Evaluating the Impact of the Post-9/11 GI Bill on Veterans' Graduate School Enrollment

Liang Zhang
Department of Administration, Leadership, and Technology
Steinhardt School of Culture, Education, and Human Development
New York University

Liang Zhang is a professor of higher education at NYU Steinhardt School of Culture, Education, and Human Development. His research focuses on higher education economics, finance, and public policy, particularly on the role of governments and institutions in affecting institutional performance and student outcomes. This project is funded by the AccessLex Institute / AIR Research Program; however, all views expressed in this article are those of the author. Address queries to Zhang at 82 Washington Square East, Pless Hall, Rm 779, New York, NY 10003-6674; email: lz65@nyu.edu

Abstract

In this study, I use data from the American Community Survey, Current Population Survey, and National Postsecondary Student Aid Study to examine the effect of the Post-9/11 GI Bill on veterans' graduate school enrollment. This analysis reveals that the Post-9/11 GI Bill has contributed to growth of veterans enrolled in graduate schools. On average, the increase is between 1.5 and 2 percentage points among veterans with bachelor's degrees. However, because a substantial proportion of veterans have attended graduate school without receiving veterans' benefits, the increase of 1.5–2 percentage points underestimates the effect of the Post-9/11 GI Bill on beneficiaries. Results of this study suggest a strong and significant effect of financial incentives on graduate enrollment among veterans.

Key words:

Post-9/11 GI Bill; graduate school enrollment; veterans' education benefits; financial aid

Evaluating the Impact of the Post-9/11 GI Bill on Veterans' Graduate School Enrollment

1. INTRODUCTION

Education benefits provided by the Post-9/11 GI Bill represent significant public investment and commitment to current and future veterans of the armed forces. Although effects of other federal subsidies such as the Pell Grant program and various loan and tax credit programs have been studied extensively, the implications and consequences of the Post-9/11 GI Bill remain underexplored. In light of the large empirical base showing that financial subsidies improve undergraduate college participation (Angrist et al., 2016; Castleman & Long, 2016; Dynarski, 2004; Goldrick-Rab et al., 2016; Zhang & Ness, 2010), only a few recent studies place an explicit focus on the Post-9/11 GI Bill (Barr, 2015; Zhang, 2018). Further, little is known about effects of education benefits on veterans' graduate school enrollment.

Knowledge growth and technological innovation have made graduate education a prerequisite for an increasing number of occupations. Mullen, Goyette, and Soares (2003) suggested that graduate education offers a fast track to the most prestigious and lucrative positions in the occupational distribution. A recent report by the Center on Education and the Workforce at Georgetown University estimated that approximately 11% of the estimated 55 million job openings between 2010 and 2020 would require a Master's degree or higher (Carnevale, Smith, & Strohl, 2013). Many fast-growing occupations in fields such as management, healthcare and education have the greatest volume of job openings for graduate degree holders. There might also be a credentialing aspect to this increasing value of graduate education: as access to college education becomes almost universal, many individuals are seeking to distinguish themselves from others through graduate education.

These two concurrent social contexts—the commitment to improving educational attainment for service members and veterans, and the increasing importance of graduate and professional education—make a strong case for conducting rigorous research to advance our understanding of the effect of the Post-9/11 GI Bill on veterans' graduate school participation. The analysis in this paper is guided by the following three research questions: (1) What is the overall impact of the Post-9/11 GI Bill on graduate school enrollment among post-9/11 veterans? (2) How does this effect vary across different demographic groups (i.e., age, sex, race/ethnicity)? (3) What is the proportion of veteran graduate students who receive veterans' education benefits, and at what levels? And how does this information assist in the interpretation of the effect of the Post-9/11 GI Bill on graduate enrollment?

This study contributes to the literature in several ways. First, the Post-9/11 GI Bill and the more recent Forever GI Bill represent significant public investment in and commitment to veterans who have served in the armed forces and those who will serve in the future. In a few recent studies, scholars have examined the effect of the Post-9/11 GI Bill on undergraduate college participation; however, little (if anything) is known about how the bill might be affecting graduate school attendance. Although holding a graduate degree does not guarantee career success, it qualifies individuals for a greater number of employment opportunities and increases their potential for career advancement. The Post-9/11 GI Bill supports veterans as they transition to civilian life and enhances their employment prospects. Understanding the effect of a policy of such magnitude on graduate school attendance will help policymakers address the evolving needs of future generations of veterans.

Second, this study extends the financial aid literature by not only investigating the overall impact of the Post-9/11 GI Bill on veterans' graduate school attendance, but also delving into

potentially heterogeneous impacts on veterans based on age, sex and race/ethnicity. For example, women hold many of the health care, administrative, intelligence, and supply officer positions in military service, many of which require college education. Consequently, women might be more likely to take the advantage of the Post-9/11 GI Bill to attend graduate school after they leave military service. Understanding the potentially heterogeneous effects of the GI bill across different subgroups will help colleges and universities provide better services to an increasingly diverse veteran population.

Third, while previous studies estimated the impact of the Post-9/11 GI Bill on college participation for veterans who served in the military in the post-9/11 era, these estimates might severely understate the enrollment effect for those who actually received education benefits if many veteran graduate students did not receive education benefits. In addition, not all beneficiaries received the full level of benefits allowed by the Post-9/11 GI Bill. To compensate for the lack of detailed financial information in the American Community Survey (ACS) and Current Population Survey (CPS), I supplemented the main analysis with data from a nationally representative sample of graduate students who participated in the most recent wave of the National Postsecondary Student Aid Study (NPSAS 2016) to probe the financial aid situations of veterans who attend graduate schools. This additional analysis facilitates a more accurate understanding and interpretation of the magnitude of the effect of the Post-9/11 GI Bill on graduate enrollment among veterans.

2. LITERATURE REVIEW

The current study is informed by two strands of research that have examined: (a) the effect of financial incentives—including education benefits under GI bills—on college enrollment; and (b) factors related to graduate school participation.

Effect of financial incentives on college enrollment

In the vast majority of studies on financial incentives, researchers have focused on undergraduate college education. Almost without exception, scholars have adopted a theoretical framework based on human capital theory, which posits that financial incentives improve college enrollment by reducing the cost side of the cost-benefit equation, making college participation favorable. Leslie and Brinkman (1987) and Heller (1997) reviewed early studies on student demand for higher education, confirming that as college tuition decreases, college enrollment rates increase. Recent studies on the effect of financial aid programs on college enrollment have further confirmed that financial subsidies improve college participation, although effects may vary across programs (Angrist et al., 2016; Castleman & Long, 2016; Dynarski, 2004; Goldrick-Rab et al., 2016; Long, 2004; Sjoquist & Winters, 2012). On average, an increase of $1,000 in financial aid improves the likelihood of college enrollment by 4 to 6 percentage points (Deming & Dynarski, 2010).

Studies on veterans' education benefits programs also have demonstrated positive enrollment effects. Bound and Turner (2002) found that the original GI Bill increased the amount of college completed by 0.23 to 0.28 year. Similarly, Simon, Negrusa, and Warner (2010) found that a $10,000 increase in education benefits under the Montgomery GI Bill (MGIB) improved its usage by about 5 percentage points. In a recent study on the effect of the Post-9/11 GI Bill, Barr (2015) found that the expansion in veterans' education benefits increased their college enrollment rate by approximately 5 percentage points immediately after the bill's adoption. Zhang (2018) considered a longer period of time and concluded that the Post-9/11 GI Bill has increased overall college enrollment by about 3 percentage points, with much larger effects immediately after the bill's adoption than in later years. While both Barr (2015) and Zhang

(2018) examined college education broadly to include both undergraduate and graduate education, no researchers have examined the effect of the Post-9/11 GI Bill on graduate enrollment specifically. The current study advances this line of research by examining the overall effect of the Post-9/11 GI Bill on graduate and professional education, as well as its potentially heterogeneous impacts based on age, sex, and race/ethnicity.

Factors related to graduate and professional education

Graduate education is an important stage of human capital accumulation, a prerequisite for many desirable and prestigious professions with great economic rewards and high social status. In recent decades, the earnings of highly successful professionals have increased sharply, sparking an increase in graduate and professional school enrollment. However, access to graduate education is not evenly distributed and is heavily influenced by a host of academic and non-academic factors. Academic factors such as undergraduate academic performance and college selectivity are significant predictors of graduate school enrollment. Simply put, students who graduate from more selective institutions and/or earn higher undergraduate GPAs are more likely to attend graduate and professional schools (Eide, Brewer, & Ehrenberg, 1998; English & Umbach, 2016; Ethington & Smart, 1986; McCormick, Nuñez, Shah, & Choy, 1999; Millett, 2003; Monks, 2001; Mullen, Goyette, & Soares, 2003; Tienda & Zhao, 2017; Zhang, 2005). Fields of study also matter (English & Umbach, 2016; Kim & Eyermann, 2006; Millett, 2003; Zhang, 2005). For example, English and Umbach (2016) found that students who majored in humanities, social or behavioral sciences, mathematics, or life and physical sciences were most likely to attend graduate school. Eagan et al. (2013) found that among STEM majors, participation in an undergraduate research program increased the likelihood of aspiring to attain a STEM graduate degree, but had no effect on interest in a non-STEM graduate degree.

Moreover, non-academic individual characteristics such as sex, race/ethnicity, and socioeconomic status have varying degrees of influence over graduate school aspirations and enrollment (Ethington & Smart, 1986; Tienda & Zhao, 2017; Zhang, 2005).

Among financial variables, undergraduate debt has been the focus of several studies (e.g., Kim & Eyermann, 2006; Malcom & Dowd, 2011; Millett, 2003; Zhang, 2013); however, findings are not unequivocal. While some researchers have found no statistically significant relationship between undergraduate debt and graduate school participation (e.g. English & Umbach, 2016; Monks, 2001), others have linked undergraduate debt to a decreased likelihood of graduate school participation. For example, Malcolm and Dowd (2012) found that cumulative undergraduate debt has a negative effect on graduate program enrollment in the STEM fields. Among students who previously indicated that they expected to earn a doctoral degree, Millett (2003) found a significant negative relationship between undergraduate debt and graduate school applications, but no relationship between debt and participation conditional on acceptance.

Beyond debt, other financial factors that have been linked to the pursuit of a graduate degree include family and personal income, undergraduate financial aid, graduate scholarship, and foregone income (Bettinger et al., 2016; Field, 2009; Millett, 2003; Scott-Clayton & Zafar, 2016; Zhang, 2005). Undergraduate scholarships have been shown to increase the likelihood of graduate school participation from aspirations to enrollment to completion (Bettinger et al., 2016; DesJardins & McCall, 2014; Myers & Pavel, 2011; Scott-Clayton & Zafar, 2016). Of course, these effects do not apply uniformly in all contexts. For example, in their analysis of Gates Millennium Scholarship recipients, DesJardins and McCall (2014) found no evidence that the scholarship increased the likelihood of graduate school enrollment immediately after college, despite significantly increasing PhD aspirations. Porter et al. (2014) examined the impact of a

randomly assigned, substantially larger scholarship on the probability of enrollment among a group of students admitted to a graduate school of education at an elite university. Their results do not support a positive matriculation effect.

In short, prior findings on determinants of graduate school attendance demonstrate that individual characteristics, academic characteristics, and financial factors all shape students' likelihood of enrolling in graduate school. However, there is little empirical research on the effect of graduate financial aid or education benefits on graduate school enrollment, including for veterans. This is a significant gap in the literature, given that veterans represent an important and growing population on college campuses.

3. Post-9/11 GI Bill and Graduate Enrollment Trend

The Post-9/11 GI Bill became law in June 2008 and went into effect in August 2009, providing education benefits for military members who have served on active duty since September 11, 2001. The main provision of the Post-9/11 GI Bill includes: (a) full tuition and fees at in-state public colleges, (b) a monthly housing allowance, and (c) up to $1,000 a year for books and supplies. These benefits are much improved over the MGIB, which paid a flat amount of about $1,400/month in 2008 and $1,857/month in 2017. However, the difference in average benefits between the Post-9/11 GI Bill and MGIB could be much smaller than the difference in full benefits. For example, in fiscal year 2017, the average amount of education benefits received by veteran students was $14,636 under the Post-9/11 GI Bill and $8,641 under the MGIB, a difference of $5,995 (U.S. Department of Veterans Affairs, 2018). The Post-9/11 GI Bill gained instant popularity after its adoption. In fiscal year 2017 alone, 755,476 veterans received education benefits under the Post-9/11 GI Bill totaling $11 billion (U.S. Department of Veterans Affairs, 2018).

The adoption of the Post-9/11 GI Bill has expanded the education benefits paid by the U.S. Department of Veterans Affairs. While the department offers a range of education programs including the Post-9/11 GI Bill, MGIB, Reserve Educational Assistance Program, Survivors and Dependents Educational Assistance, and Post-Vietnam Era Veterans Educational Assistance, the two largest programs by far are the Post-9/11 GI Bill and MGIB. (See Appendix A for a list of programs that offer education benefits.) In FY 2008, the year before the adoption of the Post-9/11 GI Bill, 70% of all education benefits were awarded under the MGIB (U.S. Department of Veterans Affairs, 2009). As the Post-9/11 GI Bill replaced the MGIB in 2009, its share rose quickly, accounting for 92% of all education benefits awarded in FY 2017 (U.S. Department of Veterans Affairs, 2018). Figure 1 shows an immediate and significant upswing in payments and beneficiaries associated with the Post-9/11 GI Bill and a gradual reduction in payments and beneficiaries associated with the MGIB since the implementation of the Post-9/11 GI Bill.

The growth in the number of beneficiaries is not even between undergraduate and graduate programs. Figure 2 shows the number of new beneficiaries of the MGIB and Post-9/11 GI Bill attending undergraduate and graduate programs (not including non-degree or vocational/training programs). While the absolute number of veterans attending undergraduate programs increased more than the number attending graduate degree programs, the *proportion* of veterans attending graduate programs increased significantly, from around 5% before 2009 to 15% after 2009. In recent years, there has been a decrease in the number of veterans attending both undergraduate and graduate programs; however, the proportion of 15% persisted.

The increase in the number of veterans attending graduate programs could be due to either an increase in the number of veterans with bachelor's degrees and/or an increase in the probability of veterans with bachelor's degrees attending graduate schools. Figure 3 shows the

number of post-9/11 veterans with and without bachelor's degrees by year based on estimates from ACS. During this period of time, the number of veterans without bachelor's degrees has nearly doubled, from 1.04 to 2.04 million, while the number of veterans with bachelor's degrees has nearly tripled, from 3.02 to 9.64 million. Figure 3 also shows a relatively stable flow of veterans into the population. There was a slight acceleration of veteran flows in 2009; however, this was unlikely due to the implementation of the Post-9/11 GI Bill that year. The bill's adoption could potentially increase the flow of veterans in two ways. First, education benefits may serve as an incentive to join the military. Under this scenario, the increased flow of veterans could occur a few years after the adoption of the Post-9/11 GI Bill because the average length of service for enlisted military personnel in recent years has been around 6.7 years. Second, the Post-9/11 GI Bill could have improved college attainment among veterans and increased the number of veterans with bachelor's degrees. Again, an increase in the flow of veterans with bachelor's degrees would take several years. Consequently, in this study I treat the flow of veterans with bachelor's degrees as given and focus on examining whether the education benefits provided by the Post-9/11 GI Bill have improved the probability of graduate school participation among veterans with bachelor's degrees.

4. DATA AND METHODS

Data and samples

This study takes advantage of multiple data sources to corroborate and inform each other. The main analysis is based on ACS data collected between 2005 and 2016. ACS collects detailed population and housing information every year based on a nationally representative sample of households. Since 2005, approximately 3 million individuals have been included in the public use file each year, accounting for about 1% of the U.S. population. Military members, including

veterans and active duty service members, represent about 7% of ACS samples, while post-9/11 military members account for about 1% of ACS samples. The four years preceding the adoption of the Post-9/11 GI Bill (i.e., 2005–2008) provide a reasonable pre-policy period to observe time trends for my treatment and comparison groups. Because the bill was implemented in August 2009 and because the ACS data were collected throughout the year, the year of 2009 traversed the pre- and post-policy periods. Therefore, the year 2009 is excluded from the pre- and post-policy comparison; however, it is included in estimates of year-by-year variations in enrollment effects.

For each ACS file, I extracted the following information: state of residence, place of birth, age, sex, race/ethnicity, educational attainment, level of school enrollment, military status, and for veterans, whether they served during Gulf War era (i.e., August 1990 to August 2001) or the post-9/11 era. In this study, I limited the sample to individuals born in the United States who were between 20 and 60 years old.[1] Because graduate school enrollment is the main dependent variable, I further limited the analytic sample to individuals with baccalaureate degrees. These restrictions resulted in a final analytical sample of approximately 4 million individuals, with over 60,000 post-9/11 veterans in the pooled sample between 2005 and 2016.

Data analyses based on ACS data are corroborated by a separate data source from CPS, a monthly U.S. household survey originally designed to measure labor market outcomes. The basic monthly survey includes a wide range of demographic and labor force variables similar to the ACS. In recent years, the CPS has collected data from 140,000 individuals in about 70,000 households each month. The basic monthly survey includes information on veteran status and the era in which veterans served. In addition to the basic monthly survey, data for some topical

[1] Relaxing the place of birth restriction does not change the results reported in this paper. The sample size of veterans over 60 years old is very small, and their college enrollment rates are very low.

supplements are collected annually. For example, the October supplement includes detailed school enrollment information. For each CPS October supplement survey, I extracted a set of variables similar to those in the ACS files and applied the same sample selection criteria. This process resulted in a final analytical sample of approximately 200,000 individuals, including around 2,500 post-9/11 veterans in the pooled sample between 2005 and 2016. These sample sizes are much smaller than the ACS. Because only October supplement surveys are used in the analysis, the year 2009 is classified as the post-policy period in CPS.

Because both ACS and CPS do not have information on education benefits received by veteran graduate students, I supplemented the main analysis with data from the NPSAS 2016. The NPSAS is a cross-sectional survey of nationally representative students attending Title IV postsecondary institutions during an academic year. The NPSAS contains comprehensive information on different types of financial aid from different sources, along with student demographic and enrollment data. Types of financial aid include grants, loans, work study, graduate assistantships, federal veterans' benefits, and military tuition aid, while sources include federal, state, institution, private, and outside sources. Although the NPSAS does not indicate the era in which a veteran served, the vast majority of veterans who received education benefits were beneficiaries of the Post-9/11 GI Bill (see Appendix A). Consequently, it is reasonable to assume that most of the veteran graduate students who received federal education benefits and participated in the NPSAS 2016 were covered by the Post-9/11 GI Bill. Alternatively, because federal law requires a minimum age of 18 (or 17 with paternal consent) for enlistment, those who served before 2001 were at least 32 years old. In other words, focusing on veteran students who are 32 or younger yielded an accurate sample of veteran students who served in the post-9/11 period.

Variables

Table 1 presents descriptive statistics for the main variables of this study based on ACS and CPS data. The proportion of post-9/11 veterans represents 1.48% of the final ACS and CPS analytical samples from 2005 to 2016 after applying individual weights. In both the ACS and CPS, *graduate school enrollment* is defined as attending graduate or professional schools at the time of survey, albeit with slightly different wording. In the ACS, graduate school enrollment is defined as an individual attending "graduate or professional school beyond a bachelor's degree," while in the CPS, it is defined as an individual attending either "first year of graduate school" or "second year or higher of graduate school." Likely due to this difference in measurement, the reported graduate school enrollment rate is slightly higher in the ACS than in the CPS. Table 1 indicates that, on average, veterans have a higher graduate enrollment rate than non-veterans. Specifically, in the ACS, the graduate school enrollment rate is 7.2% for non-veterans and 13.5% for post-9/11 veterans, compared with 6.6% and 11.1%, respectively, in the CPS. These averages, however, disguise considerable differences in age-enrollment profiles between veterans and non-veterans, which are presented in Figure 4. Graduate enrollment rates for non-veterans peak in the mid-20s, fall sharply afterwards, and continue to decline, but not as rapidly as during the initial falloff. Among individuals in their early 20s, the graduate enrollment rate is lower for veterans than for non-veterans due to military service. Graduate school enrollment peaks among veterans in their mid-20s, and then decreases gradually over time. Among individuals beyond their mid-20s, graduate school enrollment rates are higher for veterans than for non-veterans.

The remaining variables in Table 1 show similarities between the ACS and CPS samples. On average, post-9/11 veterans are slightly younger than non-veterans in the sample, but the

difference is very small. For other demographic characteristics, men are over-represented (79%) in the veteran sample versus the non-veteran sample (44%). Racial/ethnic minorities, especially Blacks, are more highly represented in the veteran sample. Finally, the ACS reported American Indians and Alaska Natives separately, whereas the CPS did not; combined, their proportions are comparable between the two samples.

Table 2 presents descriptive statistics of graduate students who participated in the NPSAS 2016. The entire sample of 23,600 graduate students included in the NPSAS was grouped into non-veterans, veterans not receiving education benefits, and veterans receiving education benefits at the time of data collection. Comparing data across the three columns in Table 2 reveals that veterans who did not receive federal education benefits received less total financial aid on average than non-veterans, while veterans who received federal education benefits had a much higher level of total financial aid/benefits. Demographically, veteran graduate students tend to be older than non-veteran graduate students, and a higher proportion is male. Black and Hispanic students are more highly represented in the veteran subgroup.

Methods

The primary goal of the first two research questions was to determine whether the Post-9/11 GI Bill has improved graduate enrollment among post-9/11 veterans. Employing a treatment-control research design, I identified program effects based on the timing of program implementation. Specifically, I used the difference-in-differences (DD) strategy with two comparison groups: (a) individuals who never served in military, assuming similar time effects between veterans and non-veterans; and (b) veterans from the Gulf War era between 1990 and 2001. Using comparison group (b) could effectively reduce the biases caused by the unobserved differences between veterans and non-veterans. I further removed young veterans in the Post-

9/11 veteran sample in order to account for different age distributions between veterans who served in the Gulf War and the Post-9/11 era[2]. Age dummy variables were also added to the model to control for differences across age cohorts.

Because the ACS and CPS are cross-sectional surveys conducted on a rolling basis, pre- and post-policy periods are clearly defined, except for the year 2009 in ACS data. Formally, I used the following ordinary least squares regression:

$$y_{it} = \alpha_0 + \beta(Vet_i * Post) + Vet_i + \theta_t year_t + Z_{it}'\xi + \mu_{it}$$

where y_{it} is graduate enrollment for individual *i* in year *t*; Vet_i is a binary variable for post-9/11 veterans; $post$ is a dummy variable indicating the implementation of the Post-9/11 GI Bill in 2009; $year_t$ is a set of dummy variables representing years (i.e., θ_t is year fixed effect); Z_{it} includes a set of covariates for individual *i* in year *t* (i.e., state of residence dummies, age dummies, sex, race/ethnicity dummies). State of residence fixed effects are added to the model to account for the fact that the actual benefit level could vary across states. Veterans and non-veterans might have different enrollment profiles across these covariates, which necessitates the inclusion of a set of interaction terms between veteran status and these covariates. Finally, because the Post-9/11 GI Bill was adopted on the heels of the financial crisis and the economic recession that officially started in December 2007, it is important to isolate the effect of the Great Recession from that of the Post-9/11 GI Bill. For this reason, I include unemployment rates by state and year, and their interaction terms with veteran status.

5. RESULTS

5.1. Overall effects based on ACS and CPS data

[2] Veterans who were 18 years old in 2001, the last year of the Gulf War era, would have been 26 years old in 2009.

Figure 5 plots average graduate enrollment rates for non-veterans and post-9/11 veterans from 2005 to 2016 based on ACS data. Time trends between veterans (the line with triangle marks) and non-veterans (the line with circle marks) suggest relatively stable gaps between these two groups prior to the implementation of the Post-9/11 GI Bill. The slight uptick in 2009 for the veteran group is due to the implementation of the Post-9/11 GI Bill in August 2009. The gap between these two groups grew substantially immediately after 2009 and then narrowed recently in 2015 and 2016. Similar patterns are observed among both males and females, although the latter exhibit larger year-to-year variations, probably due to the relatively small sample size of female veterans.

Table 3 presents results from a series of DD regression models using non-veterans as the comparison group, with covariates added to the model sequentially. Due to space limitations, only the effects of the Post-9/11 GI Bill and unemployment rates are reported in this table and subsequent tables. For each model specification, two separate models were estimated: one with the average effect and the other with the effect over time. The year 2009 was excluded when estimating the average effect and was included when estimating time-varying effects. Results are overall consistent across the five model specifications (see Table 3). It is important to note, however, that when the interaction term between veteran status and unemployment rate was added (see results in Column 5 of Table 3), there is a clear reduction in DD estimates. This suggests that the higher unemployment rate during the Great Recession was partially responsible for the positive effect of the Post-9/11 GI Bill on graduate school enrollment among veterans. Because graduate enrollment varies across individuals and is influenced by the Great Recession, the last column is the preferred model. Specifically, the Post-9/11 GI Bill increased the graduate school enrollment rate by 1.7 percentage points in the overall sample. Considering the overall

enrollment rate of 12% before the implementation of the Post-9/11 GI Bill for veterans, an increase of 1.7 percentage points represents a boost of approximately 15%.

Estimating the effect over time suggests uneven effects during the post-policy period. The graduate enrollment rate increases immediately after the implementation of the bill, quickly peaks in 2011 and 2012, and then decreases slightly in more recent years. Comparing results in Column (5) with other models that do not include the interaction term between veteran status and unemployment rate indicates that the Post-9/11 GI Bill and the Great Recession worked in tandem to create a large significant enrollment increase immediately after 2009.

Table 4 repeats the analysis in Table 3 using Gulf War veterans as the comparison group. In these comparisons, however, the age range is restricted to veterans between 27 and 60 years old. Using Gulf War veterans as the comparison group yields very similar results. For example, the preferred model indicates an increase of 1.6 percentage points, only slightly less than the 1.7 percentage points in Table 3.[3] Table 5 estimates the same equation as in Tables 3 and 4 using CPS data. Only the average effects are included in this table. The estimates are mostly in line with those based on ACS data. However, estimates are smaller in the preferred model. For example, estimates based on ACS data are 1.7 and 1.6 percentage points when non-veterans and Gulf War veterans are used as the comparison group, respectively. When CPS data are used, these estimates become 1.4 and 1.2 percentage points. Estimates based on CPS data are not statistically significant due to relatively small sample size.

5.2. Effects by sex, race/ethnicity, and age

[3] I performed two additional sets of analyses (not reported here due to space limitations) to corroborate the results here. In the first set, I used non-veterans as the comparison group but restricted the age range to 27 to 60 years old to check whether age restriction is a confounding factor. This exercise yielded very similar results to those reported in Table 4. In the second set of regressions, I compared Gulf War veterans with non-veterans. This set of analyses yielded no statistically significant effect whatsoever after 2009, suggesting that without the education benefits provided by the Post-9/11 GI Bill, being a veteran per se did not lead to higher graduate enrollment rates during the Great Recession.

In this section, I present estimates across different subgroups by sex, race/ethnicity, and age. The first two columns in Table 6 show separate effects for men and women. While the estimate for women (2.47 percentage points) is larger than that for men (1.79 percentage points), the difference is not statistically significant. Interestingly, because veteran women had a higher rate of graduate enrollment prior to the implementation of the Post-9/11 GI Bill (16% vs. 11% for men), the relative increase in graduate enrollment rate is very similar between these two groups when considering their prior enrollment rates.

The rest of Table 6 reports separate analyses by race/ethnicity. While the enrollment effects are positive across all race/ethnicity groups, some estimates are not statistically significant due to small sample sizes. The estimated effect is 1.82 percentage points for Whites and 3.17 percentage points for Blacks. The difference between these two estimates, however, is not statistically significant. Overall, although some variation exists across race/ethnicity groups, these differences are either small or statistically insignificant.

To estimate the effect by age, I divided the sample into eight age groups with 5-year intervals. Point estimates are presented in Figure 6, along with 95% confidence intervals. Estimated effects across age groups vary widely, with larger effects among older veterans (i.e., > 35 years old) than veterans between the ages of 20 and 34. The relative changes for older veterans are even more dramatic when considering how graduate school enrollment rates decrease with age, as indicated in Figure 4. For example, a 2-percentage-point increase in the enrollment rate for those over 40 years old is equivalent to more than a 20% increase in relative terms.

5.3. Veterans' education benefits for veteran graduate students

The analyses thus far have examined the effect of the Post-9/11 GI Bill on graduate enrollment for the veterans who served in the military post 9/11. However, not all post-9/11 veterans who attend graduate schools receive education benefits, and not everyone who receives them receives the full amount. While data analysis based on ACS and CPS told us the effect of the Post-9/11 GI Bill on graduate enrollment for veterans who served in the military in the post-9/11 era, these estimates might severely understate the enrollment effect for those who actually received education benefits. For that reason, I used NPSAS 2016 data to probe the financial aid situations of veteran students.

Table 7 reports the number of non-veterans, veterans not receiving education benefits, and veterans receiving education benefits among a national sample of graduate students in AY 2015-16. I used the weighted sample size to estimate the relative proportion of veterans. Overall, veteran students comprised 7.0% of all graduate students during AY 2015-16. Within the veteran sample, 38.1% received education benefits through various programs. Because NPSAS does not include information on the eras in which veterans have served, I used age to determine service periods. However, even among those who were younger than 32 years old in AY 2015-16, only 42.2% received veterans' education benefits. Assuming that the Post-9/11 GI Bill has no or little effect on veterans who are not beneficiaries, the effects of the bill on veterans who are beneficiaries could be much larger than indicated by estimates in this study.

The other piece of information that is critical in interpreting the effect of the Post-9/11 GI Bill is the magnitude of its education benefits. The actual amount of education benefits received by veteran students depends on a variety of factors including tuition and fees, the location of the institution that determines the housing allowance, and the proportion of full benefits that they qualify. Table 7 reports various financial aid and/or benefits across the three groups. On average,

veteran students received $16,173 in education benefits, $5,550 of which was for housing. Several other findings are also interesting, while not directly related to the three research questions. A comparison between non-veterans and veteran students who did not receive veteran's benefits indicates that non-veterans on average received higher levels of institutional support, including institutional grants and graduate assistantships. This is most likely due to differences in degree programs and major fields of study. For example, veteran students are less likely than non-veteran students to pursue doctoral programs, which typically provide a higher level of funding than Master's programs. In addition, veteran students are enrolled in professional degree programs (e.g., management and business) at a much higher rate than non-veteran students. These professional degree programs typically provide a lower level of financial support. Among veteran students who received veteran's benefits, the benefits accounted for nearly 90% of all financial assistance they received, not including loans.

6. Discussion and Conclusion

This study yielded several findings that when taken together, help us better understand the role of the Post-9/11 GI Bill on graduate school enrollment among veterans. From a descriptive perspective, the total number of post-9/11 veterans with bachelor's degrees has increased substantially in recent years. Between 2005 and 2016, this number has increased from 3.02 million to 9.64 million. This growth was gradual and smooth over time, exhibiting no discontinuous jump at the time of the implementation of the Post-9/11 GI Bill. The growth of this particular population is by far the single most important factor that has spurred the growth in the number of veterans enrolled in graduate schools in recent years.

To a lesser extent, the growth in the number of veterans enrolled in graduate schools was boosted by the implementation of the Post-9/11 GI Bill. Results suggest that on average,

enrollment increased between 1.5 and 2 percentage points among veterans with bachelor's degrees who served in the post-9/11 era, an increase of approximately 15% over the baseline pre-policy participation rate of 12%. The increase was similar for veteran men and women and across race/ethnicity groups. Enrollment increased more among older veterans (i.e., those over 35 years old) than younger veterans.

While the increase of 1.5–2 percentage points appears small, two additional factors need to be considered. First, because a substantial proportion of veterans attended graduate schools without receiving veteran's benefits, the increase of 1.5–2 percentage points significantly underestimates the effect of the Post-9/11 GI Bill for beneficiaries of the bill. For example, the NPSAS data indicate that only about 40% of all veterans who attended graduate school in FY 2015-16 received veteran's benefits. Assuming that the bill had no effect on veterans who were not beneficiaries, the increase of 1.5–2 percentage points among veterans needs to be multiplied by a factor of 2.5 if the growth only occurred among the veterans who received education benefits. In other words, the Post-9/11 GI Bill has likely increased graduate school participation rates among beneficiaries by about 4–5 percentage points, which translates to a 30–40% increase in relative terms.

Second, it is important to assess the increase in graduate enrollment against the magnitude of the education benefits that veterans receive. While the level of full benefits depends on the particular institutions and programs that veterans choose and could potentially be very high, the average amount of education benefits received by veteran students is about $16,000 based on NPSAS data, which is in line with the $14,636 average reported by the U.S. Department of Veterans Affairs (2018), because graduate programs are on average more expensive than undergraduate and training programs. In addition, because the Post-9/11 GI Bill

is an expansion of its predecessor, the MGIB, which already provided quite generous education benefits, the additional benefits provided by the Post-9/11 GI Bill are much lower than the average amount received by veterans. Aggregate data provided by U.S. Department of Veterans Affairs (2018) suggest that average education benefits awarded under the Post-9/11 GI Bill exceeded those awarded under the MGIB by about $6,000 in FY 2017. In other words, the increase of 4–5 percentage points in the graduate enrollment rate is due to an increase of $6,000 in education benefits.

This strong and significant effect of financial incentives on graduate school participation contrasts with findings in the limited literature that show very small or no effect of financial aid on graduate school participation. Several features of the Post-9/11 GI Bill might have contributed to this significant effect. First, the Post-9/11 GI Bill encourages veterans to apply for graduate school by guaranteeing education benefits for eligible veterans. This is analogous to a Pell Grant, which is guaranteed for eligible students if admitted. Most financial aid programs at the graduate level are provided by institutions or programs at the time of admission. In other words, potential applicants and admitted applicants could have very different responses to financial incentives. Second, while most institutional financial aid at the graduate level is offered to doctoral students and students in particular fields (e.g., science and engineering), the education benefits provided by the Post-9/11 GI Bill can be used for any graduate program, including many professional programs that offer little or no financial aid. For example, NPSAS data indicate that 42% of veterans who were receiving veterans' benefits were majoring in business and management in graduate school during AY 2015-16. Third, living expenses present a significant financial burden for graduate students. Providing a monthly stipend based on institutional location further alleviates the financial burden of attending graduate school.

While this study has revealed the effect of the Post-9/11 GI Bill on graduate school participation, many questions remain unanswered. In future research, scholars may want to examine factors (e.g., demographic, socioeconomic, academic, financial) that influence which graduate schools and degree programs veterans choose. In particular, do veterans and non-veterans make different choices? Do education benefits influence such choices? Finally, while education benefits provided by various GI bills have enabled veterans to enroll in college and graduate school and obtain necessary knowledge and skills, it is important to know how their graduate education ultimately affects their labor market outcomes and quality of civilian life.

References

Angrist, J., Hudson, S., & Pallais, A. (2016). *Evaluating post-secondary aid: Enrollment, persistence, and projected completion effects* (No. w23015). Cambridge, MA: National Bureau of Economic Research.

Barr, A. (2015). From the battlefield to the schoolyard: The short-term impact of the Post-9/11 GI Bill. *Journal of Human Resources*, *50*(3), 580-613.

Bettinger, E., Gurantz, O., Kawano, L., & Sacerdote, B. (2016). *The long run impacts of merit aid: Evidence from California's Cal Grant* (Working Paper No. 22347). Cambridge, MA: National Bureau of Economic Research.

Bound, J., & Turner, S. (2002). Going to war and going to college: Did World War II and the GI Bill increase educational attainment for returning veterans? *Journal of Labor Economics*, *20*(4), 784-815.

Carnevale, A. P., Smith, N., & Strohl, J. (2013). *Recovery: Job growth and education requirements through 2020*. Washington, DC: Georgetown University, Center on Education and the Workforce.

Castleman, B. L., & Long, B. T. (2016). Looking beyond enrollment: The causal effect of need-based grants on college access, persistence, and graduation. *Journal of Labor Economics*, *34*(4), 1023-1073.

Deming, D., & Dynarski, S. (2010). College aid. In P. Levine & D. Zimmerman (Eds.), *Targeting investments in children: Fighting poverty when resources are limited* (pp. 283-302). Chicago, IL: University of Chicago Press.

DesJardins, S. L., & McCall, B. P. (2014). The impact of the Gates Millennium Scholars Program on college and post-college related choices of high ability, low-income minority students. *Economics of Education Review, 38,* 124-138.

Dynarski, S. (2004). The new merit aid. In *College choices: The economics of where to go, when to go, and how to pay for it* (pp. 63-100). Chicago, IL: University of Chicago Press.

Eagan, M. K., Hurtado, S., Chang, M. J., Garcia, G. A., Herrera, F. A., & Garibay, J. C. (2013). Making a difference in science education: The impact of undergraduate research programs. *American Educational Research Journal, 50*(4), 683-713.

Eide, E., Brewer, D. J., & Ehrenberg, R. G. (1998). Does it pay to attend an elite private college? Evidence on the effects of undergraduate college quality on graduate school attendance. *Economics of Education Review*, *17*(4), 371-376.

English, D., & Umbach, P. D. (2016). Graduate school choice: An examination of individual and institutional effects. *Review of Higher Education*, *39*(2), 173-211.

Ethington, C. A., & Smart, J. C. (1986). Persistence to graduate education. *Research in Higher Education*, *24*(3), 287-303.

Field, E. (2009). Educational debt burden and career choice: Evidence from a financial aid experiment at NYU Law School. *American Economic Journal: Applied Economics, 1*(1), 1-21.

Goldrick-Rab, S., Kelchen, R., Harris, D. N., & Benson, J. (2016). Reducing income inequality in educational attainment: Experimental evidence on the impact of financial aid on college completion. *American Journal of Sociology*, *121*(6), 1762-1817.

Heller, D. (1997). Student price response in higher education: An update to Leslie and Brinkman. *Journal of Higher Education, 68*(6), 624-659.

Kim, D., & Eyermann, T. S. (2006). Undergraduate borrowing and its effects on plans to attend graduate school prior to and after the 1992 Higher Education Act Amendments. *Journal of Student Financial Aid*, *36*(2), 5-21.

Leslie, L. L., & Brinkman, P. T. (1987). Student price response in higher education: The student demand studies. *Journal of Higher Education, 58*(2), 181-204.

Long, B. T. (2004). The impact of federal tax credits for higher education expenses. In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it* (pp. 101-168). Chicago, IL: University of Chicago Press.

Malcom, L. E., & Dowd, A. C. (2012). The impact of undergraduate debt on the graduate school enrollment of STEM baccalaureates. *Review of Higher Education*, *35*(2), 265-305.

McCormick, A. C., Nuñez, A.-M., Shah, V., & Choy, S. P. (1999). *Life after college: A descriptive summary of 1992-93 bachelor's degree recipients in 1997, NCES 1999–155* [Data set]. Washington, DC: National Center for Education Statistics, U.S. Department of Education.

Millett, C. M. (2003). How undergraduate loan debt affects application and enrollment in graduate or first professional school. *Journal of Higher Education*, *74*(4), 386-427.

Monks, J. (2001). Loan burdens and educational outcomes. *Economics of Education Review*, *20*(6), 545-550.

Mullen, A. L., Goyette, K. A., & Soares, J. A. (2003). Who goes to graduate school? Social and academic correlates of educational continuation after college. *Sociology of Education*, *76*(2), 143-169.

Myers, C. B., & Pavel, D. M. (2011). Underrepresented students in STEM: The transition from undergraduate to graduate programs. *Journal of Diversity in Higher Education*, *4*(2), 90-105.

Porter, A., Yang, R., Hwang, J., McMaken, J., & Rorison, J. (2014). The effects of scholarship amount on yield and success for Master's students in education. *Journal of Research on Educational Effectiveness, 7*(2), 166-182.

Scott-Clayton, J., & Zafar, B. (2016). *Financial aid, debt management, and socioeconomic outcomes: Post-college effects of merit-based aid* (Working Paper No. 22574). Cambridge, MA: National Bureau of Economic Research.

Simon, C. J., Negrusa, S., & Warner, J. T. (2010). Educational benefits and military service: An analysis of enlistment, reenlistment, and veterans' benefit usage 1991-2005. *Economic Inquiry*, *48*(4), 1008-1031.

Sjoquist, D. L., & Winters, J. V. (2012). Building the stock of college-educated labor revisited. *Journal of Human Resources*, *47*(1), 270-285.

Tienda, M., & Zhao, L. (2017). Institutional and ethnic variations in postgraduate enrollment and completion. *Journal of Higher Education*, *88*(4), 561-592.

U.S. Department of Veterans Affairs (multiple years). *Veterans benefits administration annual benefits report.* Retrieved February 14, 2017, from http://benefits.va.gov/

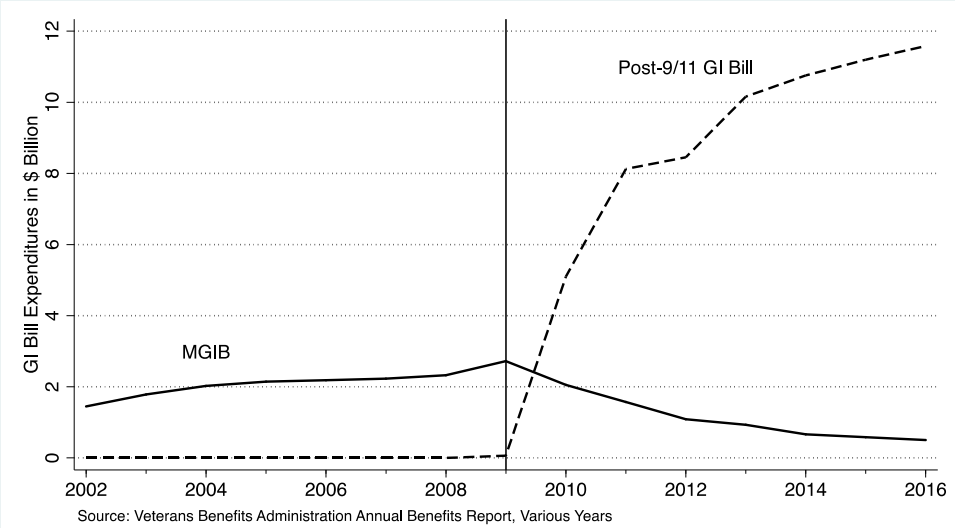
Zhang, Lei (2013). Effects of college educational debt on graduate school attendance and early career and lifestyle choices. *Education Economics*, *21*(2), 154-175.

Zhang, Liang (2005). Advance to graduate education: The effect of college quality and undergraduate majors. *Review of Higher Education, 28*(3), 313-338.

Zhang, Liang, & Ness, E. (2010). Does state merit-based aid stem brain drain. *Educational Evaluation and Policy Analysis, 32*(2), 143-165.

Zhang, Liang (2018). Veterans going to college: Evaluating the impact of the Post-9/11 GI Bill on college enrollment. *Educational Evaluation and Policy Analysis, 40*(1), 82-102.

Figure 1: Payments (in billions of dollars) and number of beneficiaries (in 1,000s) under the MGIB and Post 9/11 GI Bill, by fiscal year



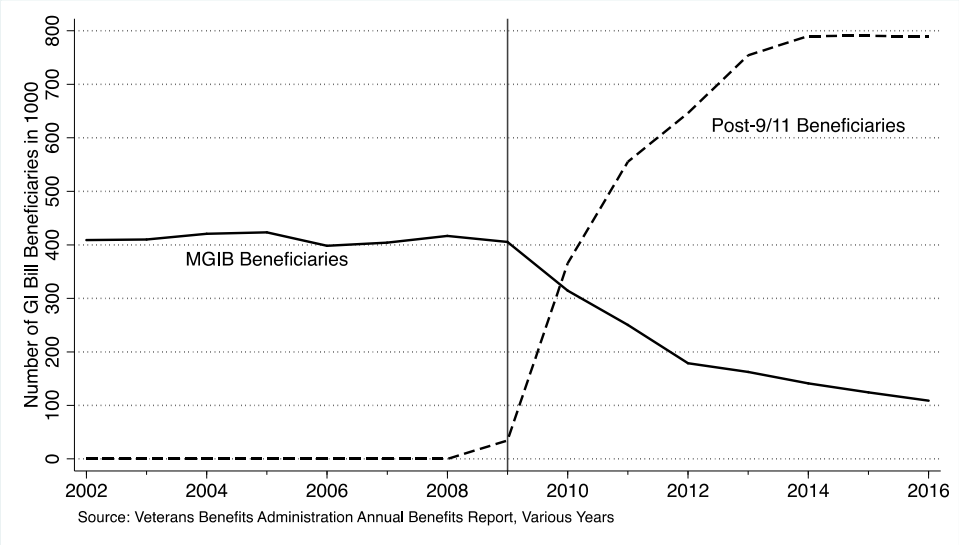


Figure 2: New beneficiaries of MGIB and Post-9/11 GI Bill attending undergraduate and graduate programs (in 1,000s), by fiscal year

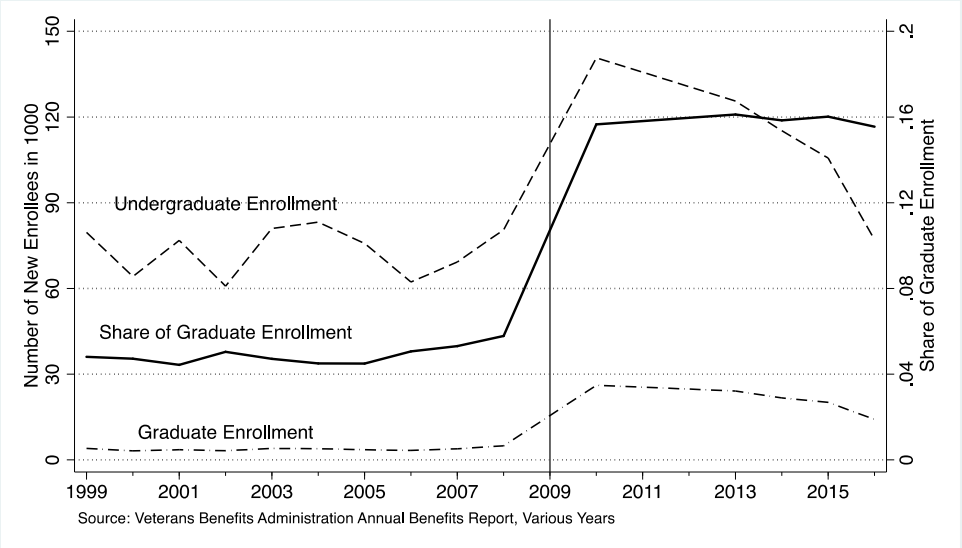


Figure 3: Number of Post-9/11 veterans with and without BA degrees (in 100K)

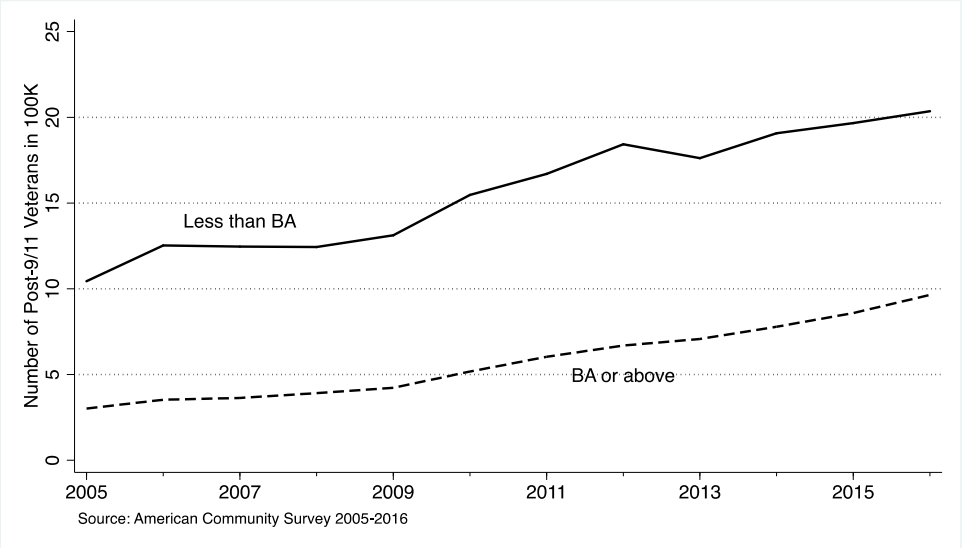


Figure 4: Graduate school enrollment rates by post-9/11 veteran status, 2005–2016

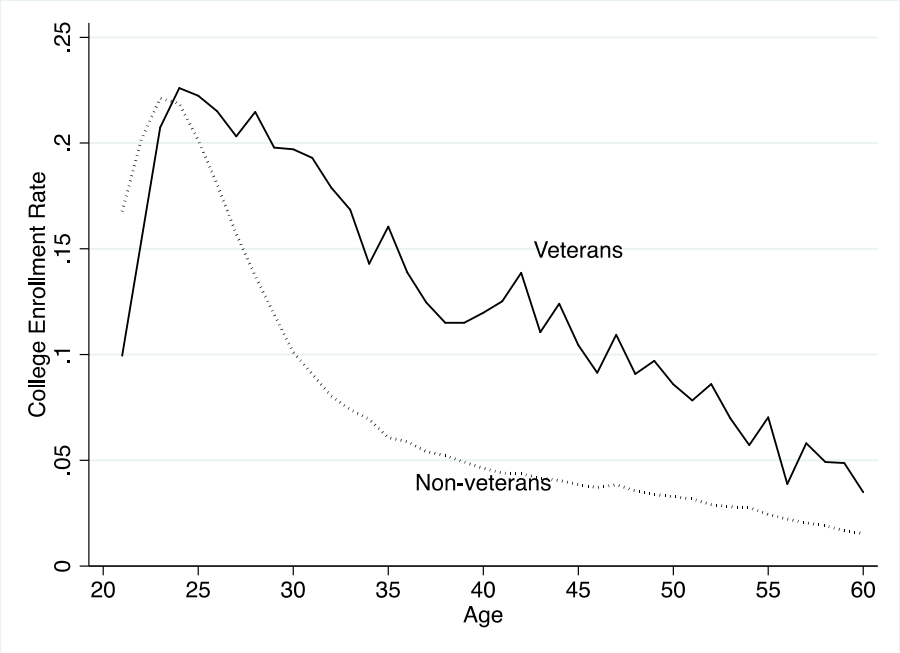
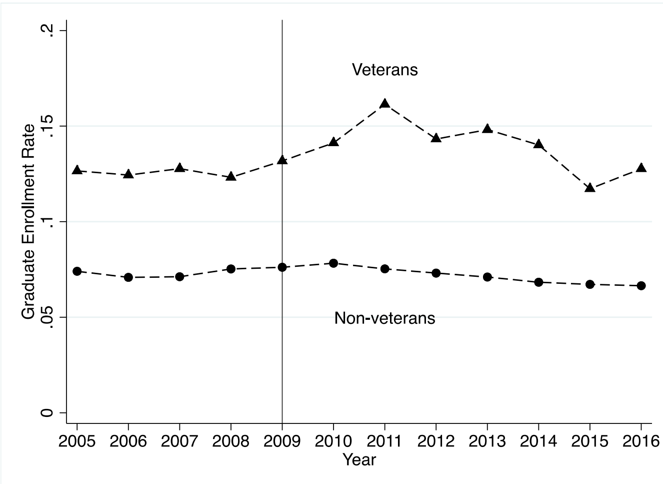
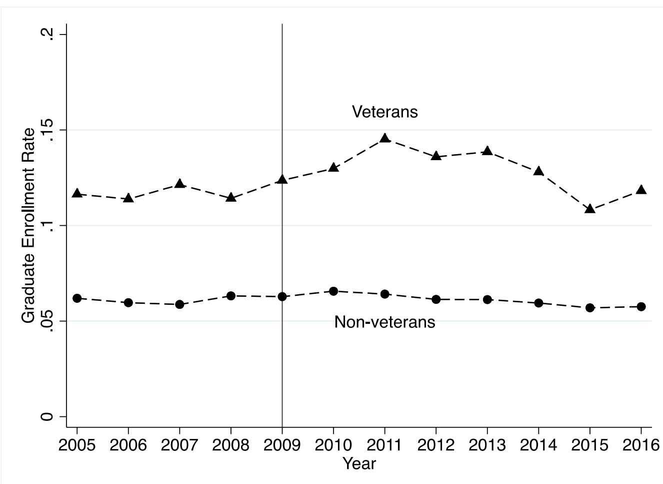


Figure 5: Time trends of graduate school enrollment rates by post-9/11 veteran status





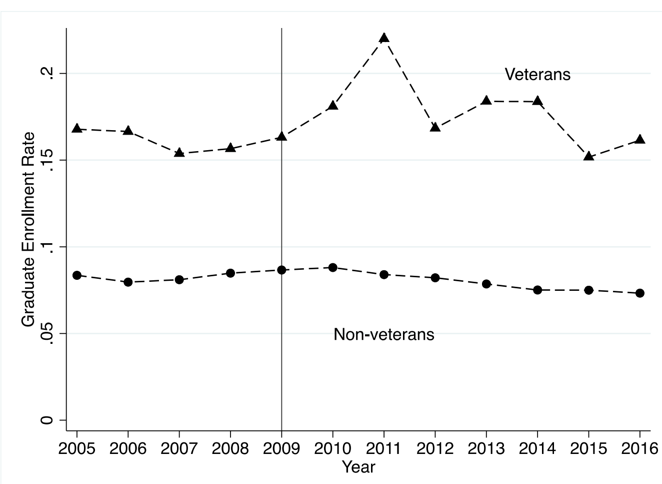


Figure 6: Effects of Post-9/11 GI Bill on college enrollment across age groups

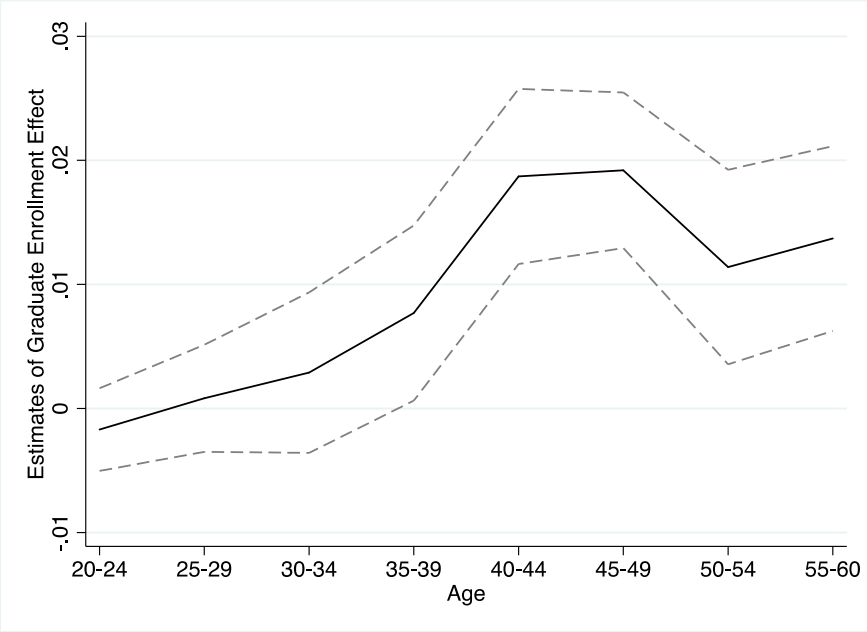


Table 1: Descriptive statistics for post-9/11 veterans and non-veterans, ACS 2005–2016

	ACS				CPS			
	Non-veterans (N = 4,521,743)		Veterans (N = 63,904)		Non-veterans (N = 214,835)		Veterans (N = 2,571)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Graduate enrollment	0.072	0.259	0.135	0.342	0.062	0.241	0.111	0.314
Age	40.645	11.032	39.636	9.380	40.641	11.048	39.458	9.387
Male	0.437	0.496	0.787	0.409	0.440	0.496	0.790	0.407
White	0.835	0.371	0.742	0.437	0.830	0.376	0.736	0.441
Black	0.075	0.264	0.143	0.350	0.080	0.272	0.139	0.346
Hispanic	0.048	0.214	0.069	0.253	0.048	0.214	0.087	0.282
Asian & Pacific Islander	0.024	0.153	0.015	0.122	0.025	0.156	0.013	0.113
Native American	0.003	0.058	0.006	0.076	-	-	-	-
Other race/ethnicity	0.014	0.119	0.025	0.157	0.017	0.129	0.025	0.155

Table 2: Descriptive statistics for graduate students in NPSAS 2016, by veteran status

	Non-veterans (N = 20,130)		Veterans not receiving benefits (N = 1,890)		Veterans receiving benefits (N = 1,580)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Total financial aid/benefits	15708	20013	11332	15332	24127	21637
Age	31.853	9.532	38.758	10.089	36.821	8.493
Male	0.389	0.488	0.652	0.476	0.630	0.483
White	0.591	0.492	0.583	0.493	0.543	0.498
Black	0.135	0.342	0.224	0.417	0.217	0.413
Hispanic	0.096	0.295	0.111	0.314	0.140	0.347
Asian & Pacific Islander	0.149	0.356	0.047	0.212	0.046	0.210
Native American	0.005	0.069	0.007	0.085	0.005	0.071
Other race/ethnicity	0.024	0.152	0.028	0.164	0.049	0.215

Table 3: Difference-in-differences estimates of the effect of post-9/11 GI Bill on graduate school enrollment (comparison group: non-veterans)

	(1)	(2)	(3)	(4)	(5)
Veteran * after 2009	0.0150*	0.0241***	0.0220***	0.0220***	0.0171**
	(0.0056)	(0.0042)	(0.0046)	(0.0046)	(0.0049)
Unemployment rate				-0.0003	-0.0004
				(0.0002)	(0.0002)
Veteran * unemployment					0.0024*
					(0.0011)
N	4206796	4206796	4206796	4206796	4206796
R^2	0.001	0.055	0.055	0.055	0.055
Veteran * year 2009	0.0031	0.0045	0.0037	0.0037	-0.0155
	(0.0077)	(0.0073)	(0.0071)	(0.0071)	(0.0118)
Veteran * year 2010	0.0104	0.0122	0.0101	0.0101	-0.0138
	(0.0087)	(0.0085)	(0.0087)	(0.0087)	(0.0154)
Veteran * year 2011	0.0335***	0.0376***	0.0359***	0.0359***	0.0159
	(0.0081)	(0.0078)	(0.0080)	(0.0080)	(0.0127)
Veteran * year 2012	0.0176*	0.0234**	0.0211**	0.0211**	0.0059
	(0.0077)	(0.0068)	(0.0068)	(0.0068)	(0.0105)
Veteran * year 2013	0.0246***	0.0343***	0.0323***	0.0323***	0.0200*
	(0.0061)	(0.0053)	(0.0053)	(0.0053)	(0.0080)
Veteran * year 2014	0.0193*	0.0295***	0.0261***	0.0261***	0.0197*
	(0.0084)	(0.0070)	(0.0071)	(0.0071)	(0.0085)
Veteran * year 2015	-0.0025	0.0106	0.0081	0.0081	0.0053
	(0.0080)	(0.0062)	(0.0067)	(0.0067)	(0.0070)
Veteran * year 2016	0.0087	0.0227***	0.0205**	0.0205**	0.0198**
	(0.0067)	(0.0056)	(0.0061)	(0.0061)	(0.0059)
Unemployment rate				-0.0002	-0.0002
				(0.0002)	(0.0002)
Veteran * unemployment					0.0051
					(0.0026)
Veteran	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
Age	no	yes	yes	yes	yes
Race/ethnicity	no	yes	yes	yes	yes
State of residence	no	yes	yes	yes	yes
Veteran * age	no	no	yes	yes	yes
Veteran * race	no	no	yes	yes	yes
Veteran * state	no	no	yes	yes	yes
N	4585647	4585647	4585647	4585647	4585647
R^2	0.001	0.055	0.055	0.055	0.055

Note: All covariates (veteran status, year, age, race/ethnicity, state of residence, and their interaction terms) are dummy coded. The year 2009 is excluded from the analysis in the first panel. All models are weighted by ACS person weights. Standard errors (in parentheses) are clustered by age. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Difference-in-differences estimates of the effect of the Post-9/11 GI Bill on graduate school enrollment (comparison group: Gulf War veterans)

	(1)	(2)	(3)	(4)	(5)
Veteran * after 2009	0.0391***	0.0225**	0.0228**	0.0229**	0.0161*
	(0.0058)	(0.0065)	(0.0066)	(0.0066)	(0.0073)
Unemployment rate				0.0023	0.0011
				(0.0016)	(0.0015)
Veteran * unemployment					0.0030*
					(0.0012)
N	121573	121573	121573	121573	121573
R^2	0.011	0.033	0.035	0.035	0.035
Veteran * year 2009	0.0252*	0.0176	0.0177	0.0179	0.0003
	(0.0099)	(0.0094)	(0.0094)	(0.0095)	(0.0177)
Veteran * year 2010	0.0155	0.0029	0.0031	0.0033	-0.0185
	(0.0097)	(0.0106)	(0.0105)	(0.0106)	(0.0228)
Veteran * year 2011	0.0583***	0.0466***	0.0464***	0.0465***	0.0282
	(0.0097)	(0.0100)	(0.0099)	(0.0099)	(0.0184)
Veteran * year 2012	0.0448***	0.0292**	0.0290**	0.0290**	0.0151
	(0.0073)	(0.0081)	(0.0080)	(0.0080)	(0.0152)
Veteran * year 2013	0.0477***	0.0318***	0.0319***	0.0320***	0.0208
	(0.0082)	(0.0076)	(0.0076)	(0.0076)	(0.0127)
Veteran * year 2014	0.0444***	0.0260**	0.0262**	0.0262**	0.0203
	(0.0089)	(0.0086)	(0.0084)	(0.0084)	(0.0111)
Veteran * year 2015	0.0251**	0.0051	0.0061	0.0060	0.0035
	(0.0085)	(0.0090)	(0.0093)	(0.0093)	(0.0094)
Veteran * year 2016	0.0373***	0.0163	0.0173	0.0172	0.0167
	(0.0096)	(0.0103)	(0.0103)	(0.0103)	(0.0102)
Unemployment rate				0.0022	0.0003
				(0.0015)	(0.0020)
Veteran * unemployment					0.0046
					(0.0037)
Veteran	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
Age	no	yes	yes	yes	yes
Race/ethnicity	no	yes	yes	yes	yes
State of residence	no	yes	yes	yes	yes
Veteran * age	no	no	yes	yes	yes
Veteran * race	no	no	yes	yes	yes
Veteran * state	no	no	yes	yes	yes
N	131768	131768	131768	131768	131768
R^2	0.011	0.034	0.035	0.035	0.035

Note: All covariates (veteran status, year, age, race/ethnicity, state of residence, and their interaction terms) are dummy coded. The year 2009 is excluded from the analysis in the first panel. All models are weighted by ACS person weights. Standard errors (in parentheses) were clustered by age. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5: Difference-in-differences estimates of the effect of Post-9/11 GI Bill on graduate school enrollment (comparison group: Gulf War veterans): CPS data

	(1)	(2)	(3)	(4)	(5)
	Comparison group: Non-veterans				
Veteran * after 2009	0.0218	0.0299	0.0172	0.0171	0.0137
	(0.0220)	(0.0213)	(0.0200)	(0.0200)	(0.0229)
N	217406	217406	217406	217406	217406
R^2	0.001	0.066	0.067	0.067	0.067
	Comparison group: Gulf war veterans				
Veteran * year 2009	0.0411	0.0180	0.0185	0.0183	0.0122
	(0.0277)	(0.0270)	(0.0252)	(0.0252)	(0.0280)
N	6130	6130	6130	6130	6130
R^2	0.013	0.053	0.072	0.072	0.072
Veteran	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
Age	no	yes	yes	yes	yes
Race/ethnicity	no	yes	yes	yes	yes
State of residence	no	yes	yes	yes	yes
Veteran * age	no	no	yes	yes	yes
Veteran * race	no	no	yes	yes	yes
Veteran * state	no	no	yes	yes	yes
Unemployment rate	no	no	no	yes	yes
Veteran * unemployment	no	no	no	no	yes

Note: All covariates (veteran status, year, age, race/ethnicity, state of residence, and their interaction terms) are dummy coded. The year 2009 is excluded from the analysis in the first panel. All models are weighted by ACS person weights. Standard errors (in parentheses) are clustered by age. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6: Difference-in-differences estimates of the effect of Post-9/11 GI Bill on graduate school enrollment by sex and race/ethnicity (comparison group: non-veterans)

	Men	Women	White	Black	Hispanic	Asian	Other
Veteran * after 2009	0.0179***	0.0247*	0.0182***	0.0317*	0.0107	0.0591	0.0291
	(0.0043)	(0.0096)	(0.0039)	(0.0123)	(0.0146)	(0.0320)	(0.0196)
N	1993313	2592334	3928622	276390	197953	101848	80834
R^2	0.059	0.053	0.054	0.037	0.044	0.090	0.050
Veteran * year 2009	0.0058	-0.0029	-0.0040	0.0200	0.0361	0.0054	0.1036*
	(0.0079)	(0.0130)	(0.0077)	(0.0221)	(0.0407)	(0.0415)	(0.0473)
Veteran * year 2010	0.0078	0.0147	0.0085	0.0096	-0.0051	0.0455	-0.0013
	(0.0080)	(0.0183)	(0.0079)	(0.0217)	(0.0234)	(0.0494)	(0.0502)
Veteran * year 2011	0.0290**	0.0555**	0.0231*	0.0468*	0.0708	0.1414	0.1400**
	(0.0084)	(0.0190)	(0.0090)	(0.0208)	(0.0368)	(0.0702)	(0.0487)
Veteran * year 2012	0.0242**	0.0081	0.0208**	0.0409	-0.0012	0.0757	-0.0073
	(0.0074)	(0.0154)	(0.0066)	(0.0223)	(0.0282)	(0.0481)	(0.0312)
Veteran * year 2013	0.0294***	0.0359*	0.0256***	0.0728**	-0.0112	0.1110*	0.0948*
	(0.0057)	(0.0155)	(0.0052)	(0.0252)	(0.0222)	(0.0547)	(0.0374)
Veteran * year 2014	0.0203*	0.0335*	0.0224**	0.0422	0.0246	0.0145	0.0552
	(0.0077)	(0.0147)	(0.0070)	(0.0221)	(0.0349)	(0.0379)	(0.0306)
Veteran * year 2015	0.0071	0.0057	0.0073	0.0050	0.0088	0.0298	0.0326
	(0.0067)	(0.0156)	(0.0066)	(0.0184)	(0.0195)	(0.0564)	(0.0250)
Veteran * year 2016	0.0177**	0.0194	0.0144*	0.0372	0.0424	0.0383	0.0577
	(0.0064)	(0.0152)	(0.0057)	(0.0195)	(0.0218)	(0.0503)	(0.0295)
N	1993313	2592334	3928622	276390	197953	101848	80834
R^2	0.059	0.053	0.054	0.037	0.044	0.090	0.050

Note: All covariates (veteran status, year, age, race/ethnicity, state of residence, and their interaction terms) are dummy coded. The year 2009 is excluded from the analysis in the first panel. All models are weighted by ACS person weights. Standard errors (in parentheses) are clustered by age. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 7: Average amount ($) of financial aid/benefits received by veterans attending graduate school in AY 2015-16 (individually weighted)

	Non-veterans (Weighted: N = 21,950; Unweighted: N = 20,130[a])					
	Grant	Loan	Work Study	Other[c]	Total	Total Minus Loan
Federal	82	9779	72	17[d]	9949	170
State	87	18	1	0	106	88
Institution	2672	83	13	1100[e]	3868	3785
Other[b]	1107	678	0	0	1785	1107
Total	3947	10558	85	1117	15708	5150

	Veterans not receiving veterans' benefits (Weighted: N = 1,020; Unweighted: N=1,890)					
	Grant	Loan	Work Study	Other[c]	Total	Total Minus Loan
Federal	175	7828	19	410[f]	8432	604
State	163	2	0	0	164	163
Institution	1046	7	0	260[e]	1314	1307
Other[b]	1272	150	0	0	1422	1272
Total	2656	7986	19	671	11332	3346

	Veterans receiving veterans' benefits (Weighted: N = 630; Unweighted: N = 1,580)					
	Grant	Loan	Work Study	Other[c]	Total	Total Minus Loan
Federal	13	5569	4	16173[g]	21760	16191
State	43	0	0	0	43	43
Institution	1234	40	16	189[e]	1479	1439
Other[b]	758	87	0	0	845	758
Total	2049	5696	20	16362	24127	18431

[a] All sample sizes are rounded off to the nearest 10 per IES requirements

[b] Other sources include outside grants, private commercial or alternative loans

[c] Other types of financial aid/benefits include graduate assistantships, federal veterans' benefits and military tuition aid

[d] Dependents or spouses receiving federal veterans' benefits and military tuition aid

[e] Graduate assistantships

[f] Veterans receiving federal veterans' benefits and military tuition aid through spouse and/or dependents

[g] Veterans themselves receiving federal veterans' benefits and military tuition aid

Appendix Table A: Education benefits programs for veterans, FY 2017

Program	Effective Dates	Enrollees	Payments ($1000)
Post-9/11 Veterans Educational Assistance Program (Post-9/11 GI Bill)	08/2009 – present	755,476	$11,056,959
All-Volunteer Force Educational Assistance Program (Montgomery GI Bill - Active Duty)	06/1985 – present	34,582	$298,818
Educational Assistance for Members of the Selected Reserve (Montgomery GI Bill - Selected Reserve)	06/1985 – present	54,909	$130,311
Veterans Retraining Assistance Program (VRAP)	07/2012 – 03/2014	0	$0
Reserve Educational Assistance Program (REAP)	10/2004 – present	1,586	$7,213
Survivors and Dependents Educational Assistance (DEA)	12/2006 – present	100,275	$553,128
Post-Vietnam Era Veterans Educational Assistance Program (VEAP)	10/1980 – present	1	$161
Total		946,829	$12,046,590

Notes: Data are from the Veterans Benefits Administration Annual Benefits Report, FY 2017. In addition to the programs that are specifically designed to provide education benefits to veterans and military personnel, Vocational Rehabilitation and Employment (VR&E) pays for education-related expenses including tuition, fees, books, and supplies when veterans need training as part of their rehabilitation services. They also receive a monthly subsistence allowance to assist them with living expenses. During the same fiscal year, 89,735 veterans received subsistence as part of a training program, with nearly 90% enrolling in undergraduate and graduate programs.