. Adjusting for this feature of the Post-9/11 GI Bill would increase our overall estimate of its effect on first-term reenlistment (including the effect of transferability) from a decrease of 1.5 percentage points to one of 1.8 percentage points. We also described evidence from the ERS that was generally consistent with our analysis of historical behavior. In the next section, we examine officer retention.

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## Officer retention

In this section, we estimate the effect of historical variation in MGIB benefits on Marine Corps officer retention. We can use this estimate to predict the officer retention effect of the benefit increase associated with the Post-9/11 GI Bill, before accounting for transferability. Certain officers, such as service academy graduates or those commissioned through a Reserve Officer Training Corps (ROTC) program, never have been eligible for MGIB benefits. Among officers who *were* eligible, some purchased the buy-up, whereas others did not. Before the MGIB, the Veterans Educational Assistance Program (VEAP) benefit offered education benefits to all officers. We therefore observe not only variation in the benefit over time within each commissioning source, but also across Marine officers for each time period. Figure 5 shows the distribution of MGIB benefits among Marine Corps officers in our data.

Figure 5. MGIB benefits available to Marine Corps officers, FY86-FY07



We model officer retention as a month-to-month continuation decision. We use a survival model in which we estimate the conditional probability of “surviving,” or remaining, in the Marine Corps an additional month, as a function of several variables, including the following:

- The real value of the Marine officer’s education benefit (time-varying)
- Individual demographic variables
- Commissioning year variables
- Indicators of academic aptitude, such as grade-point average (GPA) from The Basic School and General Classification Test (GCT) scores.

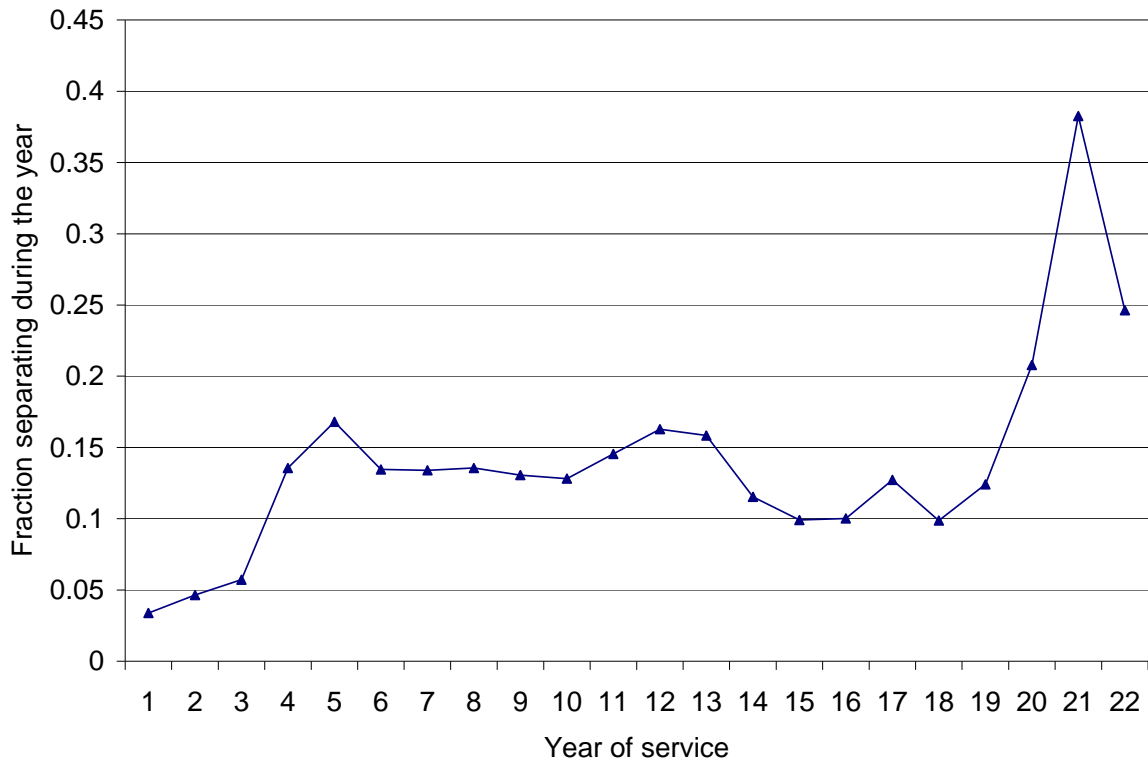
Figure 6 plots the observed exit rate (also known as a hazard rate) for officers in the cohorts we examine. Among Marine officers who have completed a given number of years of service, this function shows the proportion who have separated during their following year. For instance, among all Marine officers who stayed up through their 9<sup>th</sup> year, about 14 percent separate during their 10<sup>th</sup> year of service. There is a noticeable increase in the exit rate at the fourth year, as most minimum service obligations are fulfilled.<sup>8</sup> The exit rate remains close to 13 percent until the 10<sup>th</sup> year of service, at which point there is a gradual increase until years 12 and 13. After this point, the exit rate declines again, most likely because of the incentive to stay for retirement eligibility at 20 years. Following retirement eligibility, there is a sharp increase in the exit rate.

We estimate a regression model to determine the effect of the MGIB benefit on officers’ continuation decisions. Appendix B contains a description of our empirical approach and detailed estimation results.

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<sup>8</sup> For our regression analysis, we exclude the first 4 years of service, during which time officers are more constrained in their continuation choices.

Figure 6. Proportion exiting at various career lengths, Marine Corps officers FY86–FY07



We find that, overall, an officer’s MGIB benefit has no effect on retention. This result may be plausible because the benefit level constitutes a smaller share of lifetime income for officers than for enlisted. Furthermore, much of the return to postsecondary education comes from a Bachelor’s degree, which officers already possess. Returns to graduate education may be smaller. Finally, officers have opportunities to pursue postgraduate education within the military, though these opportunities vary by occupational field.

The degree to which results from the MGIB era can be applied to estimate the effects of the Post-9/11 GI Bill (before accounting for transferability) depends, among other things, on the extent to which the range of benefits overlap. About half of the officers in our sample had no benefits under the MGIB. For this group, the Post-9/11 GI Bill represents a \$75,000 increase in education benefits. Even though we have not detected any historical relationship between education benefits and officer retention during the MGIB era, a benefit increase of this magnitude is well above any we ob-

served in our MGIB sample. Future analysis of a longer history of retention data from the Post-9/11 GI Bill period will reveal whether it has had any adverse officer retention effects.

In the following section, we examine effects of the Post-9/11 GI Bill on recruitment.

## Recruitment

Education benefits are expected to have positive effects on recruitment outcomes because (like any fringe benefit) they increase the overall level of military compensation. In this section, we estimate the effect of the Post-9/11 GI Bill on Marine Corps recruitment. We focus on three key recruiting outcomes:

- High-quality recruits overall
- Hispanic high-quality recruits
- Black high-quality recruits.

We define “high quality” as a recruit who scores 50 or more on the AFQT and is a high school graduate.

## Background

In Figure 7, we present monthly trends in the percentages of Marine Corps accessions that are high quality, Hispanic, and black. High-quality accessions have averaged around 60 percent of each cohort, though there appears to be a slight increase since the passage of the Post-9/11 GI Bill in June 2008. The percentage of accessions who are Hispanic has been on a long upward trend since the 1990s, with no apparent break in the trend associated with the introduction of the Post-9/11 GI Bill. After falling off between FY01 and FY03, black representation also has been trending upward with each successive cohort.

Figure 7. Percentage of Marine Corps accessions that are high-quality, Hispanic, and black, FY95–FY09

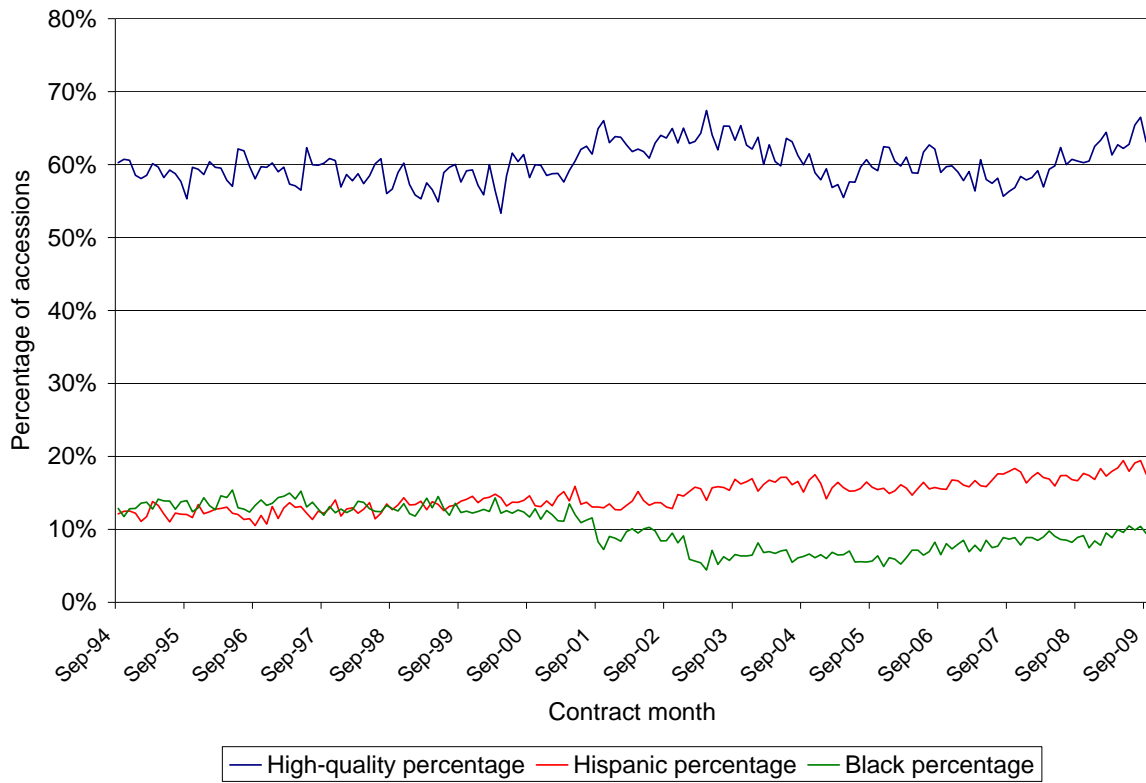
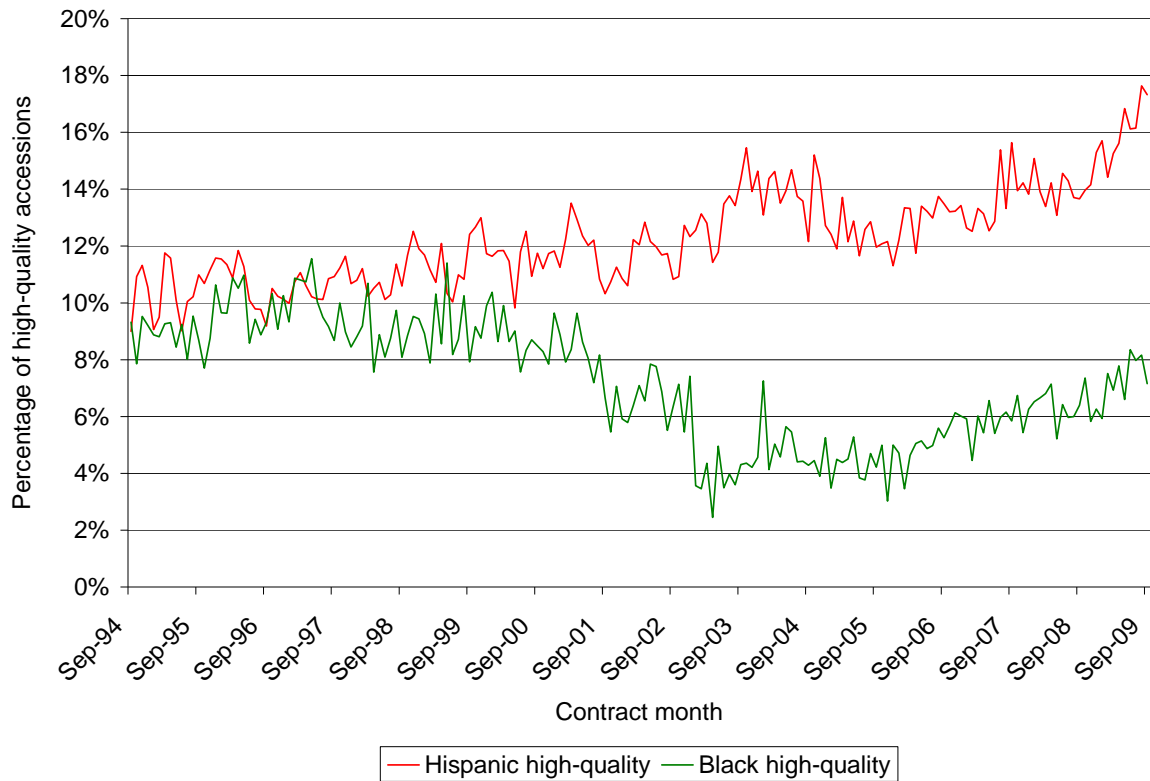


Figure 8 shows trends over time in the percentage of high-quality recruits who are black and Hispanic. We notice an increase during the last few years.

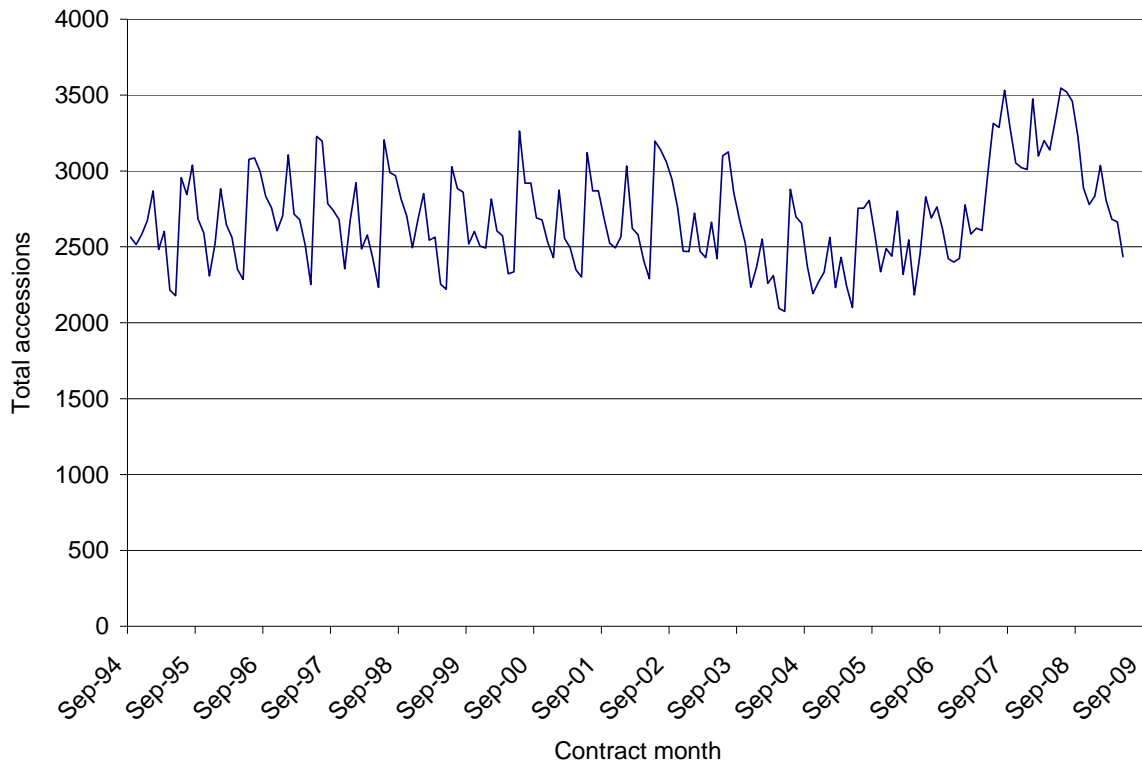


Figure 8. Percentage of Marine Corps high-quality accessions that are Hispanic and black, FY95–FY09



It is important to be aware of a number of special circumstances that have affected the recruiting environment during the past several years. The Marine Corps increased endstrength through a surge in accessions during FY07 and part of FY08, as illustrated in figure 9. This endstrength increase was accomplished largely in a supply-constrained environment, evidenced by the substantial enlistment bonuses that were offered, large increases in the advertising budget, and additions to the recruiter force, all detailed in [6]. A prolonged economic recession was one factor contributing to increased retention, resulting in a drop in demand for accessions toward the end of the buildup. Consequently, it is possible that we are in a demand-constrained recruiting environment. In such an environment, increases in unemployment or military pay may increase the supply of recruits (i.e., those wanting to enlist in the Marine Corps), but we do not observe these supply effects in the accession data simply because the Marine Corps already may have all the accessions it needs.

Figure 9. Marine Corps total active-duty accessions by date of contract, FY94-FY08



## Approach

Using quarterly state-level accession data from FY05 through FY09, we examine how variation in the education benefit (across states and over time) affects recruiting outcomes.

Other factors that influence recruiting that we are able to include in our model are:

- Relative military/civilian pay (at the national level)
- Civilian monthly unemployment rate (at the state level)
- Number of production recruiters (at the state level)
- Recruiting objective (at the state level)
- Advertising spending for diversity (at the national level)
- Proportion of accessions receiving enlistment bonuses

- State and time fixed effects.

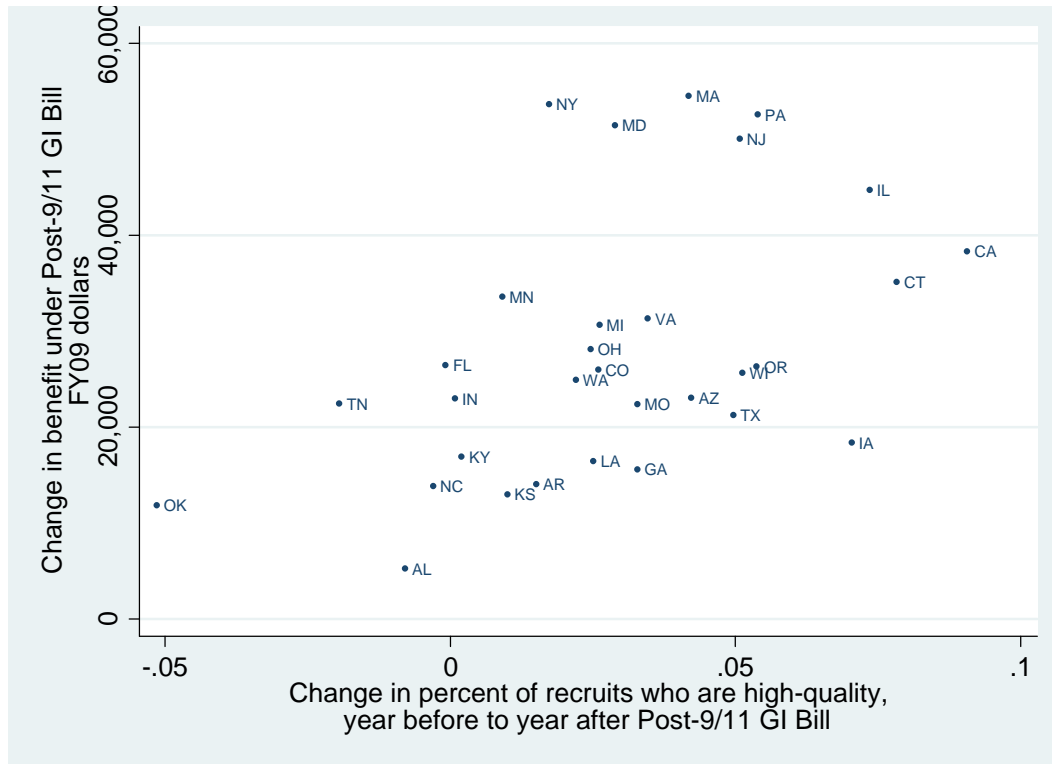
Similar to the approach in [7], we analyze aggregated data by state and quarter. Appendix C presents detailed regression results.

## High-quality recruits

Previous research on the effects of education benefits on recruitment has found sizable effects on the number of high-quality recruits. For example, [8] analyzed evidence from a controlled experiment conducted by DoD (the Educational Assistance Test Program, or EATP), in which Army recruits in some regions were offered additional education benefits. Regions offering a 65-percent increase in education benefits in 1981 (worth about \$17,000 in FY09 dollars) saw a 9-percent increase in high-quality recruits. Applying a similar response to the 75-percent increase in benefits associated with the Post-9/11 GI Bill, we would expect to see an increase of approximately 10 percent.

The Post-9/11 GI Bill entailed varying changes in the education benefits depending on the state. As an initial look at the effect of the bill, we compared the share of high-quality recruits in each state for the year preceding the passage of the Post-9/11 GI Bill with the average share in the year following the bill. We found that a state with a \$10,000 larger gain from the Post-9/11 GI Bill had a 0.8-percentage-point larger gain in its share of high-quality recruits. The varying effect by state may suggest a possible reallocation of recruiting resources away from states with the largest increases toward those that experienced smaller increases. Figure 10 illustrates this relationship for a sample of states with the largest number of recruits.

Figure 10. Before and after Post-9/11 GI Bill, change in percentage of USMC accessions that are high-quality vs. change in GI Bill benefit (states with more than 200 USMC active-duty accessions per year)



We also estimated a multivariate model for high-quality enlistments, the results of which are reported in appendix C. We estimate that a \$25,000 increase in the value of the GI Bill benefit is associated with a 10-percent increase in high-quality enlistments.<sup>9</sup>

## Hispanic high-quality recruits

Using data from FY98 through FY07 (i.e., before the Post-9/11 GI Bill), one recent study [9] found that higher education benefits were positively associated with more Hispanic high-quality Army recruits. Education benefits were measured using the percentage of

<sup>9</sup> Expressed as an elasticity, this response is 0.18, which is in line with estimates of the high-quality recruitment effect of GI Bill benefits reported in previous studies.

recruits receiving the Army college fund. We also find some evidence that GI Bill benefits increase the number of high-quality recruits. We estimate a 14-percent increase in Hispanic high-quality recruits associated with the Post-9/11 GI Bill, which is somewhat greater than the overall high-quality increase.

Other variables strongly associated with the share of high-quality Hispanic recruits are the recruiting objective and the percentage of recruits receiving enlistment bonuses.

## **Black high-quality recruits**

The authors of [9] did not find a significant relationship between black high-quality Army recruits and education benefits during the MGIB era. Our results in appendix C indicate a large effect of education benefits since the introduction of the Post-9/11 GI Bill. We estimate that black high-quality Marine Corps recruits have increased by 18.5 percent with the introduction of the Post-9/11 GI Bill.

These findings suggest that minority representation within the pool of high-quality recruits has been increasing during the period following the introduction of the Post-9/11 GI Bill. In the next section, we examine the effect of the Post-9/11 GI Bill on the use of Tuition Assistance.

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## Tuition Assistance use

In this section, we analyze the potential link between demand for Tuition Assistance (TA), the Marine Corps' in-service college education program, and the GI Bill benefit. Understanding this link is important for forecasting budgetary requirements for the TA program and setting TA policy.

First, we examine Marines' observed use of the two education benefits, relying on data that DMDC receives from the Department of Veterans Affairs (VA) on the history of Marines' MGIB use combined with individual-level data from Navy Education and Training Command (NETC) on all TA courses taken by Marines since FY95.

Later, we briefly describe some evidence from the ERS on TA use. Overall, the evidence suggests that Marines' demand for TA is likely to increase as a result of the Post-9/11 GI Bill. We estimate that the percentage of Marines using TA in any given year of their first terms will increase by 6 percent.

## Background on TA

Tuition Assistance is a benefit provided to active-duty military members under Title 10 U.S.C. 2007. It authorizes the secretaries of the respective branches to pay up to 100 percent of tuition for service-members voluntarily taking courses when they are off duty.<sup>10</sup> Marine Corps guidance can be found in [10]. Unlike the GI Bills, TA cannot be used to pursue additional degrees at the same level, such as a second Master's degree.<sup>11</sup>

The maximum benefit is \$250/semester hour, and the total benefit cannot exceed \$4,500 per fiscal year. This covers tuition and any

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<sup>10</sup> Before October 2002, TA covered only 75 percent of tuition.

<sup>11</sup> In focus groups associated with other CNA work, Marine officers said that they felt restricted by this provision.

mandatory enrollment fees. TA does not reimburse for additional fees or the cost of books and supplies.

Military members who are eligible for the Montgomery or Post-9/11 GI Bills may use those entitlements to pay any excess tuition expenses that TA does not cover (known as “top up”). Any dollar amount of GI Bill used for this purpose while on active duty reduces the GI Bill after-service benefit available by the same amount.<sup>12</sup>

To receive TA, officers must agree to remain on active duty for 2 additional years after the completion of the course that TA funded. Reservists must agree to another 4 years of reserve duty. There is no service obligation for enlisted Marines.

The Marine Corps saw steady increases in its TA program during the late 1990s, with enrollment increasing by 5 percent annually between FY96 and FY01 [11].

We are interested in what happens to the demand for TA when the GI Bill benefit increases. A more generous GI Bill may persuade more Marines to pursue further education. Some may start their studies while on active duty, increasing the demand for TA. A more generous GI Bill also may cause Marines to postpone starting their studies until after separation, confident that the Post-9/11 GI Bill will provide sufficient funding. Others who were planning to use the GI Bill for their own education may use TA instead and transfer their Post-9/11 GI Bill benefits to their dependents. The net effect of these countervailing effects on TA demand is theoretically ambiguous.

To get a sense for the interaction between in-service and post-service education, we categorize Marines who pursue further education into various groups. We examine the use patterns of Marines with at least 2 years of active service in accession cohorts FY95 through FY05 (see table 6).

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<sup>12</sup> Eligible military members can receive the GI Bill while on active duty without enrolling in TA, though payments are limited to actual tuition. Also, any months used while on active duty (regardless of dollar amount) are deducted from the GI Bill after-service benefit. For these reasons, active-duty servicemembers are often advised against using the GI Bill outside the TA program.



Table 6. MGIB and TA use among enlisted Marines with more than 2 years of service, accession cohorts FY95–FY05

	Active (as of Dec 2009)		Separated		Total
TA only	28,953	41%	19,904	10%	48,857
MGIB only	3,240	5%	65,745	32%	68,985
Both TA and MGIB	7,591	11%	38,088	19%	45,679
Neither	31,483	44%	80,286	39%	111,769
Total	71,267	100%	204,023	100%	275,290

We divided Marines by active-duty status (as of December 2009). The majority of Marines with more than 2 years of service pursue further education, through either MGIB or TA or both. Among those who have separated and obtained further education, the largest group is made up of those using MGIB only, followed by the group using both TA and MGIB. These figures illustrate that it has not been uncommon for Marines to use both TA and MGIB.

## Empirical results

Appendix D describes our empirical approach. In our initial specification, we estimate that an additional \$25,000 in GI Bill benefits, as provided under the Post-9/11 GI Bill, will increase first-term TA participation by 9.8 percentage points. We consider this to be an upper-bound estimate because Marines have some choice in the level of their GI Bill benefits. For instance, they can choose to purchase the buy-up option as well as opt for a college fund enlistment incentive if one is offered. These choices are likely to be correlated with the Marine’s aptitude and desire for further education in general and TA use in particular. To the extent that Marines would have used TA even in the absence of higher benefits, it would be incorrect to attribute their TA use to the larger benefit.

To account for these possible self-selection effects, we use a second model that examines a Marine’s choice of whether or not to use TA in each year of his or her first term, and whether this choice depends on the Marine’s level of GI Bill benefits in that year. This approach controls for individual selection effects. We still find a significant, though somewhat smaller, effect of GI Bill benefits on a Marine’s probability of TA use. We estimate that a Marine is about 6

percent more likely to use TA in any given year as a result of the Post-9/11 GI Bill. This effect is dwarfed, however, by the 30-percent estimated increase in TA use associated with reducing the TA copay from 25 percent to 0 percent.

## **Evidence from the ERS**

We also gathered information from the ERS that may provide indirect evidence regarding TA use. Respondents were asked to report their education level in the ERS. About 25 percent reported having “some college, but not a complete degree.” If we are willing to assume that most TA users fall into this group, we can examine how they intend to use the Post-9/11 GI Bill. Controlling for other factors, the “some college” population is almost 10 percentage points more likely to intend to use the Post-9/11 GI Bill. This evidence is consistent with what we observed in the use patterns—namely, that TA and the GI Bill tend to be complementary.

## Conclusion

In this report, we have presented estimates of selected manpower effects of the Post-9/11 GI Bill.

The Post-9/11 GI Bill represents a \$25,000 increase in the education benefit available to veterans with at least 3 years of active-duty service since 9/11. Results from our reenlistment analysis are consistent with estimates from the literature and indicate that such an increase in the GI Bill benefit may reduce the Marine Corps' first-term reenlistment rate by 2.2 percentage points, before accounting for transferability.

Based on differences in reenlistment behavior between those with and without dependents observed since the Post-9/11 GI Bill took effect, we estimate that the transferability feature will increase reenlistment by 0.7 percentage point, resulting in a net decrease in the first-term reenlistment rate of 1.5 percentage points.

We identify subgroups likely to see larger- or smaller-than-average decreases in reenlistment rates as a result of the Post-9/11 GI Bill. Among those groups likely to see larger-than-average declines in the first-term reenlistment rate are those with dependents, those who are older, those who possess security clearances, and those in PMOSs with longer training times. We estimate a smaller-than-average decrease in reenlistment rates among blacks and Hispanics. In addition, we present survey evidence that suggests an increase in reserve affiliation among separating enlisted Marines E5 and above who have 6 or more years of service.

For Marine Corps officers, we find no evidence from the MGIB era that education benefits affect retention. Therefore, we expect a net increase in retention among officers as a result of any transferability effects.

We find that the Post-9/11 GI Bill is likely to increase the share of high-quality Marine Corps accessions, in particular among Hispanic and black recruits.

Finally, we estimate that TA use is likely to increase as a result of the Post-9/11 GI Bill.

## Appendix A: Enlisted retention regression results

In table 7, we report selected regression estimates for our first-term reenlistment models. Column 1 of the table contains the results of our central model, which uses a single combined value for the education benefit. Column 2 is a variant in which we include as separate variables the tuition subsidy and cash components of the GI Bill benefit. The data cover Marines recommended and eligible for reenlistment who reached their first reenlistment decision between FY99 and FY07. The model also includes FY dummy variables, which are not reported here.

The coefficient estimates can be interpreted as the effect of a one-unit increase in the associated variable on the probability of first-term reenlistment, holding constant all of the other variables. For instance, having a security clearance is associated with an 18.9-percentage-point higher reenlistment probability. Similarly, a Marine with a 10-point higher AFQT score is 1 percentage point less likely to reenlist.

An additional \$10,000 in SRB is associated with a 2.4-percentage-point increase in the reenlistment rate. Other variables with positive and statistically significant effects on reenlistment probability include the Marine's home state unemployment rate and the number of months spent in the Delayed Entry Program (DEP).

Table 7. First-term reenlistment model estimation results, eligible Marines FY99-FY07

Variable	(1)	(2)
Enlistment bonus	-0.005 (1.17)	-0.004 (0.99)
MGIB cash benefit (per \$10,000)	-	-0.006 (4.48)**
Free veteran tuition state	-	-0.026 (7.42)**
MGIB total benefit (per \$10,000)	-0.009 (7.58)**	-
SRB amount (per \$10,000)	0.024 (16.62)**	0.024 (16.61)**
Age	-0.003 (4.02)**	-0.003 (3.80)**
Female	0.016 (3.27)**	0.015 (3.21)**
Hispanic	0.006 (1.55)	0.010 (2.46)*
Black	0.111 (28.11)**	0.110 (27.83)**
Married at decision	-0.099 (32.77)**	-0.098 (32.71)**
Dependents at decision	0.151 (106.04)**	0.151 (106.06)**
AFQT score	-0.001 (6.56)**	-0.001 (6.87)**
Security clearance	0.189 (68.41)**	0.189 (68.41)**
PMOS training time	0.006 (5.92)**	0.006 (5.92)**
Months in DEP	0.003 (11.27)**	0.003 (11.17)**
State average BAH (per \$10,000)	-0.047 (0.70)	-0.093 (1.38)
State 4-year public university cost (per \$10,000)	-0.031 (3.67)**	-0.030 (3.61)**
Unemployment rate	0.004 (3.23)**	0.005 (3.81)**
Observations	167,429	167,429

Estimates represent the change in the probability of reenlistment associated with each variable.

Notes:

Absolute value of z statistics are in parentheses.

\* Significant at 5 percent.

\*\* Significant at 1 percent.

All dollar amounts expressed in constant 2009 dollars.

## Appendix B: Officer retention regression results

In this appendix, we report the results for a survival regression model of officer separation rates based on various determinants, including the contemporaneous value of the GI Bill benefit. Our sample consists of Marine Corps officers commissioned between FY86 and FY07. We limit observations to officers who were eligible for the MGIB; that is, we exclude those commissioned through the service academy or ROTC. We also limit the sample to retention decisions beyond the 4<sup>th</sup> year of service.

The model we estimate is a parametric hazard model given by:

$$\lambda(t, x_t) = \lambda_0(t)e^{x_t\beta},$$

where  $t$  represents a officer's months of service since commissioning date,  $x_t$  is a vector of time-varying covariates, and  $\lambda_0(t)$  is a baseline hazard rate assumed to follow a Weibull distribution. We obtained similar results using a Cox proportional hazards model, which does not require specification of a baseline error distribution.

We allow officers' benefits and other characteristics to vary over time. We include the MGIB benefit available to the officer as one of the explanatory variables. Other control variables we include are indicators for the commissioning source, race and ethnicity, and academic aptitude (GCT scores and GPA). We also include dummy variables for the commissioning year to control for cohort effects.

The reported values in table 8 can be interpreted as the proportional increase in the separation rate in response to a one-unit change in the explanatory variable, holding all else constant. Values greater than 1 mean that the relevant variable is associated with a higher separation rate, while values less than 1 are associated with higher retention rates. For instance, female officers have a separation rate 1.25 times the rate of otherwise identical officers.

Table 8. Officer retention model, selected estimation results

Variable	
GI Bill benefit (per \$10,000) in FY09 dollars	0.9996 (0.03)
Rank	
O3	0.195 (26.31)**
O4	0.029 (34.48)**
O5	0.006 (28.06)**
Commissioning source	
Platoon Leadership Class (PLC)	1.063 (0.38)
Officer Candidate Class (OCC)	0.868 (0.87)
Marine Enlisted Commissioning Education Program (MECEP)	0.751 (1.63)
Enlisted Commissioning Program (ECP)	0.697 (1.93)
Meritorious Commissioning Program (MCP)	0.578 (2.08)*
Missing	0.769 (0.44)
Age 30–39	0.649 (7.34)**
Age 40+	1.149 (1.28)
Has dependent(s)	0.875 (1.61)
Female	1.248 (2.50)*
Black	1.077 (0.97)
Hispanic	1.230 (2.87)**
Married	0.890 (1.41)
Length of PMOS training (days)	0.9997 (8.94)**
GCT score	1.012 (6.73)**
Basic school GPA	0.983 (3.76)**
Tuition Assistance user	0.483 (15.22)**
National unemployment rate	0.880 (4.84)**
Results for cohort indicators 1987-2005 not shown.	
Observations (representing 11,246 individuals)	242,996
Absolute value of z statistics are in parentheses.	
* significant at 5 percent; ** significant at 1 percent.	



During the MGIB era, we find no statistically significant retention effect of the size of the GI Bill benefit. There are a number of other interesting findings. A 1-percentage-point increase in the unemployment rate is associated with a 12-percent decline in the separation rate. In other words, if the baseline separation rate for a particular group of officers is 10 percent per year, it would decline to 8.8 percent per year. Tuition Assistance use is associated with a 52-percent decline in the separation rate. This reflects both the 2-year service commitment required for officers who use TA and the greater window of opportunity to use TA enjoyed by those who remain on active duty longer.

Those in PMOSs with longer training, as well as those with higher basic school GPAs, have lower separation rates, while those with higher GCT scores have higher separation rates. Higher basic school GPA may foreshadow stronger performance, promotion opportunities, or job satisfaction as a Marine officer relative to a civilian career.

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## Appendix C: Recruitment regression results

In table 9, we report the results from regressions of Marine Corps accessions on various determinants, including the contemporaneous value of the MGIB. The data cover the period of FY05 through FY09. The regressions include state fixed effects and dummy variables for year and season. Each observation corresponds to one quarter in a given state. The dependent variable is the logarithm of the total number of recruits of interest as a percentage of the state's population between the ages of 17 and 21. We control for changes in the overall recruiting environment by allowing the unemployment rate to have a different effect on recruiting in the period since July 2008. This period also happens to coincide with the introduction of the Post-9/11 GI Bill.

Coefficients can be interpreted as the percentage increase in the number of high-quality recruits in a state in response to a one-unit increase in the explanatory variable. For instance, a coefficient of 0.044 for the GI Bill benefits variable in column 1 means that \$10,000 in additional GI Bill benefits is associated with a 4.4-percent increase in high-quality recruits as a share of a state's population age 17 to 21.

Among the other explanatory variables, enlistment bonuses have the strongest effect. A 10-percentage-point increase in the number of enlistment bonuses is associated with a 3-percent increase in the number of high-quality enlistments. The estimated effects of some other variables are opposite to what has been found in earlier studies. For instance, the negative and statistically significant estimated coefficients on the civilian unemployment rate in columns 1 and 3 suggest that higher unemployment is associated with lower recruitment. This result may be an artifact of our particular sample period. Higher unemployment during this time has led to higher reenlistment, thus reducing the demand for new recruits.

Table 9. Recruitment regression results, USMC accessions FY05 – FY09

Explanatory variable	Dependent variable		
	(1) Log (high quality per population 17-21)	(2) Log (high-quality Hispanic)	(3) Log (high- quality black)
Log (recruiting objective)	0.350 (1.28)	1.127 (2.98)**	0.628 (0.45)
Log (production recruiters)	0.417 (1.61)	-0.489 (1.26)	0.110 (0.08)
Log (state quarterly unemployment rate)	-0.295 (3.48)**	-0.306 (1.48)	-0.484 (2.39)*
Log (military/civilian pay)	0.116 (0.29)	2.583 (1.68)	1.683 (1.14)
GI Bill benefits per \$10,000 \$FY09	0.044 (4.31)**	0.056 (2.12)*	0.074 (3.06)**
Percent receiving enlistment bonus	0.300 (4.56)**	0.434 (2.79)**	-0.247 (1.09)
Average home-state public four-year uni- versity cost	0.022 (0.09)	-0.264 (0.40)	1.114 (1.14)
Percent of home state's population aged 17-21 in college	0.164 (0.69)	-0.693 (0.91)	-0.402 (0.63)
Percent of state's population aged 35-65 who are veterans	2.166 (2.32)*	-0.895 (0.29)	-0.460 (0.12)
FY2006 indicator	0.047 (2.65)*	0.079 (1.07)	0.090 (1.53)
FY2007 indicator	-0.039 (1.09)	0.215 (1.76)	0.405 (4.18)**
FY2008 indicator	0.107 (2.44)*	0.502 (3.85)**	0.655 (3.17)**
FY2009 indicator	-0.211 (3.17)**	0.514 (2.72)**	0.639 (1.68)
Quarter 2 (Apr-Jun)	0.043 (3.69)**	0.037 (1.19)	0.069 (1.55)
Quarter 3 (Jul-Sep)	0.024 (1.81)	0.015 (0.41)	0.141 (3.52)**
Quarter 4 (Oct-Dec)	-0.001 (0.06)	0.052 (0.70)	0.121 (1.97)
Log state quarterly unemployment rate X Post-June 2008 indicator	-0.023 (1.21)	-0.176 (1.90)	-0.166 (2.88)**
Constant	-2.696 (2.70)**	-8.199 (3.93)**	-7.222 (1.55)
Observations	1009	797	651
Number of states	51	51	48
R-squared	0.43	0.15	0.25

Robust t statistics are in parentheses.

\* significant at 5 percent; \*\* significant at 1 percent.

## Appendix D: Tuition assistance regression results

We first estimated a reduced-form model of the probability of first-term TA use as a function of GI Bill education benefits at accession and other determinants. Over 90 percent of TA users use TA in their first term. Our data included Marines with at least 4 months of service in accession cohorts from 1995 through 2005. To control for the opportunity that Marines have to use TA, we included a Marine's length of service as an explanatory variable. We used a probit specification.

Table 10 shows the regression results for the probability of first-term TA use. Values corresponding to each variable represent the change in probability of TA use associated with a one-unit increase in the variable. For 0-1 variables, the value corresponds to the change in probability of TA use associated with changing the variable from 0 to 1. For instance, the probability of TA use is 17 percentage points greater for women, 6 percentage points greater for Hispanics, and 1.1 percentage points lower for those with dependents.

Table 10. Probability of first-term TA use probit regression results (marginal effects)

GI Bill benefit at accession (\$10,000) in FY09 dollars	0.039 (43.41)**
Age	0.001 (2.84)**
Female	0.170 (44.24)**
Hispanic	0.060 (22.13)**
Black	0.031 (10.58)**
Married at accession	0.002 (0.43)
Dependents at accession	-0.011 (3.34)**
GED	-0.029 (5.23)**
Enlistment term	0.022

Table 10. Probability of first-term TA use probit regression results (marginal effects)

	(6.72)**
First-term months of service	0.011
	(80.79)**
AFQT score	0.003
	(48.83)**
Percent college in home state	-0.058
	(2.67)**
Percent veteran in home state	-0.038
	(0.70)
Median family income in home state	0.000
	(8.86)**
Accession fiscal year 1996	0.012
	(2.41)*
Accession fiscal year 1997	0.011
	(2.24)*
Accession fiscal year 1998	0.019
	(3.60)**
Accession fiscal year 1999	0.009
	(1.47)
Accession fiscal year 2000	-0.003
	(0.52)
Accession fiscal year 2001	-0.016
	(2.30)*
Accession fiscal year 2002	-0.026
	(3.63)**
Accession fiscal year 2003	-0.044
	(6.87)**
Accession fiscal year 2004	-0.045
	(6.65)**
Accession fiscal year 2005	-0.063
	(8.35)**
PMOS 2-digit group 01	0.156
	(35.32)**
PMOS 2-digit group 03	-0.112
	(39.66)**
PMOS 2-digit group 06	-0.052
	(14.24)**
PMOS 2-digit group 08	-0.113
	(22.27)**
PMOS 2-digit group 13	-0.060
	(15.12)**
PMOS 2-digit group 21	-0.044
	(8.43)**
PMOS 2-digit group 30	0.111
	(23.97)**
PMOS 2-digit group 35	-0.043
	(12.77)**
PMOS 2-digit group 58	-0.024
	(4.26)**
PMOS 2-digit group 60	0.012
	(2.27)*
PMOS 2-digit group 61	-0.099
	(20.20)**

Table 10. Probability of first-term TA use probit regression results (marginal effects)

Have clearance	0.038 (17.91)**
Average training time of PMOS	-0.0001 (7.54)**
Months in DEP	0.001 (3.63)**
Average annual BAH in home state (\$10,000) FY09 dollars	0.207 (4.60)**
Average 4-year cost of public university in home state	-0.045 (7.81)**
Unemployment rate at time of separation or reenlistment	-0.001 (1.12)
Military/civilian pay at time of separation or reenlistment	-0.130 (4.91)**
Observations	262,170

Absolute value of z statistics are in parentheses.

\* significant at 5 percent; \*\* significant at 1 percent.

To control for unobserved individual heterogeneity, we also estimate a fixed-effects logit model. In this model, we have a separate observation for each Marine in each year of his or her first enlistment term. This model allows us to examine whether Marines are more likely to use TA in a year in which their GI Bill benefits are higher.

The estimated relationship is:

$$\Pr(TA_{it} = 1) = \frac{e^{\alpha_i + \beta GI_{it} + \gamma x_{it}}}{1 + e^{\alpha_i + \beta GI_{it} + \gamma x_{it}}}$$

where  $TA_{it} = 1$  if Marine  $i$  used TA in year  $t$  and 0 otherwise,  $GI_{it}$  measures Marine  $i$ 's real MGIB benefits in year  $t$ , and  $x_{it}$  represents a batch of other determinants of TA use. The controls we include are an indicator for the time period following the switch from 25 percent to 0 percent copayment for tuition cost, as well as indicators for the enlistment year of observation. Most TA use occurs after the first enlistment year.

The  $\alpha_i$  represents an individual fixed effect. This is usually thought to account for any characteristic of the Marine that is fixed over the

observation period, including any unobserved traits (such as academic aptitude) that would affect a Marine's likelihood of using TA. Table 11 contains the results of the fixed-effects logit model of TA use. The coefficients can be interpreted as the percentage increase in the probability of TA use in a given year associated with a one-unit change in the explanatory variable. For instance, we see that a \$10,000 increase in the GI Bill benefit results in a 2.5-percent increase in the probability of TA use.

Table 11. Probability of TA use each year, fixed-effects logit regression results (estimated coefficients reported)

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GI Bill benefit in year (\$10,000) in FY09 dollars	0.025 (3.28)**
FY2003 and later indicator	0.309 (13.11)**
Year 2 of first term	2.944 (95.36)**
Year 3 of first term	3.583 (112.56)**
Year 4 of first term	3.678 (108.93)**
Year 5 of first term	4.002 (97.71)**
Year 6 of first term	4.227 (19.50)**
Observations	222,666

Absolute value of z statistics are in parentheses.

\* significant at 5 percent; \*\* significant at 1 percent.



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## List of figures

Figure 1. Comparing average MGIB and hypothetical Post-9/11 GI Bill benefits over time, USMC recommended and eligible first-term reenlistment candidates (FY09 dollars) .....	5
Figure 2. Number of USMC beneficiaries receiving their first MGIB payment by month, 2005–2009.....	7
Figure 3. Distribution of MGIB benefits available to Marines facing their first reenlistment decision, FY99–FY07.....	11
Figure 4. Decomposition of benefit between tuition subsidy and cash stipend: Post-9/11 GI Bill and MGIB, FY99–FY09 .....	14
Figure 5. MGIB benefits available to Marine Corps officers, FY86–FY07 .....	23
Figure 6. Proportion exiting at various career lengths, Marine Corps officers FY86–FY07 .....	25
Figure 7. Percentage of Marine Corps accessions that are high-quality, Hispanic, and black, FY95–FY09.....	28
Figure 8. Percentage of Marine Corps high-quality accessions that are Hispanic and black, FY95–FY09.....	29
Figure 9. Marine Corps total active-duty accessions by date of contract, FY94–FY08.....	30
Figure 10. Before and after Post-9/11 GI Bill, change in percentage of USMC accessions that are high-quality vs. change in GI Bill benefit (states with more than 200 USMC active-duty accessions per year) .....	32

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## List of tables

Table 1. Share of education benefits in discounted civilian income .....	10
Table 2. Differential effects of GI Bill benefits on various subgroups .....	15
Table 3. USMC Post-9/11 GI Bill transfer applications, August 2009 through January 2010.....	16
Table 4. Responses to questions about influence of the Post-9/11 GI Bill and the intent to reenlist, 2010 ERS, paygrades E4 and below (percentages of total in parentheses) * .....	18
Table 5. Selected Marine Corps Reserve affiliation by all E5–E9s eligible for reenlistment who leave active duty.....	20
Table 6. MGIB and TA use among enlisted Marines with more than 2 years of service, accession cohorts FY95–FY05 .....	37
Table 7. First-term reenlistment model estimation results, eligible Marines FY99-FY07.....	42
Table 8. Officer retention model, selected estimation results.....	44
Table 9. Recruitment regression results, USMC accessions FY05 – FY09.....	48
Table 10. Probability of first-term TA use probit regression results (marginal effects) .....	49
Table 11. Probability of TA use each year, fixed-effects logit regression results (estimated coefficients reported) .....	52

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