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MILITARY OFFICER QUALITY IN THE ALL-VOLUNTEER FORCE

Matthew F. Cancian
Michael W. Klein

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ABSTRACT

We show a statistically significant and quantitatively meaningful decline in the quality of commissioned officers from 1980 to 2014 as measured by the scores of Marine officers on the General Classification Test (GCT), using data obtained from a Freedom of Information Act request. This test has been shown to be a good predictor of success in the military. This result differs from the widely-studied increase in the quality of enlisted personnel since 1973 when conscription ended and the All-Volunteer Force (AVF) began. We consider a range of possible causes for this decline. We focus on the fact that, during this period, Marine officers had to have a four-year college degree and there has been an expansion of the pool of young Americans in college. We find that other factors, such as the increasing diversity of the pool of incoming officers, have not contributed in any meaningful way to the decline in average annual GCT scores.

Matthew F. Cancian
Fletcher School
Tufts University
Medford, MA 02155
matthew.cancian@tufts.edu

Michael W. Klein
Fletcher School
Tufts University
Medford, MA 02155
and NBER
michael.klein@tufts.edu

I. Introduction

The question of "Who serves when not all serve?" has been a central issue in the all-volunteer United States military, even before the end of conscription in 1973.[1] Advocates for the end of the peace-time draft argued conscription was, in the words of Milton Friedman, "inequitable and arbitrary, seriously interfer[ing] with the freedom of young men to shape their lives."[2] Others, however, were concerned with the quality of an all-volunteer force.[3] While the military services initially faced challenges in attracting high-quality enlisted personnel, the problems seemed to have been resolved by the late 1980s. Bernard Rostker, one of the foremost experts on military manpower analysis, declared in his 2006 RAND monograph *I Want You* that "the alternative to the draft, the all-volunteer force, has been a resounding success for the American military and the American people."[4] Even during the most trying years of conflicts in Iraq and Afghanistan, around 60 percent of new recruits were deemed "high-quality," possessing a high school diploma and being above the average intelligence of the American population (compared to a low of 27.1 percent of new recruits deemed high-quality in 1977).

The success of the volunteer military in attracting high quality enlisted recruits, however, does not necessarily carry over with respect to its ability to

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[1] See *In Pursuit of Equity: Who Serves When Not All Serve*, United States National Advisory Commission on Selective Service, 1970. This commission is commonly referred to as the Gates Commission after its Chairman, Thomas Gates, Jr., a former Secretary of Defense in the Eisenhower administration.
[2] *Capitalism and Freedom*, p. 36
[3] See, for example, Janowitz and Moskos (1974).
[4] Rostker (2006), p. 9

attract high-quality officers.[5] Commissioned officers comprise about 16 percent of the military, but they make up its leadership and exert a disproportionate impact on military effectiveness.

In this paper, we show that the quality of officers in the Marines, as measured by scores on the General Classification Test (GCT), a test that all officers take, has steadily and significantly declined since 1980.[6] For example, the GCT score in 1980 that demarcated the lower one-third of new officers that year demarcated the lower two-thirds of the new officers in 2014. While 85 percent of those taking the test in 1980 exceeded 120, the cut-off score for Marine officers in World War 2,[7] only 59 percent exceeded that score in 2014. At the upper end of the distribution, 4.9% of those taking the test scored above 150 in 1980 compared to 0.7% in 2014. This negative trend could contribute to adverse consequences for military effectiveness and national security.

We also examine the relationship between the annual averages of these test scores and the size and composition of the pool of potential officers (i.e., college graduates), labor market conditions, and the ethnic, racial and gender composition of incoming officers. We find that the dominant correlate to the declining GCT scores over time is the expansion of the pool of potential officers as the ranks of college graduates has risen over the past three decades. There is no evidence that

[5] In the American military, officers are said to receive a commission for service rather than enlisting. Enlisted personnel can be promoted to be non-commissioned officers, but these positions are distinct from those of commissioned officers (who are simply called officers, the term we will henceforth use in this paper).
[6] As discussed in more detail below, we obtained individual-level information on the universe of Marine Officer Recruits who took General Classification Test (GCT) from 1980 to 2014. The data provided do not include any individual level characteristics, such as race or gender, in order to preserve privacy for the test takers.
[7] Nalty and Moody (1970).

the increasing proportion of women or African Americans in the ranks of incoming officers are independent causes of the decrease in test scores, and while in some specifications there is a significant effect of the proportion of incoming Hispanic officers on these scores, the quantitative effect of this on the average GCT is very small, representing only about 5 percent of the decline; the other 95 percent is due to the expansion of the pool of non-Hispanic college students.

The next section of this paper traces the history of intelligence testing by the American military in the 20th century. This section also includes a brief discussion of America's return to an All-Volunteer Force in 1973. Section III presents our analysis of the GCT individual-level data that shows a steady and significant decline in the mean scores across the period 1980 to 2014 as well as a significant shift in the distribution of the scores. Section IV presents a regression analysis of the partial correlates of annual mean test scores with the characteristics of the potential pool of officer recruits, the gender, racial, and ethnic characteristics of the recruits, and labor market and other factors that could potentially affect the quality of recruits and, therefore, the GCT scores. We offer some concluding comments in Section V.

II. The General Classification Test

The military developed new intelligence tests at the beginning of World War II in order to classify incoming servicemen during the huge buildup of forces. The Army General Classification Test (initially called the AGCT to distinguish it from the Navy's test, but subsequently called simply the GCT) was given to all entering service members due to its utility in sorting initial entrants into the military. By the end of the war, over 12 million men and women had taken this test. The GCT was designed to have a mean score of 100 and a standard deviation of 20 (standard IQ tests have standard deviations of 15). Those who took the test were placed in one of five categories, with Category I being those with the highest scores. In a 1946 *Science* article, one of the creators of the test, Walter V.D. Bingham, stated that the average score for college graduates was 130, which was the lower boundary for a test-taker to place in Category I.

The link between intelligence, as measured by the GCT, and military performance was systematically studied during World War II. Research found that enlisted soldiers in Category IV or V (those with GCT scores below 90) were not able to learn at the same pace as soldiers of average mental ability, and Special Training Units were established to prepare these men for basic training.[8] Studies undertaken in World War II showed that the GCT was a powerful tool for predicting officer performance as well. In World War II, enlistees in the army without a college degree who scored above 110 on the GCT were considered for Officer

[8] Bingham (1947).

Candidate School (OCS), which was used to train and screen potential officers (those with a four-year college degree could be commissioned without taking the GCT). A candidate's GCT score was found to be highly correlated with his success in OCS.[9] In fact, there was much debate about whether 110 was a sufficiently high minimum score for enlistees to enroll in OCS since most of the failures at that school were from candidates who scored between 110 and 115.[10]

The GCT had been replaced by the Armed Services Vocational Aptitude Battery (ASVAB) by the time the All-Volunteer Force (AVF) began in 1973 for all branches of the services. Out of all the services, the GCT is only still administered in the Marine Corps, and there only to officers. The GCT was found to be highly predictive of a success at The Basic School, a six-month training course that all new Marine officers take at Quantico, Virginia.[11] While the importance of the GCT in deciding a young officer's Military Occupational Specialties has declined, those who take it continue to treat it as a serious and important requirement.[12]

All candidates to become officers in the Marines, except those coming from the Naval Academy, must complete Officer Candidate School (OCS) in Quantico, Virginia, as well as completing a four-year Bachelor degree.[13] There are several

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[9] Palmer (1948).
[10] The minimum score for Marine Officers in World War 2 was 120: (Nalty and Moody, 1970)
[11] Stoloff (1983).
[12] Anecdotally, one of the authors can attest to the seriousness with which it was taken when he was a lieutenant at The Basic School in 2009; it is hard to find a group of young people quite as earnest and competitive as new Marine lieutenants.
[13] Graduates of the Naval Academy typically represent around 15% to 20% of each year's group of new Marine officers.

programs that may take an aspiring officer candidate to OCS, such as the Reserve Officer Training Corps (ROTC) or the Platoon Leader's Class (PLC).

OCS represents the primary screening tool for Marine officers, with grades determined through a combination of physical fitness, academic, and leadership evaluations. There is usually a 40% attrition rate at OCS. Failure is not often due to academic evaluations; in fact, academic talent is not a good predictor of success at OCS.[14] Rather, most failures come from orthopedic injuries that arise because of the physical intensity of the course, or from failures to exhibit leadership.[15] Those candidates that successfully complete OCS are commissioned as second lieutenants upon receipt of their Bachelor's degree (or upon completion of OCS if they already have their degree). One could offer a simple formula for creating a Marine officer in the years of the AVF: OCS completion + 4-year Bachelor's degree = an officer.

After commissioning, all Marine officers go to a six-month course called The Basic School (TBS) in Quantico, Virginia. Newly-commissioned lieutenants attending The Basic School learn infantry tactics and general knowledge about the Marine Corps. It is here that lieutenants take the GCT, at a consistent time in their careers and in a consistent environment (as opposed to, say, being administered by a recruiter in varying conditions). The Basic School is an

[14] Stoloff (1983).

[15] If a candidate fails five academic tests, then they are supposed to fail the course. According to Stoloff (1983), however, this rarely happens. Anecdotally, when one of the authors was at OCS, a few candidates failed five tests but were prevented from being kicked out by instructors who placed a high value on physical fitness. A similar result has been found for Army Officer Candidate School (Allen, Bynum, Oliver, Russell, Young, and Babin (2014).

academically intense experience, and success there is strongly predicted by a lieutenant's score on the GCT.[16]

The GCT provides a valuable source of consistently normed test data; unlike the ASVAB, which is normed every 15-20 years, and the SAT, for which there are many different versions given every year, the data from the GCT can be compared across years because the questions remain the same and the scores are not re-normalized. Along with consistency, another reason to consider the GCT is relevance. According to the 2009 version of the Marine Corps Order on Testing, "…the GCT is generally used as a metric for measuring the intellectual health of the officer corps." [17] The intellectual health of junior officers is especially important in the military because there is no lateral entry into mid-level management positions and there is an "up or out" promotion system. This means that the military pays a premium in order to attract especially high quality junior officers, as the most senior leaders in twenty years must be chosen from amongst them.[18] Additionally, it has been shown that more intelligent officers themselves benefit more from the mentoring of successful senior officers.[19] If the 'intellectual health' of new officers suffers, it affects the military not just in the short term, but for a long time. In the next section, we investigate the evolution of this health over the past 35 years.

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[16] Stoloff (1983)
[17] Marine Corps Order 1230.5B: Classification Testing, 4
[18] Asch and Warner (2001).
[19] Lyle and Smith (2014).

III. GCT Scores, 1980 to 2014

We received data on the GCT scores of all officers at The Basic School from Fiscal Year 1980 to Fiscal Year 2014 through a Freedom of Information Act (FOIA) request to the Marine Corps.[20] The data we obtained (over 46,000 observations) included only the test scores, with no other individual-level information, for reasons of privacy. As we show in this section, there was a statistically significant decline in these scores over time and the magnitude of the change is relevant given the distribution of the scores.

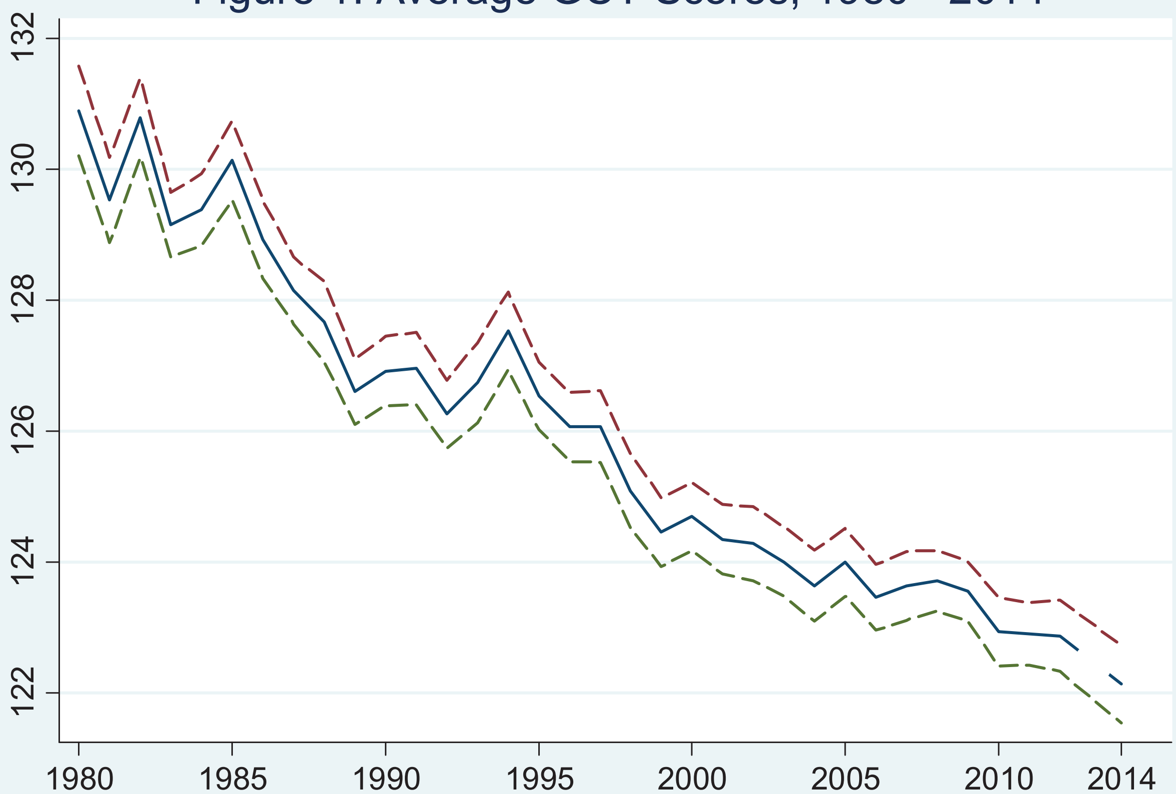
Table 1 presents statistics for the mean, standard deviation, range and number of observations for every fifth year of the sample, beginning with 1980, and including the information from the last year for which we have data (2014) as well. The table shows a steady decline in the average test scores. Figure 1 presents the mean GCT score along with the 95 percent confidence interval of the mean for 1980 to 2014. The figure shows that the decline in the mean was not monotonic, but the general downward path is evident. The average annual rate of decrease during this period was 0.19 percent per year, giving a cumulative change of 6.6 percent. This corresponds to a decrease in the average GCT score of 8.2 points, which is 80 percent of the standard deviation of the 46,341 observations.[21]

[20] We received only 272 observations for 2013 (which is roughly the size of one class of TBS), a year in which, according to the Marine Corps Times, over 1,400 Marine officers joined the Corps (to put this in context, we have 1,320 observations for 2012). In the analysis that follows, we do not use the 2013 observations.

[21] In response to a separate FOIA request (DON-USMC-2014-009339), Marine Corps Recruiting Command provided the average SAT scores of new officers from 2005-2014 (the average SAT scores for officers before 2005 are not available). According to the scores provided, the average SAT for new Marine Officers is well above the average SAT for college bound high-school seniors; for example the average for officers in 2014 was 1,200, as

Table 1: GCT Scores, Statistics for Selected Years					
Year	Mean	St. Dev.	Min.	Max.	No. of Obs.
1980	130.9	10.5	95	160	963
1985	130.1	10.8	90	158	1357
1990	126.9	9.9	84	157	1448
1995	126.5	9.5	95	158	1417
2000	124.7	9.5	94	154	1372
2005	124.0	9.5	91	155	1396
2010	122.9	9.9	94	151	1473
2014	122.1	9.6	91	151	1080
Statistics for General Classification Test data described in text.					

Figure 1: Average GCT Scores, 1980 - 2014



compared to the overall average of 1,010 for college-bound high school seniors. This is consistent with the result in 1980, as reported by Stoloff, when the average SAT for Marine officers was 1,050, as compared to 860 overall.

The means and standard errors of the means presented in Figure 1 suggest that there was a significant decline in the average GCT score over time. Table 2 confirms this. The statistics reported in this table represent t-tests of the differences in means in 1980, 1990, 2000 and 2010. These differences increase with the difference in years, and are significant at better than the 99 percent level of confidence for each ten, twenty and thirty year interval presented in this table.

Table 2: Differences in Means of GCT Scores; t-tests				
		1990	2000	2010
1980	Δ	3.97**	6.19**	8.00**
	(s.e.)	(0.42)	(0.42)	(0.42)
1990	Δ		2.22**	4.03**
	(s.e.)		(0.37)	(0.37)
2000	Δ			1.80**
	(s.e.)			(0.37)
Δ represents difference in means between earlier year (column) and later year (row). Standard error of difference in parenthesis. ** Significant at 99 percent level of confidence or higher.				

Figure 2 illustrates the change in the distribution of GCT scores in 1980, 1990, 2000 and 2010. This figure shows a steady leftward shift in the kernel distribution of scores across the decades. The Kolmogorov-Smirnoff test allows us to consider whether these distributions significantly differ across time.[22] The D-statistics for these tests, and the associated p-values, are provided in Table 3. The statistics in this table show that, in fact, there is a significant difference in the distribution between each ten-year period, as well as between the longer periods (1980 vs. 2000, 1980 vs. 2010, and 1990 vs. 2010). Thus, the distributions of test

[22] The Kolmogorov-Smirnov test generates the D-statistic that can be used to test whether two distributions are statistically distinct, with larger values of this statistic associated with lower p-values for the null hypothesis that the two distributions are not different.

scores, as well as their means, exhibit a decline decade-by-decade. In the next section, we investigate possible causes of the decline in average annual GCT scores.

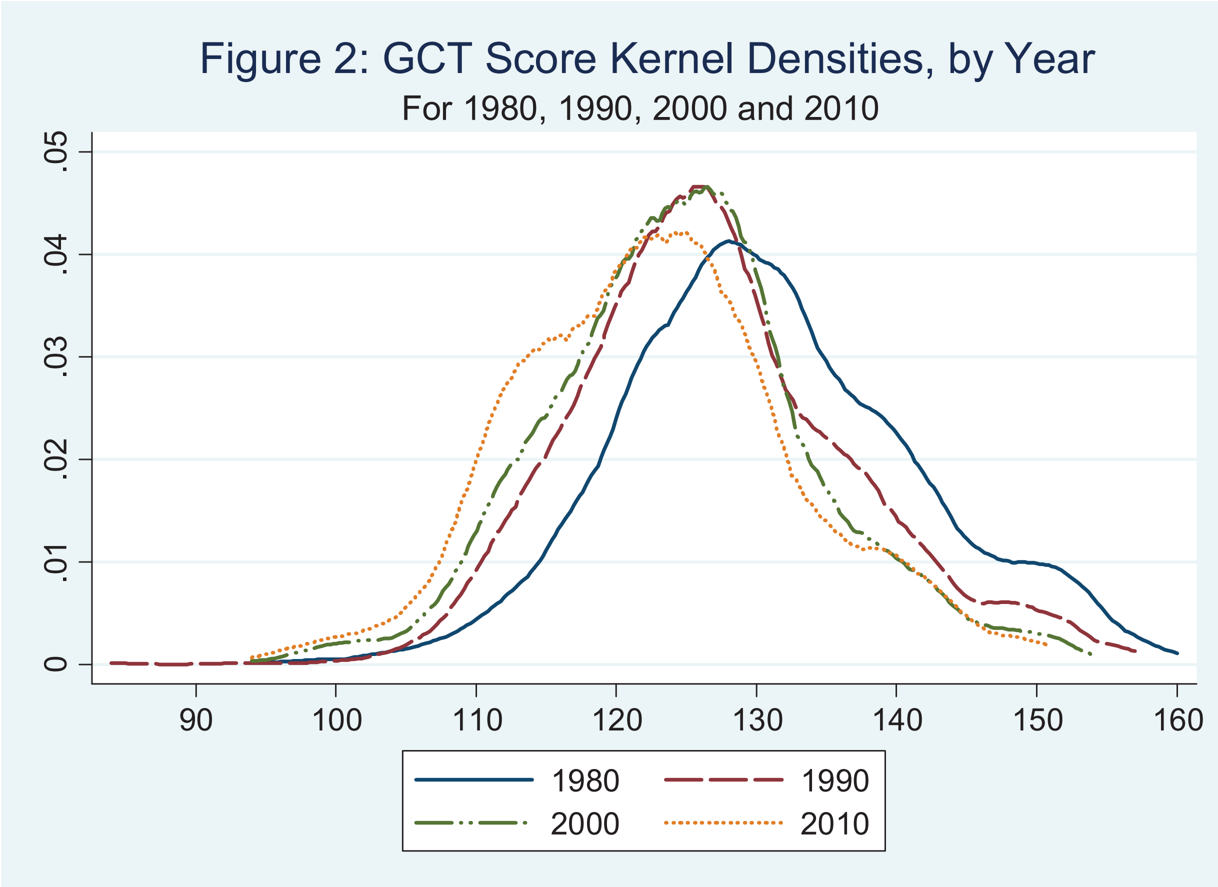


Table 3: Differences in Distributions of GCT Scores; Kolmogorov-Smirnov tests				
		1990	2000	2010
1980	K-S	0.203**	0.269**	0.335**
	(p-value)	(0.00)	(0.00)	(0.00)
1990	K-S		0.080**	0.159**
	(p-value)		(0.00)	(0.00)
2000	K-S			0.092**
	(p-value)			(0.00)
K-S is Kolmogorov-Smirnov test of differences in distributions between earlier year (column) and later year (row), with associated p-value given in parentheses. ** Significant at 99 percent level of confidence or higher.				

IV. Determinants of GCT Scores

The decline in the average GCT scores documented in the previous section raises the questions of the sources of this change. In this section we address this point by regressing the average value of the GCT score in each year against a variety of variables observed at an annual frequency.[23]

The basic framework for our analysis is one that draws on the institutional features discussed in Section II. In particular, in the period under study, officer candidates must have completed a four-year college degree and, to have progressed to the point to attend The Basic School and take the GCT, the candidates must also have completed Officer Candidate School. As mentioned above, attrition from Officer Candidate School is typically due to physical limitations or injuries, not due to a lack of intellectual ability that would be reflected in the GCT. While there has been much written about the effect of military demographics and the GI Bill on college participation,[24] college participation also might have an impact on military demographics. The key point is that the pool of those attending and completing college has increased dramatically over time, increasing the pool of potential officer candidates. If the expansion of this pool over time is biased towards increasing those who were less well-suited for higher education, then the average intellectual ability of college graduates will decrease over time. This will be reflected in a decrease in the average GCT score over time if there is not a preliminary selection

[23] Ideally, we would have liked to have used information on individuals in order to use a panel data set but, as mentioned above, privacy concerns meant that we only had individual-level GCT scores in each year rather than these scores along with any individual-level characteristics.
[24] For example, see Bound and Turner (2002).

by the Marines towards those with higher intellectual abilities; and, as we have discussed, OCS does not primarily select or retain based on intellectual ability.

To illustrate this point, we begin with a highly stylized model. For simplicity, consider a situation where the range of intelligence of potential college students follows a uniform distribution bounded by the values L and U. Suppose that the most intelligent potential students go to college but, over time, the college population rises.[25] If the lower bound of those going to college is $L_C > L$, then the mean intelligence of college students is $(U + L_C)/2$ and the proportion of those going to college is $(U - L_C)/(U - L)$. If there is an increase in the proportion of college attendees to $(U - L_C')/(U - L)$ where $L < L_C' < L_C$, then the average intelligence of college attendees decreases to $(U + L_C')/2$ which is less than $(U + L_C)/2$. If the pool of those wanting to become Marine officers is representative of the pool of college attendees, and if there is a positive, monotonic relationship between intelligence and GCT scores, then the expansion of the pool of college students will be associated with lower average GCT scores.[26]

In an effort to test the basic message of this framework, we first investigate the potential link between college participation and the GCT scores by estimating the regression

$$(1)\ \ln(\overline{GCT_t}) = \beta_0 + \beta_C \ln\left(\frac{1}{4}\sum_{i=t-2}^{t-5} C_i\right) + \varepsilon_t$$

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[25] By some calculations, around 85% of the Americans in the upper quartile of intelligence went to college by 1980. See Herrnstein and Murray (1994), p. 34.

[26] It is straightforward to extend this framework along several dimensions, for example, by allowing for a change in the upper bound as well or for allowing some type of selection into the pool of potential officers that is not completely neutral with respect to the size of the pool. With reasonable assumptions, these modifications would not alter the main conclusion on the link between the size of the pool of college attendees and the average GCT score.

where $\ln(\overline{GCT_t})$ is the logarithm of the average GCT score in year t and C_i is the college participation rate of those between 18 and 24 years old, so the regressor, $\ln\left(\frac{1}{4}\sum_{i=t-2}^{t-5} C_i\right)$, is the logarithm of the average value of the college participation rates capturing the experiences of those who, in year t, are between 20 and 29 years old.[27] Based on the discussion above, we expect $\beta_C < 0$.[28]

The first column of Table 4 presents the estimate of Regression (1). The coefficient on college participation is negative and significant at better than the 99 percent level of confidence. The goodness of fit is also very large, with an R^2 statistic of 0.92. Figure 3 illustrates these results, plotting the observations and the regression line. We calculate the quantitative relevance of this estimated effect by considering the proportion of the change in the GCT explained by the rise in the college participation rate. The estimated cumulative change in the college participation variable over the 35 years is 52 percent. The estimated effect of college participation on the GCT is the product of this number and $\widehat{\beta_C}$. The

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[27] The proportion of young people who have completed college, rather than those attending college, would be a preferable regressor, but these data are not available.

[28] According to the College Board, the mean SAT scores for college bound high school students has remained relatively constant since 1980, even after adjusting the scores for score recenterings. There is some debate on this point, especially after the 1995 recentering. See for example 'Educational Reform: 1994-1995', Educational Excellence Network, 1995. The result presented in this paper would also be in line with a large meta-analysis of IQ tests in North America, which suggested that IQ declined when controlling for education during the time period studied. See Uttl and Van Alstine (2003).

Table 4: Annual Average GCT, College Participation, Labor Market Factors,and Other Potential Covariates					
	I	**II**	**III**	**IV**	**V**
ln(College)	-0.121**	-0.113**	-0.120**	-0.121**	-0.112**
(s.e.)	(0.0062)	(0.0061)	(0.0062)	(0.0074)	(0.0071)
ln(MilitaryPay/CivilianPay)		0.049*			0.055*
(s.e.)		(0.021)			(0.024)
ln(Participation Rate)		0.070			0.013
(s.e.)		(0.121)			(0.170)
ln(Unemployment Rate)		-0.003			-0.005
(s.e.)		(0.006)			(0.007)
ln(Number)			-0.0088		-0.0084
(s.e.)			(0.0062)		(0.0071)
ln(Dummy2003-08)				-0.00069	-0.0003
(s.e.)				(0.0028)	(0.0033)
R^2	0.92	0.94	0.93	0.92	0.94
No. of Obs.	34	30	34	34	30

Dependent variable is natural logarithm of annual average of GCT scores.
Samples: 1983–2012 (if obs = 30) or 1980–2014 (if obs = 34, 2013 dropped)
College is two-year lagged MA(4) of college participation among 18 – 24 y.o..
Participation rate and unemployment rate are for 25 – 29 y.o., lagged one year.
MilitaryPay/CivilianPay is ratio of Military to equivalent Civilian pay.
Number is Number of Officer Recruits in each year.
Constant included in each regression, but not reported.
Significant at 95% level = *; Significant at 99% level = **

estimated effect of an increasing college participation rate is 96 percent of the actual percentage change in the GCT over this period.

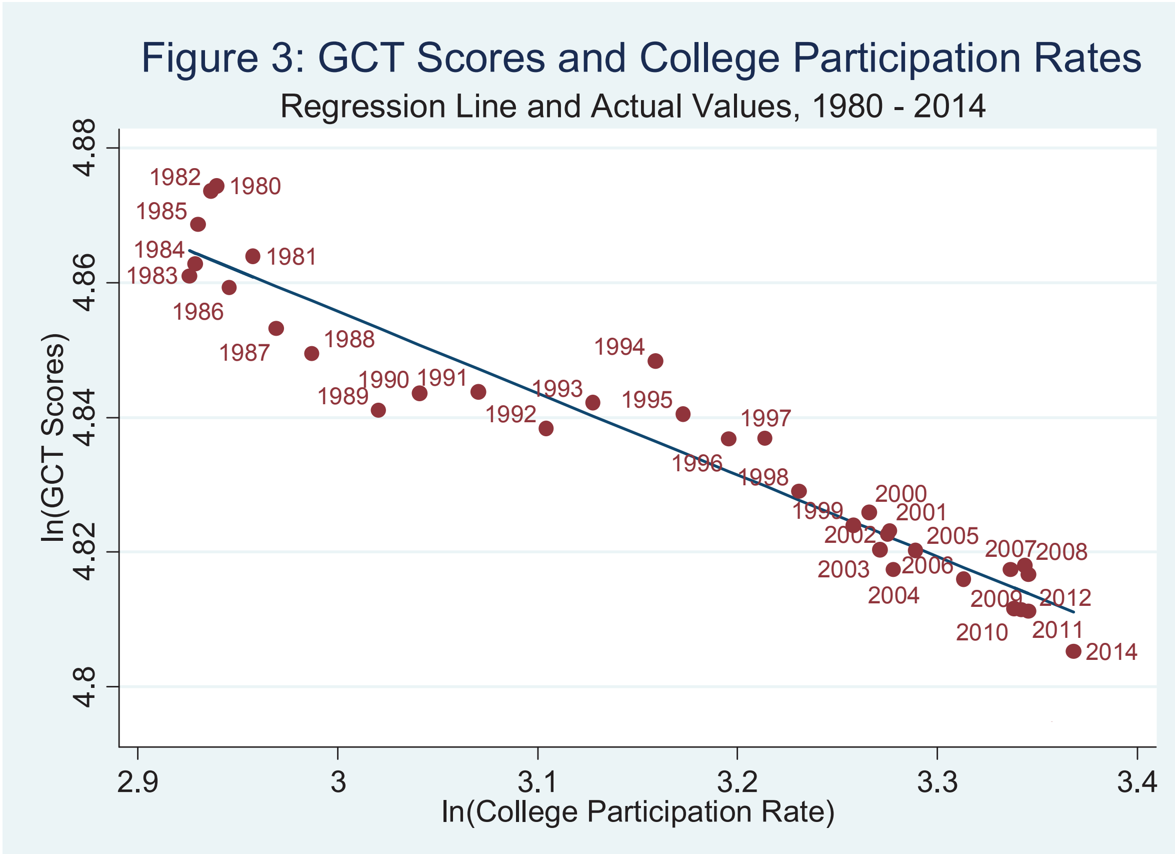

Figure 3: GCT Scores and College Participation Rates

The other columns of Table 4 show the robustness of the effect of college participation rates on the annual average GCT scores while controlling for other factors. Column II presents a regression that includes labor market factors. The relative pay of young military officers to that of civilians of similar educational attainment and age is expected to have a positive coefficient, since higher pay makes a military career more attractive to those who might otherwise chose a civilian path. We do find that there is a statistically significant effect of this variable on the annual average GCT score. The other two variables in this regression measure broad labor market conditions, the unemployment rate for those aged 25 to 29 and the labor market participation rate for this age group.[29] The expected sign of the coefficient on the unemployment rate is negative if a weaker civilian labor market makes a military career more attractive to college graduates who cannot otherwise find a job. The participation rate is included to control for the possibility that, say, a decrease in the unemployment rate is just reflecting a decrease in labor market participation. The coefficient on the participation rate would be negative if a higher participation rate indicates a more vibrant civilian job market and a more limited pool of potential military officers. The coefficients on these two variables are not significant in the estimates presented in this table but, as we will see, they are statistically significant in a subsequent regression presented in the next table that include other regressors.

The estimates presented in Columns III through V of Table 4 show the robustness of the effect of the college variable to the inclusion of other factors that have been suggested as potential contributors to the decline in the GCT scores over time. Column III presents a regression in which the logarithm of the number of recruits is included; the argument is that a larger number of recruits means a weaker pool. As shown by the results in this column, however, there is no evidence of this effect. The estimates in Column IV consider the hypothesis that an aversion to the campaigns in Iraq and Afghanistan led to lower GCT scores because of the effect of this war weariness on the pool of applicants similar to how it made

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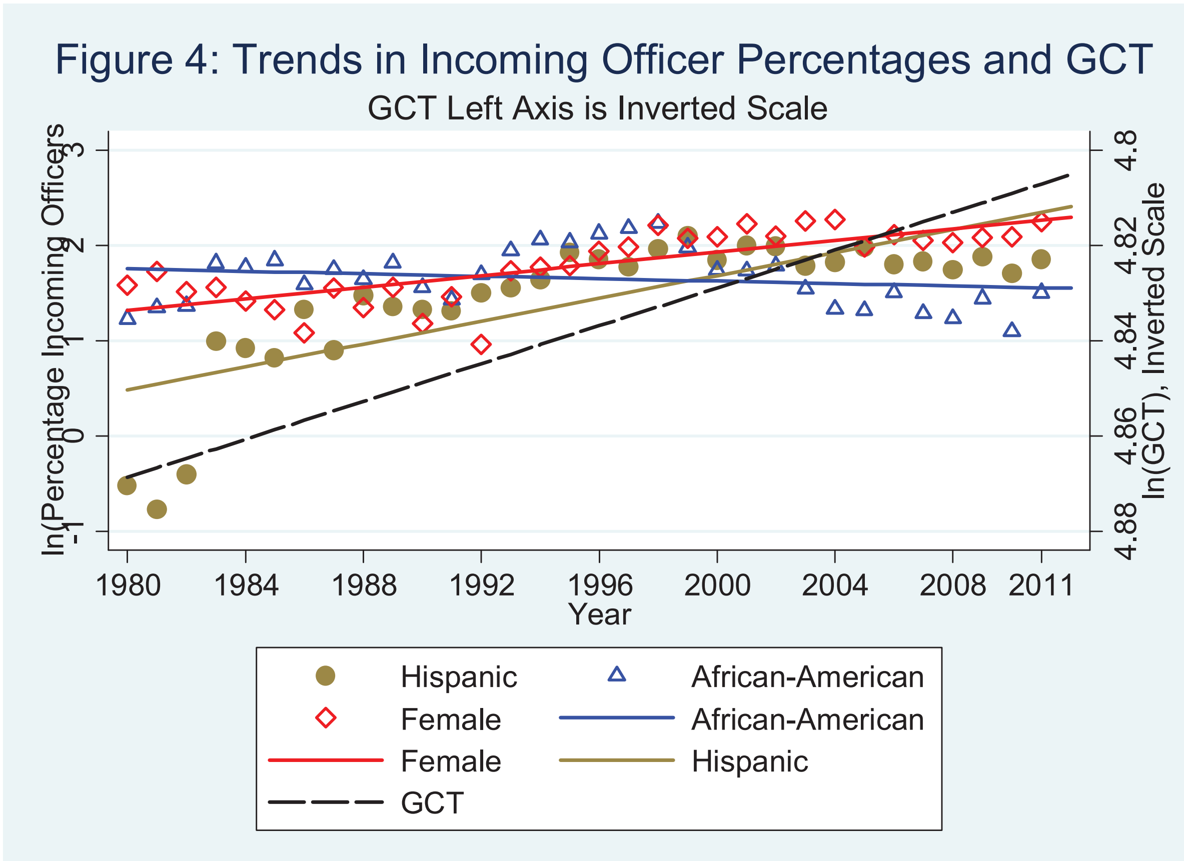
[29] Previous analyses of recruiting high-quality enlisted have focused on number of potential recruits, number of recruiters, unemployment, and the ratio of Civilian/Military Pay. See Murray, Michael, and Laurie McDonald. Recent Recruiting Trends and Their Implications for Models of Enlistment Supply. RAND, 1999.

recruiting high-quality enlisted more difficult.[30] Again, there is no empirical support for this proposition. Finally, in Column V we include all regressors. In this estimate, as well as in all others presented in this table, there is little change in the value or the statistical significance of the coefficient on college participation, suggesting that the change in college participation over this period is not serving as a proxy for any of these other factors.

We conclude this section by considering whether changing demographics of the pool of incoming officers has contributed to the downward trend in the GCT scores. Figure 4 presents the proportion of incoming officers who are African American, Hispanic, and Female over the period 1980 to 2011, with the respective estimated trend lines and, corresponding to an inverted scale on the right axis, the trend line for the GCT scores (the axes are presented as a logarithmic scale). This figure shows that there has not been a significant increase in the diversity of incoming officers with respect to the proportion of African American incoming officers over the 1980 – 2011 period. But there has been a statistically significant trend in the proportion of incoming officers who are female, and who are Hispanic. The proportion of incoming officers who were women almost doubled from about 4.9 percent in 1980 to 9.5 percent in 2012, with a statistically significant estimated annual average increase of 3.1 percent. The proportion of incoming officers who are

[30] Perry, William James. The U.S. Military under Strain and at Risk. Washington, D.C.: National Security Advisory Group, 2006.

Hispanic was less that 0.6 percent in 1980, and this rose to 6.4 percent in 2011, representing a statistically significant estimated growth rate of 6.0 percent.[31]



One way to test for the effect of increasing diversity on the average GCT scores is to simply augment the regression specification (1) with the logarithm of the proportion of incoming officers who are women, or who are African American or Hispanic (we estimate separate regressions for gender and for race and ethnicity because we do not have information by gender-race or gender-ethnicity groups and,

[31] This estimated rate of growth for Hispanic incoming officers is heavily influenced by the especially low values of incoming Hispanic officers in 1980, 1981 and 1982. The proportion of incoming Hispanic officers jumped from 0.7 percent in 1982 to 2.7 percent in 1983. Accordingly, the estimated growth rate from 1983 to 2011 is 3.4 percent, which is still statistically significant, but which is also only a little more than half as large as the estimated growth rate if the first three years of the sample are included.

therefore, there is overlap between the category of females and the categories of African American and Hispanic). If, in fact, the increasing diversity of the pool of incoming officers is contributing to the decline in GCT scores, then we would expect to find a negative and significant coefficient on these variables.

The estimates in Column I of Table 5 shows that there is not a significant relationship linking the higher proportion of women incoming officers to lower GCT scores; in fact, if anything, a higher proportion of incoming women officers is associated with a higher average GCT score (although this result is not significant at standard confidence levels since the p-value is 0.16). The college participation rate variable is still highly significant, and even larger than that reported in the columns of Table 4. The estimates in Column II show that the results of the effects of the proportion of women in the incoming class of officers, and the estimated contributions of women to the change in the average GCT scores over time, are little altered by the inclusion of regressors used in Table 3.

What is the magnitude of these effects? In the lower part of the table, we present the overall percentage change in the GCT over the sample period as well as the amount attributable to the factors included in the regression and the proportion of the overall change attributable to each of these factors.[32] These statistics show that, in the estimates presented in Columns I and II, the actual change in the GCT is smaller than the change attributed to the increase in the college participation

[32] As in the discussion of the contribution of the increased size of the college pool to the overall change in the GCT based on the estimates in Column I of Table 4, the percentage change attributable to each variable is calculated as the product of the change in that variable over the sample period and the respective estimated coefficient. The proportion of the overall change is this value divided by the percentage change in the GCT over the sample period.

rate. The estimated change due to the changing proportion of female incoming officers is actually positive, rather than negative.

Columns III and IV present this type of analysis for the proportion of incoming officers who are African-American and Hispanic. These estimates show that, as with the number of incoming female officers, there is a positive relationship between the number of incoming African-American officers and the average GCT score and, unlike the case with incoming female officers, this estimated effect is statistically significant (at better than the 99 percent level of confidence). Conversely, the estimated effect of the proportion of incoming Hispanic officers and the average GCT score is negative and statistically significant.[33] The lower panel shows that the preponderance of the change in the GCT score is attributable to the increased size of the pool of college students. The estimated change in the GCT score due to the changing proportion of incoming African-American officers is only 3% - 4% of the actual change. In contrast, there is a relatively substantial estimated effect attributable to the increased proportion of Hispanic officers; in the estimates in Column III, this is -1.8% (representing 29% of the total change in GCT scores over this period) and in Column IV it is -1.5% (representing 24% of the change in GCT scores). The estimated coefficient on the proportion of incoming

[33] Figure 4 shows that the growth rate of incoming Hispanic officers is heavily influenced by the low values in 1980, 1981, and 1982. An inspection of Figure 3 shows that the actual GCT values for these three years are greater than what is predicted by a simple bivariate regression, but not unusually so. In order to consider the sensitivity of the results in Column II to the inclusion of these three observations, we re-estimate this regression for the period 1983 to 2011. In a regression with same specification as in Column II, the coefficient on the logarithm of incoming Hispanic Officers is 0.009 and its standard error is 0.005, with a p-value of 0.12. Also, given the much smaller increase in the rate of growth of incoming Hispanic officers, the contribution of this effect to the change in the GCT is 15%(as compared to 29%). The estimated coefficient on the college population is a bit lower, but it is still highly significant and its estimated contribution to the change in the GCT rises from 67% (in Column II) to 73%.

Table 5: Annual Average GCT, College Participation and Gender, Race and Ethnicity				
	I	II	III	IV
ln(College)	-0.13**	-0.13**	-0.08**	-0.093**
(s.e.)	(0.01)	(0.01)	(0.009)	(0.012)
ln(Incoming Female)	0.007	0.005		
(s.e.)	(0.004)	(0.005)		
ln(Incoming Afr. Amer.)			0.012**	0.009*
(s.e.)			(0.003)	(0.004)
ln(Incoming Hispanic)			-0.010**	-0.007
(s.e.)			(0.002)	(0.006)
ln(MilitaryPay/CivilianPay)		0.075*		0.040
(s.e.)		(0.029)		(0.027)
ln(Unemployment Rate)		-0.012†		-0.007
(s.e.)		(0.006)		(0.006)
ln(Number)		-0.012†		-0.006
(s.e.)		(0.006)		(0.006)
R^2	0.92	0.94	0.96	0.96
Estimated Contributions to Percentage Change in GCT				
%ΔGCT	-6.4%			
%ΔGCT due to College	-6.8%	-6.9%	-4.2%	-4.8%
● % of total ΔGCT	107%	109%	67%	76%
%ΔGCT due to Female	0.7%	0.4%		
● % of total ΔGCT	-11%	-7.2%		
%ΔGCT due to Afr.Amer.			0.2%	0.2%
● % of total ΔGCT			4%	3%
%ΔGCT due to Hispanic			-1.8%	-1.5%
● % of total ΔGCT			29%	24%

Dependent variable is natural logarithm of annual average of GCT scores.
Sample: 1980–2011 (32 observations)
Incoming "X" is proportion of incoming class of officers that are "X"
College= two-year lagged MA(4) of college participation among 18 – 24 y.o..
Unemployment rate are for 25 – 29 y.o., lagged one year.
MilitaryPay/CivilianPay is ratio of Military to equivalent Civilian pay.
Number is Number of Officer Recruits in each year.
Constant included in each regression, but not reported.
Sig. at 95% level = *; Sig. at 99% level = **
† Sig. at 90% to 95% level of confidence

Hispanic officers is not significant in Column IV, however, but neither are the coefficients on any of the other regressors but for the college participation rate and the proportion of incoming African-American officers.

The relatively large estimated contribution of incoming Hispanic officers to the decline in GCT scores raises the question of the source of this effect. One possibility is that the main mechanism we consider, the increasing proportion of college students, is especially pronounced for Hispanics; over the sample period, the average annual increase in the college participation rate for Hispanics was 4.1 percent, as compared to 1.7 percent for the non-Hispanic population. We investigate this possibility by first defining the geometric average of the GCT score in any year as

$$GCT_t = (GCT_t^H)^{\alpha_t}(GCT_t^N)^{1-\alpha_t}$$

where GCT_t^H is the average GCT score for Hispanics in year t, GCT_t^N is the average GCT score for non-Hispanics in that year, and α_t is the proportion of incoming officers who are Hispanics in year t. It is worth noting, at this point, that the proportion of incoming officers who were Hispanic varied quite a bit over the sample period, rising from 0.6% in 1980 to a peak of 8.2% in 1999, and ending the sample period at 6.4%.

A version of Specification (1) that disaggregates college attendance into the Hispanics and non-Hispanics populations, and takes into account the changing proportion of incoming officers who were Hispanic, is

$$\ln(\overline{GCT_t}) = \theta_0 + \theta_H \, \alpha_t \ln C_t^H + \theta_N (1 - \alpha_t) \ln C_t^N + \varepsilon_t.$$

The variables in the regression are the product of the proportion of incoming officers who are Hispanics, α_t, and the proportion of Hispanics who are in college, C_t^H, and the corresponding variables for non-Hispanics, $1-\alpha_t$ and C_t^N. We can use the results from this regression to estimate the contribution of the incoming Hispanic officers to the GCT in each year relative to the variation in the GCT, $\widehat{P_t^H}$, by calculating

$$\widehat{P_t^H} = \frac{\widehat{\theta_H}\,\alpha_t \ln C_t^H}{\ln(GCT_t) - \widehat{\theta_0}}$$

and a comparable estimate for the non-Hispanic population, $\widehat{P_t^N}$, is

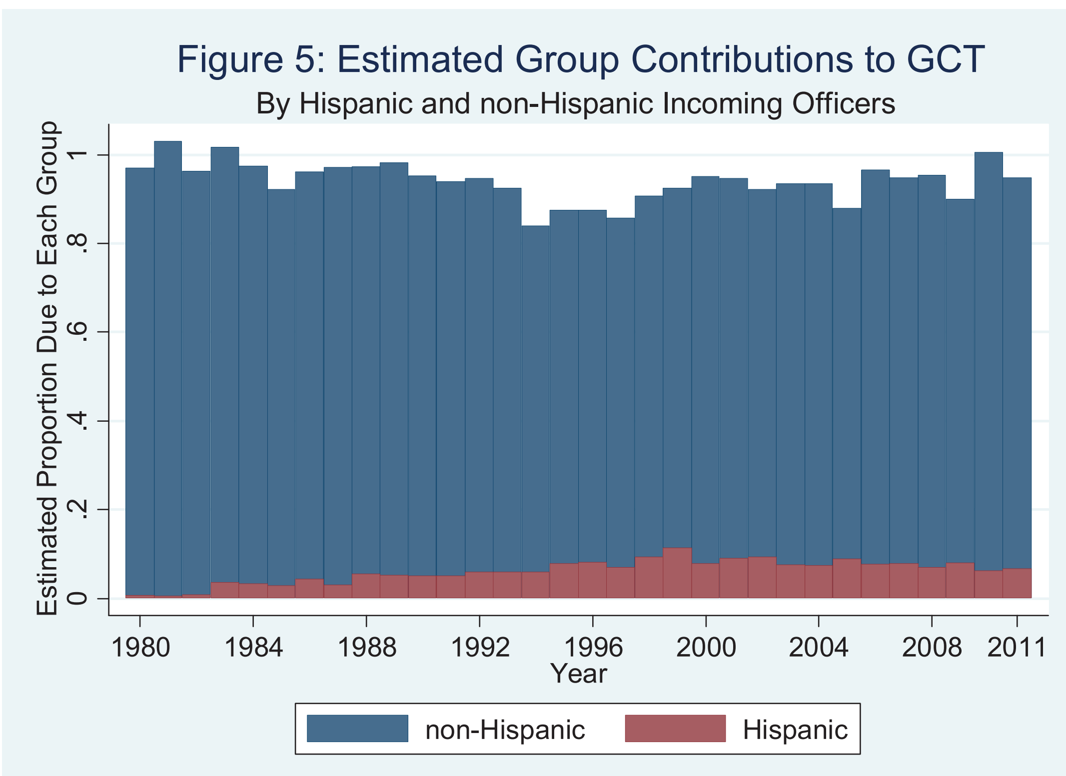
$$\widehat{P_t^N} = \frac{\widehat{\theta_N}(1-\alpha_t)\ln C_t^N}{\ln(GCT_t) - \widehat{\theta_0}}.$$

We present the estimate of this regression, and $\widehat{P_t^H}$ and $\widehat{P_t^N}$, in Column I of Table 6. As shown in that Column, the estimated coefficient $\widehat{\theta_N}$ is very significant, but the coefficient $\widehat{\theta_H}$ is no longer significant at the 95 percent level of confidence. More telling, the average value for $\widehat{P_t^H}$ is 0.06 while that of $\widehat{P_t^N}$ is 0.94. This is illustrated in a year-by-year basis in Figure 5 which plots bars whose heights represent the estimated contribution of Hispanics (red bars) and non-Hispanics (blue bars) for each year.

We conclude this section by considering a model that nests both the regression presented above, in which the contribution of incoming Hispanic officers to the GCT is through the change in the proportion of incoming officers and the proportion of Hispanics attending college, and a model in which there is some Hispanic-specific effect on the GCT scores unrelated to these changing proportions.

Table 6: Annual Average GCT Effects Due Hispanic and Non-Hispanic Officers		
	I	II
$\ln(\text{College}^{\text{HISPANIC}})\times\alpha$	-0.109**	-0.105**
(s.e.)	(0.009)	(0.009)
$\ln(\text{College}^{\text{NON-HISPANIC}})\times(1-\alpha)$	-0.069†	-0.100†
(s.e.)	(0.038)	(0.038)
ln(Incoming Hispanic)		-0.003
(s.e.)		(0.004)
R^2	0.92	0.92
Average $\widehat{P_t^H}$	0.06	0.06
Average $\widehat{P_t^N}$	0.94	0.94

Dependent variable is natural logarithm of annual average of GCT scores.
Sample: 1980–2011 (32 observations)
$\ln(\text{College}^{\text{HISPANIC}})\times\alpha$ is Proportion of Hispanics 18 – 24 in college time proportion of incoming officers who are Hispanic (and respectively for Non-Hispanic)
Incoming Hispanic is proportion of incoming class of officers who are Hispanic
Constant included in each regression, but not reported.
Sig. at 95% level = *; Sig. at 99% level = **
† Sig. at 90% to 95% level of confidence



This model combines the regression specification above with one in which there is a Hispanic-specific effect,

$$\ln(\overline{GCT_t}) = \gamma_0 + \gamma_1 \alpha_t + \varepsilon_t$$

to give us the specification that nests both possibilities,

$$\ln(\overline{GCT_t}) = (\theta_0 + \gamma_0) + \gamma_1 \alpha_t \; + \theta_H \, \alpha_t \ln C_t^H + \theta_{NC}(1 - \alpha_t) \ln C_t^N + \varepsilon_t.$$

Column II of Table 6 presents the estimate of this regression. The coefficient $\widehat{\theta_H}$ is not significant at the 95 percent level of confidence (the p-value is 0.102), the coefficient $\widehat{\theta_N}$ is significant at better than the 99 percent confidence level and the coefficients $\widehat{\theta_H}$ and $\widehat{\theta_N}$ are virtually identical, suggesting no difference in the contribution of Hispanics and non-Hispanics to the GCT score. This implication of the similarity in these two coefficients is bolstered by the insignificance of the coefficient on incoming Hispanic officers, γ_1 (the p-value of this estimated coefficient is 0.51). Thus, these results show no evidence that the proportion of incoming officers who are Hispanic plays any meaningful role in the average GCT scores in any year.

IV. Conclusion

Twenty percent of the United States federal budget goes towards funding the American military[34] and it is one of America's most trusted institutions.[35] Yet despite the intense scrutiny of the enlisted force quality and composition, there has been little study of the quality of the officer corps. This paper analyzed the quality of the officers of one branch of the military, the Marine Corps, and found a relevant and steady decline in intelligence, as measured by GCT scores, since 1980. This decline was closely associated with an expansion of the pool of young college graduates during the same time period, which potentially diminished the overall intellectual quality of that pool.

Our results also support those who argue that affirmative action has not had a negative impact on the quality of the officer corps. The Marine Corps has, since the 1990's, actively recruited African-American officers, and there has been some debate on whether this is harmful to overall officer quality.[36] A similar debate has played out recently about the recruitment of women. We find, in fact, a positive association between African-American officers and mean GCT score, perhaps because recruitment efforts by the Marine Corps have attracted minority officers who are more qualified than the typical college graduate. There is no evidence that a greater proportion of incoming Hispanic officers reduces the annual average GCT scores for any reasons other than those identified for the non-Hispanic group and

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[34] Plumer (2015).
[35] Gronke and Feaver (2001).
[36] See Strotman (1993) and Harrington (1993). For a counter argument, see Peele (1993).

furthermore, given the small proportion of incoming Hispanic officers, this effect has no meaningful quantitative contribution to the change in GCT scores over time. Overall, then, this study rebuts the often tacit assumption that minority officers are less qualified than their counterparts.

What has been the impact of this drop in quality on the effectiveness of the military? Answering this question is beyond the scope of this paper. Given the myriad studies associating performance with intellect, however, it is hard to imagine anything other than a seriously deleterious impact on the quality of officers and, by extension, on the quality and efficacy of the military.

Data Sources

- GCT Data: Freedom of Information Act Request DON-USMC-2014-010501, Submitted September 3, 2014 to Marine Corps Training and Education Command, Marine Corps Base Quantico, Fulfilled 16 January, 2015.
  - Data is sorted by fiscal year, instead of calendar year
  - Comparing the number of valid scores we received with the number of Marine Officers who were commissioned in each year according to the annual Personnel Readiness Reviews, it appears that we received the scores of around 90% of the officers.
  - Erroneous scores of 0 were deleted
  - Those scores below 80 were deleted as unlikely
  - 96 members of the third TBS class of 2004 was assigned a score of 100, which must be erroneous; in 2003, for example, only 3 officers received a 100 out of the entire year. It would appear that the scores of two platoons in the third TBS class of 2004 were lost and a default value of 100 was entered. All values of 100 from the third TBS class of 2004 were therefore deleted. If anything, this means that we are missing a few officers who really did score 100 in that year.
  - While all values from 2014 were received, there were only 272 values reported in 2013 (corresponding to one class of TBS). According to the Marine Corps Times, over 1400 Marine officers joined that year, a normal amount. We are therefore missing over a thousand scores from that year, making it suspect.
- College Participation Rate: This is percentage of 18-24 year-olds enrolled in a 4-year degree-granting institution, from Table 302.60 from the National Center for Education Statistics. The table was prepared on May, 2013, from the Census Bureau's Current Population Survey (CPS) data.
- Unemployment rate: Unemployment rate for those 25 to 29 years old. Bureau of Labor Statistics See http://data.bls.gov/cgi-bin/srgate
- Incoming Female: The percentage of incoming Marine officers who are female, by Fiscal Year, from the Department of Defense's 'Population Representation in the Military Services' report, available here http://prhome.defense.gov/RFM/MPP/AP/POPREP.aspx(the most recent available report is from 2011).
- Incoming African American: The percentage of incoming Marine officers who are African American, by Fiscal Year, from the Department of Defense's 'Population Representation in the Military Services' report
- Incoming Hispanic: The percentage of incoming Marine officers who are Hispanic, by Fiscal Year, from the Department of Defense's 'Population Representation in the Military Services' report

- College Hispanic: In order to calculate what percentage of 18-24 year-olds in college each year were Hispanic, we used CPS data; specifically Table A-5a, The Population 14 to 24 Years Old by High School Graduate Status, College Enrollment, Attainment, Sex, Race, and Hispanic Origin: October 1967 to 2013, available here: http://www.census.gov/hhes/school/data/cps/historical/

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