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Spillover Effects of Financial Aid for Education: Does Post-9/11 GI Bill Reduce Veteran SNAP Participation?

RESEARCH

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ABSTRACT

Many veterans rely on the Supplemental Nutrition Assistance Program (SNAP). We study the change in the veterans' reliance on SNAP in response to the GI Bill, the veterans' financial aid for higher education. Using the unanticipated increase in educational benefits due to the Post-9/11 GI Bill and employing a difference-in-differences approach, we estimate that the benefit increase lowered veteran SNAP participation by about 28%, the effect being larger among new veterans. These findings reflect changes in the veterans' choices that are attributable to wealth effects, SNAP eligibility criteria, and human capital accumulation. SNAP eligibility typically expires when the veteran attends college, and a larger educational benefit increases the veterans' probability of college attendance. Furthermore, a college degree increases future earnings, which reduces the veterans' SNAP reliance in the longer run. Quantifying these relationships provides insights into how financial aid for education in general improves veterans' economic well-being and may help break some veterans' dependence on SNAP and similar welfare programs.

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Since 2007, the onset of the Great Recession, the percentage of US households receiving nutritional assistance under the Supplemental Nutrition Assistance Program (SNAP)[1] has soared to an all-time high in 2012. In that year, 13.6% of US households participated in the program, increasing total outlays to $78.4 billion, relative to $33.2 billion in 2007.[2] SNAP is a means-tested program, with the eligibility largely depending on earned income and other assets. About 1.3 million veterans, representing 7% of the entire veteran population, received SNAP benefits during the 2015–2017 period (Keith-Jennings & Cai, 2018). For veterans, SNAP represents an important support during their transition from military to civilian life (London & Heflin, 2015; Keith-Jennings & Cai, 2018). Many veterans who are eligible for SNAP are also eligible for the GI Bill, a type of financial aid for the veterans' higher education. College attendance, however, restricts SNAP eligibility, so all else constant, increases in GI Bill generosity—and the subsequent higher college attendance among veterans—are bound to reduce SNAP eligibility, participation, and ultimately, SNAP outlays. The implementation of the Post-9/11 GI Bill in August 2009 greatly increased the generosity of the GI Bill, which in turn increased veterans' college attendance (Barr, 2015; Zhang, 2018). In this paper we assess the extent to which the Post-9/11 GI Bill reduced SNAP participation among veterans.

In the short run, veterans benefiting from a more generous GI Bill award are more likely to attend college and thus forego SNAP, since the GI Bill is typically more generous than SNAP. In this sense, a decrease in SNAP participation is merely the reflection of a surge in college attendance driven by an increase in the GI Bill. However, in the longer run, veterans with college education typically have larger earnings and fewer employment barriers than veterans without college education and may therefore be less likely to become SNAP eligible later in life.[3]

Using a difference-in-differences strategy, we exploit an exogenous change in the GI Bill award that occurred in 2009 to estimate: (a) the effect of the GI Bill on SNAP participation among veterans who transitioned from military to civilian life within the previous year ("new veterans"); and (b) the impact of the GI Bill on SNAP participation among veterans who separated from the military more than a year ago ("long-term veterans"). We use comparable non-veterans as a control group to approximate the counterfactual behavior of veterans in the absence of the Post-9/11 GI Bill. Our results indicate that the Post-9/11 GI Bill leads to a 28% reduction in SNAP participation among veterans, with differential effects among new veterans and long-term veterans. We estimate a smaller reduction in the SNAP participation rate, of 13.9%, among long-term veterans, while new veterans experience a 33.4% reduction in SNAP participation rates due to the Post-9/11 GI Bill.

The financial aid for higher education provided under the Post-9/11 GI Bill changes veterans' SNAP eligibility, generates an income effect in the current period, and a wealth effect—through human capital accumulation—in the future that may alter the veterans' SNAP participation decisions. The primary objective of the Post-9/11 GI Bill policy is not to reduce the veterans' reliance on welfare programs; as such, the GI Bill's effect on the SNAP utilization can be viewed as a spillover effect. We examine a previously unexplored link within the veteran population, between financial aid for higher education and participation in welfare programs. We provide insights into the extent to which financial aid for education crowds out SNAP participation and reduces the outlays of this large public welfare program. The results of this study suggest that the Post-9/11 GI Bill, and financial aid for education in general, may be a good example of a public program helping break the intergenerational transmission of SNAP reliance.

In the next section, we describe the SNAP eligibility, the Post-9/11 GI Bill program and its implications. We discuss our data in the data section. Next, we present our conceptual framework and empirical strategy, and then our main results. In the last section we present our concluding remarks.

SNAP ELIGIBILITY AND THE POST-9/11 GI BILL

SNAP provides financial assistance to low-income households. It is the largest nutrition assistance program in the US, serving over 42 million individuals. In fiscal year 2013, the national average monthly benefit per person was $133 and $275 per household.[4] Individuals become eligible for SNAP if their (a) gross household income is less than 130% of the poverty line;[5] (b) household income minus deductions is less than 100% of the poverty line;[6] or (c) assets are less than $2,250, after excluding the recipient's home and retirement accounts.[7]

Students enrolled at least half-time at an institution of higher education are ineligible for SNAP. They can retain SNAP eligibility while attending college if they: (a) work at least 20 hours per week; (b) receive a federal work-study grant; (c) participate in programs under the Social Security Act (e.g., Temporary Assistance for Needy Families), and are under the age of 18 or above 50; (d) are a parent caring for an age-eligible child; (e) are unable to work because of a mental or physical disability; or (f) have been placed into college by a workforce training program. Baicker et al. (2014) and Burney et al. (2018) examined the spillover effects of other public policies such as Medicaid expansion

on SNAP enrollment.[8] However, the literature is scarce on the potential effect of the financial aid for higher education on SNAP participation. In our study we illustrate how educational benefit can crowd out SNAP participation and thus lower the program outlays.

Between 1985 and 2009, college-bound active-duty personnel and military veterans relied on the Montgomery GI Bill (MGIB) as the primary Veterans Benefits Administration (VBA) education benefits program. The Post-9/11 GI Bill went into effect in August 2009, retroactively providing additional benefits to individuals with active-duty service after September 11, 2001. The vast majority of individuals serving on active duty after September 11, 2001 are eligible, with benefit levels tiered based on active-duty service lengths.

Under the Post-9/11 GI Bill program, the US Department of Veterans Affairs (VA) pays tuition and fees directly to schools up to the in-state maximum of each. The level of benefits increased considerably under the Post-9/11 GI Bill. In 2008, the MGIB provided about $1,400 of benefits per month for up to 36 months, resulting in a maximum total benefit level of approximately $50,000. During 2009–2010 the maximum per-credit benefit provided under the Post-9/11 GI Bill varies from $93 per credit in South Dakota to $1,471 in Texas. In addition, the VA provides veteran students enrolled half-time or more with a monthly housing allowance that varies by the location of the institution that they attend. Including the housing allowance, the annual combined maximum benefit amount ranges from $10,486 to $46,464 in benefits in a single year. The monthly basic allowance for housing (BAH) ranges from around $800 in many rural areas to over $2,700 in New York City. Finally, each full-time student receives an annual book stipend of roughly $1,000. It is important to note that the BAH provided under the Post-9/11 GI Bill program is counted as earned income for the purpose of SNAP income eligibility.[9] Moreover, the lack of clear and easy access to information on SNAP eligibility can make it difficult for eligible students to make informed choices about applying for SNAP (Government Accountability Office, 2018). Given the stringent SNAP eligibility and the inclusion of the BAH as earned income for the purpose of that eligibility, the low-income college enrolled veterans may lose on their SNAP eligibility due to the Post-9/11 GI Bill.

Barr (2019) found that the Post-9/11 GI bill increases college degree attainment. A positive relationship between college degree attainment and earnings is well documented in other studies (Kane & Rouse, 1995; Belfield & Bailey, 2011). Hence, the increased degree attainment in response to the Post-9/11 GI Bill may improve the veterans' earnings and reduce reliance on SNAP.

DATA

Our main analysis is based on annual American Community Survey (ACS) data (Ruggles et al., 2019), covering the 2006–2012 period. We have also used data from the 2008 Panel of the Survey of Income and Program Participation (SIPP) for the same period, and annual data on state unemployment rates from the US Bureau of Labor Statistics.

The ACS data include information on whether anyone in the household received Food Stamps (i.e., participated in SNAP) at any time in the past 12 months. ACS is a reliable source of information for SNAP participation. The participation rates based on ACS data are consistent with the percentages of American household receiving SNAP benefits that are estimated by Loveless (2015), and the estimates published by other studies on veteran SNAP participation (London & Heflin, 2015).[10] ACS includes questions allowing for the identification of veterans, their period of service (i.e., after 9/11), or whether they attend college, along with detailed economic, and socio-demographic characteristics. ACS also provides a question (asked for the last time in 2012) on whether the veteran has separated from military active duty within the last year—this is how we define the "new veterans." This information allows us to determine whether the response of new veterans to the Post 9/11 GI Bill with respect to SNAP is different from that of long-term veterans.

Focusing on college enrollment among veterans, we have restricted the data to veterans between the ages of 23 and 40. The empirical strategy, described in the next section, is based on a valid control group. Non-veterans who are not eligible for the GI Bill that have similar demographic characteristics as veterans serve as a counterfactual for veterans. We have also restricted our data to include only veterans and non-veterans who have at most a high-school diploma (or equivalent), and veterans who served in the US armed forces after 9/11.[11,12] We have ended up with a number of 56,707 veterans, of which 13,564 are "new" veterans. Since ACS does not specifically identify GI Bill usage, we have assumed that all veterans that are attending college do so by using the GI Bill.[13] The number of non-veterans in the sample we analyze is 2,048,649.

As shown in ***Table 1***, 11.6% of veterans, and 17.3% of non-veterans enroll in SNAP in the 2006–2012 period. In the same timeframe, 26.3% of veterans and 12.3% of non-veterans attend college. The annual SNAP participation rates for veterans and non-veterans are shown in ***Figure 1*** and also presented in Appendix Table A.1. In 2005 the estimated SNAP participation rate among veterans in our sample is 6.6% compared to 12.2% among non-veterans. The difference in the SNAP participation rates between these two groups remains relatively stable during

VARIABLES	INDIVIDUALS AGED 23–40		VETERANS AGED 23–40	
	VETERANS	NON-VETERANS	NEWLY SEPARATED	SEPARATED > 1 YEAR
In SNAP (%)	11.6	17.3	7.0	13.2
In College (%)	26.3	12.3	25.6	26.6
Associate Degree (%)	15.5	14.7	15.2	15.7
Age (mean in years)	29.2	31.2	28.8	29.3
Male (%)	83.5	49.4	83.6	83.4
Number of Children (mean)	0.826	1.057	0.810	0.831
Number of Children under 5 (mean)	0.383	0.341	0.368	0.388
Married (%)	46.4	42.6	51.0	44.7
Single/Never Married (%)	36.0	44.4	33.4	36.9
Divorced/Separated/Widowed (%)	17.7	13.0	15.6	18.4
Non-Hispanic White (%)	69.1	68.0	65.9	70.2
Non-Hispanic Black (%)	15.9	16.3	18.3	15.0
Hispanic (%)	10.6	11.7	11.1	10.5
Other race (%)	4.4	4.0	4.7	4.3
Living in a metro area (%)	74.1	72.8	76.4	73.3
Observations	56,707	2,048,649	13,564	43,143

Table 1 Descriptive Statistics, ACS (2006–2012).

Note: The weighted means are based on American Community Survey Data. Individuals are restricted to those who are US citizens and who have completed high school but haven't completed bachelor's degree yet. Information on whether veterans are newly separated is not available after 2012.

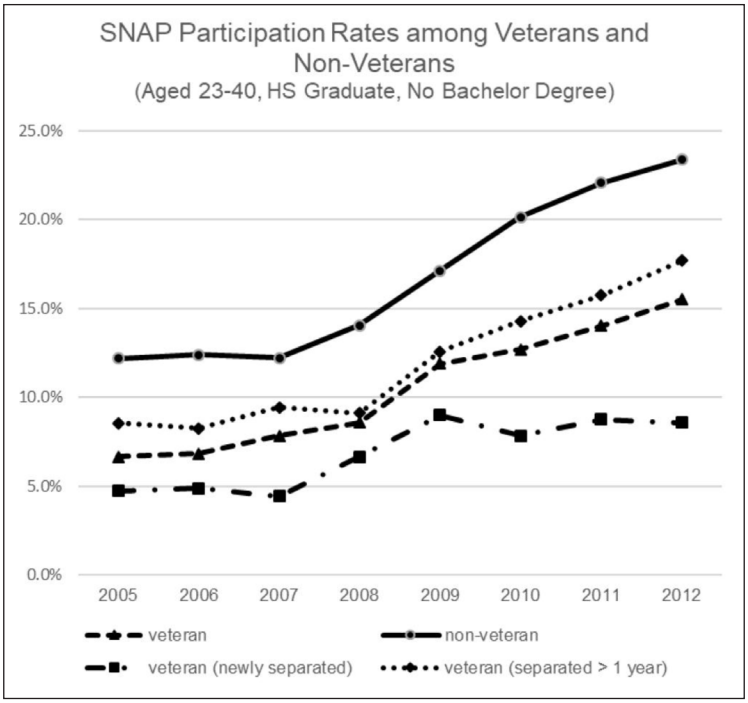

Figure 1 SNAP Participation Rates, ACS 2005–2012.
Note: The data points above are based on the ACS data, 2005–2012.

2005–2009 period. In 2009 the SNAP participation rate among veterans is 11.9% and it is 5.2% points lower than the rate among non-veterans. After the introduction of the Post-9/11 GI Bill, the SNAP participation rates continue to increase for both veterans and non-veterans, but notably, the growth in the veterans' participation rate is slower than that of non-veterans. In 2012, the SNAP participation rate among veterans reaches 15.5% compared to 23.4% among non-veterans. Hence, the difference in the SNAP participation rates increases to 7.9 percentage points. This represents about 52% increase in the difference since 2009.

Distinguishing between new veterans and veterans separated for more than a year, we note that the SNAP participation rate of new veterans remains flat after 2009, while the participation rate of the rest of the veterans slows down, relative to that of non-veterans. The SNAP participation rate among new veterans increases from 4.7% in 2005 to 9% in 2009 and declines slightly afterwards to reach 8.6% in 2012. The difference in the SNAP participation rates between new veterans and non-veterans increases from 8.1 percentage points in 2009 to almost 14.8 percentage points in 2012. During the same period, the difference in SNAP participation rates between veterans who separated more than a year ago and non-veterans increases from 4.1 to 5.7 percentage points.

Potential drivers of this slowdown in SNAP enrollment among veterans are college enrollment and degree attainment. In ***Figure 2*** we show that after 2009 the college enrollment rate increases faster for veterans than for non-veterans. Annual college enrollment rates and associate degree attainment rates are summarized in Appendix Table A.2. The college enrollment rate of veterans increases from 24.1% in 2008 to 28.7% in 2012. The difference in the college enrollment rates among veteran and non-veteran increases from 12.7 to 15.5 percentage points during this period. This represents almost 22% increase in the difference. In our timeframe we cannot assess whether the Post-9/11 GI Bill increases the rate of degree attainment at 4-year colleges. Focusing instead on associate degrees, which typically take 2 years to complete, we find that the proportion of veterans with associate degrees increases notably relative to non-veterans from 2011 onwards, that is, 2 years after the Post-9/11 GI Bill. In 2008, the associate degree attainment rates are very similar for veterans and non-veterans: 14.2% of veterans in our sample are estimated to have associate degree compared to 14.5% of non-veterans. However, in 2012 almost 17% of veterans have associate degrees compared to 15.3% of non-veterans. Hence, the difference in associate degree attainment increases from –0.3 percentage points in 2008 to 1.7 percentage points in 2012.

In ***Table 2*** we present additional descriptive statistics on the four potential choices individuals make with respect to college enrollment and SNAP participation (in college and not

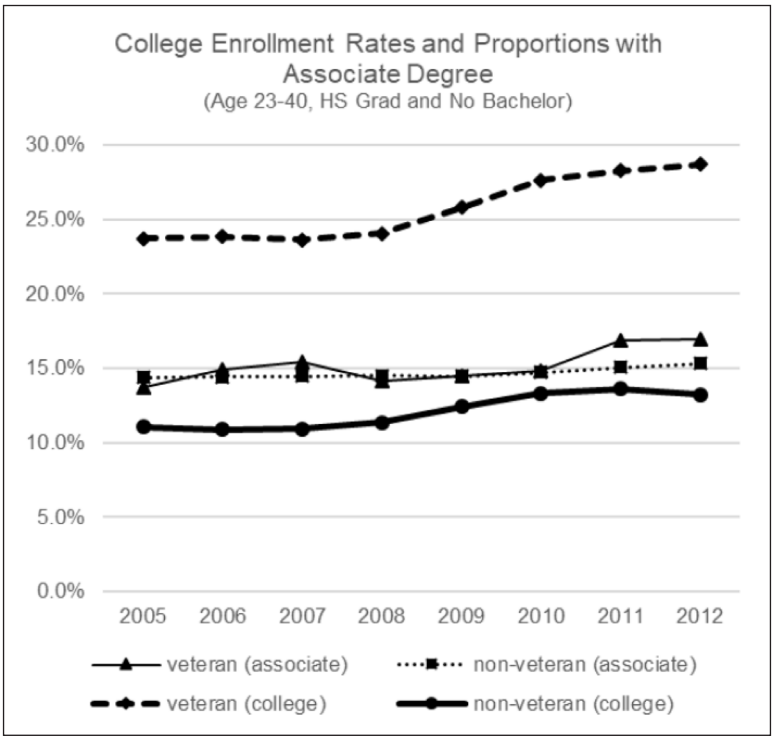

Figure 2 College Enrollment Rates and Proportions with Associate Degree.

Note: The data points above are based on the ACS data, 2005–2012.

IN COLLEGE? →	YES	NO	YES	NO	YES	N/A
IN SNAP? →	NO	YES	YES	NO	N/A	YES
OUTCOMES	1	2	3	4	IN COLLEGE	IN SNAP
	YEAR 2006–2012					
Veteran	23.6%	8.8%	2.8%	64.9%	26.3%	11.6%
New Veteran	24.0%	5.4%	1.6%	69.0%	25.6%	7.0%
Long-term Veteran	23.4%	10.0%	3.2%	63.4%	26.6%	13.2%
Non-Veteran	10.0%	15.1%	2.3%	72.7%	12.3%	17.3%
	YEAR 2006–2009 (BEFORE POST-9/11 GI BILL)					
Veteran	22.5%	7.0%	1.8%	68.6%	24.4%	8.9%
New Veteran	22.2%	4.8%	1.0%	72.0%	23.2%	5.8%
Long-term Veteran	22.7%	7.9%	2.2%	67.3%	24.8%	10.1%
Non-Veteran	9.8%	12.3%	1.7%	76.3%	11.4%	14.0%
	YEAR 2010–2012 (AFTER POST-9/11 GI BILL)					
Veteran	24.6%	10.5%	3.7%	61.3%	28.3%	14.2%
New Veteran	26.0%	6.1%	2.3%	65.6%	28.3%	8.4%
Long-term Veteran	24.1%	11.9%	4.1%	59.9%	28.2%	16.0%
Non-Veteran	10.3%	18.8%	3.1%	67.8%	13.4%	21.9%

Table 2 College and SNAP Enrollment Rates, Age 23–40 (ACS 2006–2012).

in SNAP; not in college and in SNAP; in college and in SNAP; not in college and not in SNAP), before and after the Post-9/11 GI Bill. In the two rightmost columns we show the totals for being in college, and for being in SNAP, respectively. It is important to note that the proportion of veterans choosing option one (i.e., enrolled in college, and not in SNAP) increases by 2.1 percentage points, from 22.5 to 24.6%, after 2009, while the increase among non-veterans is only 0.5 percentage points (from 9.8 to 10.3%). In contrast, the proportion of veterans choosing option two (i.e., not in college, and in SNAP) increased by 3.5 percentage points relative to 6.5 percentage points increase among non-veterans.

The Survey of Income and Program Participation (SIPP) provides monthly information on SNAP participation and college enrollment status in each month. Using data from the 2008 panel, over the May 2008 and December 2012 period we have identified 1,358 veterans and 24,552 non-veterans aged 23–40 who have at most a high school degree. As shown in ***Table 3***, the increase in the proportion of veterans attending college after 2009 is larger for veterans than for non-veterans, and the increase in the proportion of veterans in SNAP after 2009 is lower for veterans than for non-veterans. Although the rates of college attendance and SNAP reliance are lower than those from ACS, they imply a similar story to the one from ***Tables 1*** and ***2*** and ***Figures 1*** and ***2***.[14] The monthly SNAP participation rates among these individuals in the SIPP data are shown in ***Figure 3***.

CONCEPTUAL FRAMEWORK AND EMPIRICAL STRATEGY

Veterans make decisions about whether to participate in SNAP, enroll in college, work, or combinations of these alternatives. Their choices are shaped by current and future values of college and non-college wage rates, the cost of education, asset income, personal preference, and random shocks. When the GI Bill benefit increases, there are three potential effects among the population of veterans. First, the Post-9/11 GI Bill provides a basic housing allowance that increases the veterans' non-labor income, thus generating an income effect that reduces the marginal benefit of SNAP participation. Second, as per the SNAP administrative eligibility criteria students enrolled at least half-time at an institution of higher education are generally ineligible for SNAP. Hence, many veterans who attend colleges at least half time (in response to higher GI Bill benefits) lose their SNAP eligibility. Third, in the longer run, the future returns to college degree (net of the cost of education) creates a

VETERAN STATUS	AGE 23–40 HS GRAD		AGE 23–64 HS GRAD	
	IN SNAP	IN COLLEGE	IN SNAP	IN COLLEGE
	Before (May 2008–Aug. 2009)			
Veteran	3.9%	16.7%	2.7%	5.4%
Non-Veteran	9.5%	12.6%	6.9%	6.9%
	After (Sep. 2009–Dec. 2012)			
Veteran	6.0%	19.2%	4.6%	6.4%
Non-Veteran	13.1%	14.3%	10.1%	7.6%
	Overall (May 2008–Dec. 2012)			
Veteran	5.4%	18.5%	4.0%	6.3%
Non-Veteran	12.2%	13.9%	9.3%	7.5%

Table 3 SNAP Participation and College Enrollment Rates (SIPP 2008 Panel).

Note: Table shows the sample weighted means based on monthly data across all individual veterans and non-veterans in the listed age range who are high school graduates but without bachelor's degree.

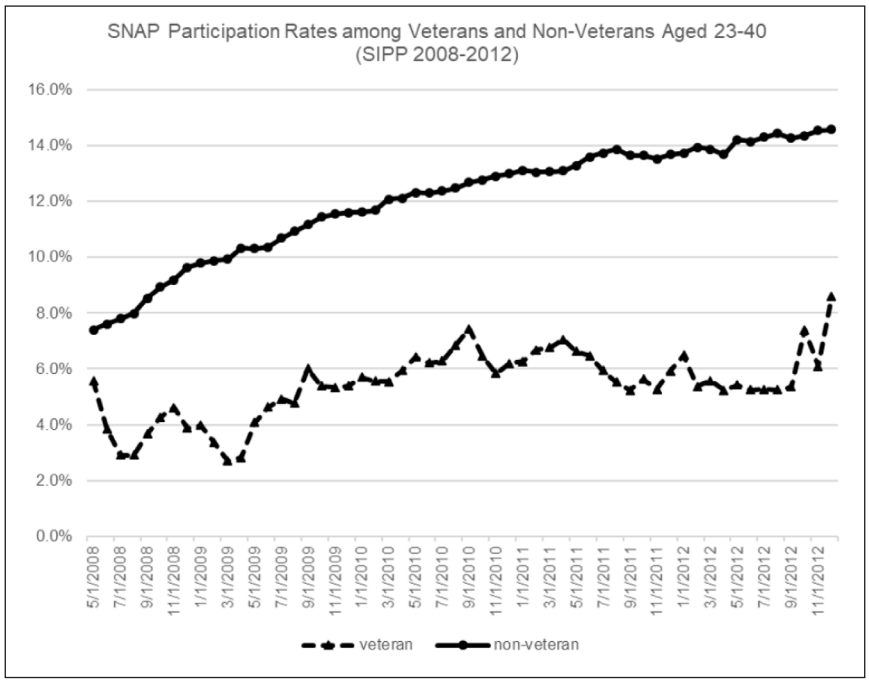

Figure 3 SNAP Participation Rates, SIPP 2008 Panel.

Note: The data points above are based on the SIPP data, 2008–2012.

wealth effect that further reduces SNAP participation.

It is important to note that even though some veterans lose SNAP eligibility once they attend college, there may be veterans that could retain SNAP eligibility, as discussed in the section on the SNAP eligibility rules. It is possible that some of these veterans, especially "new" veterans, are unaware of this possibility. It is therefore likely that the reduction in their SNAP eligibility once the GI Bill value increases is in part due to this lack of awareness. In time, they may become more aware of their dual eligibility (GI Bill and SNAP). New veterans may also have different preferential pattern for future consumptions which may be altered by the generous benefits under the Post-9/11 GI Bill. This may result in differential effects on their SNAP participation.

Our empirical strategy is informed by these considerations. However, data limitations prevent us from obtaining separate estimates for each of these potential effects. For instance, ACS data do not allow us to track and examine the changes in the veterans' income over time. This

prevents us from estimating a causal effect of the change in the veterans' lifetime income due to Post-9/11 GI Bill on their SNAP reliance in the long run. We have examined the changes in veterans' behavioral responses regarding SNAP participation after the implementation of Post-9/11 GI Bill as a combination of income, eligibility, and wealth effects.

We have relied on a difference-in-difference (DID) approach using non-veterans as the comparison group. We have estimated the following specification as our main empirical model:

$$Y_{i.t} = \alpha + \beta \cdot Post_t + \theta \cdot Veteran_i + \delta \cdot Post_t * Veteran_i + X'_{it} \cdot \Lambda + \varepsilon_{it} \quad (1)$$

The dependent variable has the value of 1 if the veteran participates in SNAP, and 0 otherwise. The dummy *Veterani* indicates veteran status, while the variable *Postt* indicates whether the observation is from the period when the Post 9/11 GI Bill was implemented (i.e., 2010–2012). The main coefficient, δ, measures the effect of the Post-9/11 GI Bill on the veterans' SNAP participation. The vector *X* in equation (1) include a set of socio-demographic characteristics: veteran status, age, sex, marital status, race, number of children (overall and under age 5), metropolitan status, year fixed effects, and unemployment rate. We have estimated equation (1) as a linear model and as a logistic regression. We have estimated similar models to distinguish between newly separated veterans and long-term veterans.

We recognize that the introduction of the Post-9/11 GI Bill coincides with the Great Recession, which may pose a threat to the identification of the GI Bill's effect on SNAP enrollment. Ganong and Leibman (2018) documented a strong correlation between SNAP enrollment rate and local economic conditions, as measured by unemployment rates.[15] In all models we have controlled for the unemployment rate at the state and year level. We have also accounted for the heterogeneity of the effect of unemployment on veterans and non-veterans by interacting the unemployment variable with the veteran indicator.[16]

We have also estimated additional DID models to study the effect of the Post-9/11 GI Bill on college enrollment and degree attainment among veterans. Given that it typically takes at least 2 years to complete an associate degree, the post-period indicator in the model for degree attainment is defined to indicate whether the year of observation is 2011 or later. We have estimated all models using clustering by state to obtain robust standard errors (Bertrand et al., 2004).

RESULTS

In ***Table 4*** we show the estimates from our DID models of

VARIABLES	LINEAR PROBABILITY MODELS (LPM)						
	AGE 23–40	AGE 23–40	AGE 23–40 (HEAD HH)	AGE 23–40 (INCOME ELIG.)	AGE 23–29	AGE 30–40	AGE 23–49
Post (Year>2009)*Veteran	−0.025*** (0.006)						
Post*Veteran (Separated >1 Year Before)		−0.014** (0.006)	−0.014** (0.006)	−0.027** (0.012)	−0.011 (0.009)	−0.022*** (0.007)	−0.012** (0.006)
Post (Year>2009)*Veteran (Newly Separated)		−0.057*** (0.006)	−0.056*** (0.007)	−0.037** (0.016)	−0.053*** (0.007)	−0.071*** (0.008)	−0.052*** (0.005)
Veteran	−0.033** (0.014)						
Veteran (Separated >1 Year Before)		−0.023 (0.014)	−0.015 (0.012)	−0.012 (0.022)	−0.017 (0.016)	−0.022 (0.014)	−0.023** (0.012)
Veteran (Newly Separated)		−0.049*** (0.013)	−0.048*** (0.011)	−0.068*** (0.022)	−0.045*** (0.015)	−0.043*** (0.013)	−0.048*** (0.011)
Post (Year>2009)	0.087*** (0.018)	0.087*** (0.018)	0.073*** (0.015)	0.119*** (0.026)	0.096*** (0.019)	0.083*** (0.017)	0.077*** (0.017)
Observations	2,105,356	2,105,356	1,393,778	951,348	848,625	1,256,731	3,428,569

Table 4 Difference-in-Difference Models of SNAP Participation (ACS Data).

Note: The model for Head HH is restricted to individuals who are either Household Head or Spouse of Household Head. Model in 4th column is for those who meet SNAP income eligibility. All specifications include the following covariates: age, sex, number of children (overall and under age 5), marital status, race, metropolitan status, year fixed effects, unemployment rate, and interaction of veteran status and unemployment rate. * p < 0.10; ** p < 0.05; *** p < 0.01.

SNAP participation. The model results in column 1 indicate that veterans are 2.5 percentage points less likely to enroll in SNAP relative to comparable non-veterans after the implementation of the Post-9/11 GI Bill. Relative to the SNAP participation of veterans before 2009, of 8.9%, this represents a reduction in the veterans' SNAP enrollment of 28.1% relative to the rate in the "pre" period. In column 2 we estimate separate effects for new and long-term veterans and find that after the implementation of the Post-9/11 GI Bill, for new veterans, the reduction in SNAP participation relative to civilians is much larger (5.7 percentage points) than the reduction in the long-term veterans' SNAP participation (1.4 percentage points). For long-term veterans, this translates into a 13.9% reduction, while for new veterans it represents a 98.3% reduction.[17] The overall effect on long-term veterans captures the combined effect of changes in their income eligibility, changes in their preference for future consumption, and a long-term wealth effect due to the Post-9/11 GI Bill. In contrast, the large impact on new veterans is observed in the first year of their transition from military to civilian life in college. This short-term impact is likely reflecting a combined effect of income eligibility changes, differential shifts in their preference for future consumption, and potentially a stronger impact of the lack of awareness of the SNAP eligibility process. As they gradually get settled in civilian life and navigate through the SNAP eligibility process later on, the subsequent impact on their SNAP participation may likely be in the same range as the effect on long-term veterans. Despite the fact that the effect on new veterans is most likely temporary, this may yield potential cost savings for the SNAP program.

Next, we restrict the sample to include only individuals who are the head of the household, or the spouse of the head of the household. This is meant to mitigate concerns on whether the individual veteran, instead of a non-veteran household head, is making the decision about SNAP participation. The results are shown in the third column of ***Table 4***. The estimated effects of the Post-9/11 GI Bill on the SNAP participation of new and long-term veterans are almost identical to what we estimated in the unrestricted sample (column 2).

The results in the fourth column in ***Table 4*** show the estimated effects on veterans with total family income below 130% of the federal poverty line (FPL), that is, below the gross income limit for SNAP eligibility.[18] The effect of the Post-9/11 GI Bill on long-term veterans is expected to be larger than in the main model, since the SNAP participation rate is relatively higher among these low-income individuals. It is important to note that income of veterans may not be strictly exogenous, because the Post-9/11 GI Bill may have altered veterans' income through the changes in their labor market decisions, the receipt of basic housing allowance and their participation in SNAP. Thus, any measurable significant effect among these low-income veterans provides stronger evidence that the Post-9/11 GI Bill may have crowded out SNAP participation. We estimate about 2.7 percentage points reduction in SNAP participation among long-term veterans. This represents a 13.6% reduction in SNAP participation relative to their mean participation rate of 19.8% in the "pre" period. This effect is very similar to what we estimate in the first column of ***Table 4***. On the other hand, for SNAP income eligible new veterans, we estimate 3.7 percentage points reduction in SNAP participation. This translates into a 33.4% lower SNAP participation relative to their mean. This potential temporary effect is still significantly higher than the effect among long-term veterans. However, the effect is much lower than the 98.3% reduction that we estimated in the first column of ***Table 4*** because low-income new veterans may have greater financial need to navigate through the SNAP eligibility rules. Also, these low-income veterans are most likely SNAP income eligible. Hence, the estimated effect suggests that the temporary impact of the lack of awareness of the SNAP eligibility rules and the changes in their preference for future consumption are likely dominating for new veterans.

The estimated effects for different age groups are shown in the last three columns in ***Table 4***. The effect on long-term veteran aged 23–29 is smaller and insignificant. But the effect is much larger for long-term veterans aged 30–40: about 2.2% points lower SNAP participation rates (i.e., 24% lower relative to the mean from the "pre" period). This larger decline is consistent with a relatively higher proportionate increase in college enrollment rates among veterans in this older age group. When we estimate the model using individuals aged 23–49, the effects are very similar to the main effects, estimated using the 23–40 age group.

In Table A.4 in the Appendix, we show the estimates of the Post-9/11 GI Bill on college enrollment across different age ranges. The estimated effects are very similar across two age groups (i.e., aged 23–29 and 30–40). However, relative to the mean college enrollment rates, veterans aged 30–40 experienced about 17% increase in college enrollment in response to the Post-9/11 GI Bill. Veterans aged 23–29 experienced about 11% increase in college enrollment. Hence, the effect of the Post-9/11 GI Bill on SNAP participation is expected to be more pronounced among veterans aged 30–40.

Additionally, we estimate a higher degree attainment among veterans in response to the Post-9/11 GI Bill (presented in Appendix Table A.5). Veterans aged 23–40 experienced a 1.2 percentage points increase in associate degree attainment as a result of the Post-9/11 GI Bill,

representing an 8% increase relative to mean.[19] The availability of a degree may improve earnings, which in turn may reduce the veterans' reliance on SNAP. Thus, the reduction in SNAP participation among veterans could be attributed to both an increase in college attendance and an increase in degree attainment in response to the Post-9/11 GI Bill.

In ***Table 5*** we estimate the impact of the Post-9/11 GI Bill on SNAP participation using SIPP data. One limitation of SIPP is that it does not allow us to distinguish between new veterans and long-term veterans. Hence, we present an overall effect on all veterans. In the first column we show that the increase in the SNAP participation among veterans aged 23–40 was 1.7 percentage points lower relative to the increase among comparable non-veterans: this is about a 44% reduction relative to the mean SNAP participation rates from SIPP data. However, this is approximately 1.6 times higher than the effect we estimate using ACS data (of 28%). Despite their variation, the estimates obtained from ACS and SIPP data point in the same direction, indicating that the Post-9/11 GI Bill induces a lower SNAP participation among veterans.

	LPM – SNAP (AGE 23–40)	LPM – SNAP (AGE 23–49)
Post (Month>Aug. 2009)*Veteran	−0.017*** (0.003)	−0.019*** (0.002)
Post (Month>Aug. 2009)	0.036*** (0.001)	0.031*** (0.001)
Veteran	−0.029*** (0.006)	−0.020*** (0.004)
Observations	609,034	963,587

Table 5 Difference-in-Difference Models of SNAP Participation (SIPP Data).

Note: The linear probability models (LPM) also include the following covariates: age, sex, number of children, race, marital and metropolitan status, year fixed effects, unemployment rate, and interaction of veteran status and unemployment rate. Standard errors are in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

JOINT DECISION OF COLLEGE ENROLLMENT AND SNAP PARTICIPATION

To examine the impact of the Post-9/11 GI Bill on veterans' choice of SNAP participation and college enrollment simultaneously we use DID methodology in a multivariate probit (MVP) model framework. This model is useful to better understand the drivers of the changes in the SNAP participation rates in response to the Post-9/11 GI Bill. The generosity of Post-9/11 GI Bill may influence veterans' work and college enrollment decisions simultaneously. However, the monthly SNAP benefit amount is much smaller to materially alter their work decisions. Hence, to examine the pathways of SNAP enrollment in the context of Post-9/11 GI Bill, we only focus on individuals' SNAP and college enrollment decisions, irrespective of their work decisions. The MVP model is ideal for situations where multiple binary outcome variables are potentially correlated with one another. We estimate the MVP model using the approach illustrated by Cappellari and Jenkins (2003, 2006).[20] The estimated effects of the Post-9/11 GI Bill on each of the four possible outcome choices are presented in ***Table 6***.

IN COLLEGE ? →	YES	NO	YES	NO	YES	N/A
IN SNAP ? →	NO	YES	YES	NO	N/A	YES
OUTCOMES	1	2	3	4	IN COLLEGE	IN SNAP
Veteran						
DID Effect	0.026**	−0.028**	0.006**	−0.004	0.032**	−0.022**
Std. Error	(0.004)	(0.003)	(0.001)	(0.004)	(0.004)	(0.004)
Long-term Veteran						
DID Effect	0.026**	−0.021**	0.008**	−0.013**	0.034**	−0.013**
Std. Error	(0.005)	(0.003)	(0.001)	(0.005)	(0.006)	(0.004)
New Veteran						
DID Effect	0.031**	−0.042**	−0.003	0.014	0.029**	−0.045**
Std. Error	(0.011)	(0.004)	(0.002)	(0.011)	(0.011)	(0.005)

Table 6 Impact of the Post-9/11 GI Bill on College Enrollment and SNAP Participation Rates (ACS Data).

Note: The table shows estimated differences in predicted probabilities based on Bivariate Probit model.

The estimates are calculated by taking the appropriate differences between veterans and non-veterans, in the before and after periods. The standard errors are also obtained through bootstrapping. Separate effects are estimated for veterans in general, new veterans and long-term veterans. The results show that the proportion of veterans aged 23–40 who are in college and not in SNAP increases by about 2.6 percentage points in response to the Post-9/11 GI Bill. However, the majority of this change can be tied to about 2.8 percentage points reduction in the proportion of veterans who are not in college but in SNAP. The changes in the other two outcome categories are relatively trivial and have not contributed much to the reduction in SNAP participation among veterans. Hence, the increase in college enrollment that is induced by the Post-9/11 GI Bill is primarily responsible for the reduction in SNAP participation. A similar impact is also observed among long-term veterans.

Consistent with our previous discussion, we estimate a 4.5 percentage points reduction in the proportion of new veterans who are in SNAP but not in college. As larger fractions of these new veterans enroll in college right after their military service, they find it challenging to navigate through SNAP eligibility and enrollment process during their transition to civilian life. At the same time the proportion of new veterans enrolled in college without SNAP increases substantially, which explains about two-thirds of the reduction in SNAP participation. This larger effect is most likely due to the lack of awareness about SNAP eligibility and the general ineligibility arising from enrolling in college in response to the Post-9/11 GI Bill.

CONCLUSION

In addition to a substantial tuition benefits, the Post-9/11 GI Bill provides a significant housing allowance to college enrolled veterans. This generous financial aid for education leads to a lower reliance on SNAP among veterans due to a combination of income eligibility and wealth effects. The exogenous variation in the GI Bill policy allows us to examine the potential spillover effect of financial education assistance on veterans' SNAP participation. Using ACS and SIPP data, in this paper we provided evidence that after the Post-9/11 GI Bill is adopted veterans reduce their SNAP participation by about 28%. The reduction in SNAP participation among veterans indicates a potential wealth effect of human capital accumulation that leads to long-term economic stability and improved food security. This may suggest that the Post-9/11 GI Bill may help break the intergenerational transmission of SNAP dependence. From a policy perspective, a more generous financial aid to education may increase college attendance, increase lifetime incomes, and this in turn, may reduce family's dependence on SNAP and similar public welfare programs in the long run.

For long-term veterans the estimated reduction in SNAP participation is 13.9%, while the effect, albeit potentially temporary, is much larger among new veterans. A sizeable part of the estimated larger temporary reduction in SNAP participation among new veterans is potentially due to the lack of awareness of the SNAP eligibility rules while in college in their first year of transition into civilian life. Future research and policies can address this issue of the information gap to help veterans. Nonetheless, the long-term economic gains of improved education outcomes and reduced reliance on SNAP due to Post-9/11 GI Bill are more honorable for veterans than the persistent dependence on SNAP benefits.

NOTES

1 The 2008 Farm Bill changed the name of the program from the "Food Stamp Program" to the "SNAP." We use SNAP throughout the paper to refer to this program, regardless of time period.

2 US Department of Agriculture: *https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap*.

3 Past studies (Kane & Rouse, 1995; Belfield & Bailey, 2011) indicated that college degrees improve earnings. Subsequently, college educated individuals with higher income are less likely to meet SNAP income eligibility limit (Finifter & Prell, 2013).

4 US Department of Agriculture (*https://www.fns.usda.gov/pd/supplemental-nutrition-assistance-program-snap*). A household's benefit is equal to the maximum benefit, minus 30% of its net income.

5 In FY2015, 130% of poverty is $1,265/month for one person and $2,584/month for four people.

6 There is a standard deduction of $155 for households with 1 to 3 members along with a 20% earned income deduction, and other deductions including medical and child-care expenses.

7 All states also exclude at least a portion of the value of the household's primary vehicle when determining assets.

8 These studies indicated about a 4 to 5.7% increase in SNAP participation rate due to Medicaid expansion.

9 Virginia Department of Social Services: *https://www.dss.virginia.gov/files/division/bp/fs/manual/P11.pdf*.

10 Some differences in the SNAP participation rates between the ACS and the SNAP administrative data are noted in past studies (Harris, 2014; Meyer & George, 2011). It is unlikely that the differences are correlated with the GI Bill policy change and hence the estimated effect of the Post-9/11 GI Bill on SNAP participation will not be contaminated.

11 Non-veterans aged under 23 (the traditional college-aged) may respond differently than veterans to changing economic and financial aid conditions and thus may serve as a poor control group. Also, college students under 23 may still be dependents, and thus ineligible to apply for SNAP on their own.

12 Barr (2015) examined college enrollment among veterans aged 23–29. Zhang (2018) also found a substantial impact of the Post-9/11 GI Bill on college enrollment among veterans aged 30–50.

13 Barr (2015) also used the college attendance information from

ACS to infer GI Bill utilization among veterans. It is unlikely that veterans attend college without the GI Bill.

14 Ratcliff et al. (2011) discussed the potential underreporting of SNAP receipt and indicate that if the underlying policy change is not systematically correlated with the underreporting of SNAP receipt, the estimated effect of the policy on SNAP participation is unlikely to be biased.

15 Ganong and Leibman (2018) concluded that majority of the growth in SNAP enrollment during 2007–2011 economic recession could be explained by the increase in unemployment rates.

16 Ganong and Leibman (2018) also discussed two SNAP policies that expanded during 2007–2011 economic recession: broad-based categorical eligibility and temporary waivers on time limits. These policies that started (in 2001) well before the Post-9/11 GI Bill are expected to impact both veterans and non-veterans. Hence, our DID model is useful to distinguish the effect of the Post-9/11 GI Bill from the effect of these SNAP policy changes.

17 We also estimated Logistic models of SNAP participation. The DID estimates are constructed by taking the differences between the predicted probabilities corresponding to each group in each period; we then bootstrap the standard errors following Norton et al. (2003, 2004) and Dowd et al. (2014). The results (in Appendix Table A.3) indicate that the SNAP participation rates among veterans are 22.5% lower after the implementation of the Post-9/11 GI Bill. For long-term veterans the SNAP participation rate drops 1.2 % points (i.e., 12%), while for new veterans the rate decreases by 4.5% points (or 78%).

18 For determining income below 130% FPL, we exclude the ACS income measures "other income" which most likely include the basic housing allowance provided under the Post-9/11 GI Bill.

19 We do not find a statistically significant effect of the Post-9/11 GI Bill on associate degree attainment among veterans aged 30–40. If veterans in the older age group have enrolled in 4-year degree program, it is not possible to detect such an effect within our data period.

20 We estimate the MVP model in Stata (statistical software). The estimated coefficients are shown in Appendix Table A.6. The estimated model indicates a small negative but statistically significant correlation (–0.16) between SNAP and college enrollment.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Appendix.** Supplementary Tables of SNAP Enrollment, College Outcomes and Additional Model Estimates. DOI: *https://doi.org/10.21061/jvs.v6i3.203.s1*

COMPETING INTERESTS

The authors have no competing interests to declare.

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