

## Online Appendix

### Stacking the Deck for Employment Success: Labor Market Returns to Stackable Credentials

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#### Supplementary Tables

**Appendix Table 1**

*Virginia Community College System and Two-Year, Public Institutions Nationally*

	VCCS	Non-VCCS	National Differential	Regional Differential
Enrollment	1187	1134	53 (377.259)	370 (379.776)
Asian	0.03	0.03	-0.01 (0.007)	0.01 * (0.007)
Black	0.17	0.14	0.02 (0.025)	-0.09 *** (0.028)
Hispanic	0.09	0.21	-0.12 *** (0.015)	0.01 (0.014)
White	0.65	0.52	0.14 *** (0.038)	0.07 (0.040)
Female	0.54	0.52	0.02 ** (0.009)	0.00 (0.010)
Completion Rate (150%)	0.32	0.29	0.03 * (0.014)	0.03 * (0.016)
Net Price	\$6,685	\$7,256	-\$570 (358)	\$496 (381)
N Institutions	23	776	799	219

*Notes:* Data from the Integrated Postsecondary Education Data System (IPEDS) downloaded via the Urban Institute Education Data Portal. Demographic data as of the 2018-19 academic year; completion rate and net price retrieved from the 2017-2018 academic year. Reports Virginia and National average characteristics and outcomes for two-year, public, degree-granting institutions. Tests for differences between Virginia institutions and national average as well as Virginia institutions relative to other Southeast states (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, and WV).

**Appendix Table 2**

*Sample Characteristics, Stackers and Never Attempters*

	Stackers	Never Attempted Stack		Never Attempted Stack, Matched	
<i>Student Characteristics</i>					
Female	0.66	0.57		0.65	
Asian	0.02	0.03	+	0.01	*
Black	0.27	0.22	***	0.27	
Hispanic	0.04	0.03	***	0.05	
White	0.65	0.70	***	0.66	
Virginia Resident	0.98	0.99		0.99	
First-Generation	0.51	0.45	***	0.53	
Missing Parental Education	0.34	0.40	***	0.32	
Ever Received Pell	0.48	0.40	***	0.47	
Age at Initial Degree	36.91	36.45		36.92	
Military Service	0.04	0.02	***	0.04	
Rural	0.27	0.29		0.28	
Urban	0.47	0.39	***	0.48	
Suburban	0.16	0.19		0.14	
<i>Initial Credential Characteristics</i>					
Short-term certificate	0.65	0.41	***	0.67	
Long-term certificate	0.21	0.11	***	0.19	
Applied Associate	0.14	0.48	***	0.13	
N graduates	809	6,643		809	

*Notes:* Compares individuals who completed a stack ("stackers" - earned two non-concurrent credentials at VCCS) to individuals who never attempted a second credential at VCCS overall and for a matched subsample of never attempters (using nearest neighbor 1:1 matching without replacement). First-generation indicates that the highest recorded graduation of the student's parents of record is less than college graduation. Ever received Pell indicates whether individual received a Pell grant prior to their first graduation. Age is age at first graduation from VCCS.

+p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Appendix Table 3***Effect of Stacking on Labor Market Outcomes, Relative to Never Attempters*

	Never Attempted Stack			Never Attempted Stack, Matched		
	Employed	Quarterly Wages	Log Quarterly Wages	Employed	Quarterly Wages	Log Quarterly Wages
<i>Panel A: Full Sample</i>						
Stack*Post	0.030 + (0.02)	332.84 (216.63)	0.014 (0.03)	0.060 ** (0.02)	885.27 *** (273.90)	0.109 ** (0.04)
Comparison Mean	0.707	6020.24	8.712	0.707	6020.24	8.712
N graduates	7,452	7,452	7,452	1,618	1,618	1,618
N observations	357,462	357,462	274,041	76,803	76,803	59,549
<i>Panel B: Health</i>						
Stack*Post	0.031 (0.03)	-324.45 (368.54)	-0.076 (0.05)	0.087 ** (0.03)	881.00 + (457.68)	0.111 (0.07)
Comparison Mean	0.694	5333.16	8.605	0.694	5333.16	8.605
N graduates	2,804	2,804	2,804	711	711	711
N observations	137,142	137,142	108,621	33,557	33,557	26,240
<i>Panel C: Business</i>						
Stack*Post	0.046 (0.03)	1047.49 ** (407.60)	0.111 * (0.05)	0.063 (0.04)	1102.90 + (571.59)	0.081 (0.07)
Comparison Mean	0.729	7001.20	8.886	0.729	7001.20	8.886
N graduates	1,191	1,191	1,191	336	336	336
N observations	58,226	58,226	45,248	16,158	16,158	12,850
<i>Panel D: Other Fields</i>						
Stack*Post	-0.001 (0.02)	279.83 (332.55)	0.041 (0.05)	0.020 (0.03)	616.46 (406.90)	0.129 * (0.06)
Comparison Mean	0.710	6327.34	8.741	0.710	6327.34	8.741
N graduates	3,457	3,457	3,457	571	571	571
N observations	162,094	162,094	120,172	27,088	27,088	20,459

*Notes:* Robust standard errors in parentheses. Models include individual-specific time trends, an individual fixed effect, as well as indicators for each quarter in the panel, indicators for quarters when students were enrolled at VCCS and controls for the number of credits enrolled each quarter, as well as an Ashenfelter's Dip indicator for the two quarters prior to students first VCCS enrollment and an Ashenfelter's Dip indicator for the two quarters prior to students' second VCCS enrollment.

+p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Appendix Table 4***Effect of Stacking on Labor Market Outcomes, Additional Pre-Enrollment Data*

	Employed	Quarterly Wages	Log Quarterly Wages
<i>Panel A: Full Sample</i>			
Stack*Post	0.038 *	319.53	0.068 +
	(0.019)	(235.48)	(0.037)
Comparison Mean	0.746	8790.12	9.075
N graduates	2,556	2,556	2,556
N observations	119,534	119,534	92,914
<i>Panel B: Health</i>			
Stack*Post	0.079 **	912.21 **	0.093
	(0.031)	(389.31)	(0.062)
Comparison Mean	0.759	8362.54	9.009
N graduates	1,081	1,081	1,081
N observations	50,282	50,282	39,203
<i>Panel C: Business</i>			
Stack*Post	0.020	-169.00	0.060
	(0.038)	(466.38)	(0.067)
Comparison Mean	0.737	9107.37	9.142
N graduates	454	454	454
N observations	21,601	21,601	17,107
<i>Panel D: Other Fields</i>			
Stack*Post	-0.006	-272.80	0.036
	(0.028)	(355.43)	(0.058)
Comparison Mean	0.738	9064.08	9.112
N graduates	1,021	1,021	1,021
N observations	47,651	47,651	36,604
<p><i>Notes:</i> Robust standard errors in parentheses. Models include individual-specific time trends, an individual fixed effect, as well as indicators for each quarter in the panel, indicators for quarters when students were enrolled at VCCS and controls for the number of credits enrolled each quarter, as well as an Ashenfelter's Dip indicator for the two quarters prior to students first VCCS enrollment and an Ashenfelter's Dip indicator for the two quarters prior to students' second VCCS enrollment. Results vary from main model in that this table includes up to 10 quarters of pre-initial-enrollment data rather than six in the main model.</p> <p>+p&lt;0.10, *p&lt;0.05, **p&lt;0.01, ***p&lt;0.001</p>			

**Appendix Table 5**

*Sample Characteristics, Stackers and Attempters Matched*

	Stackers	Stack Attempted		Stack Attempted, Matched
<i>Student Characteristics</i>				
Female	0.66	0.64		0.66
Asian	0.02	0.02		0.02
Black	0.27	0.30		0.27
Hispanic	0.04	0.04		0.04
White	0.65	0.62		0.64
Virginia Resident	0.98	0.99		0.99
First-Generation	0.51	0.50		0.50
Missing Parental Education	0.34	0.34		0.34
Ever Received Pell	0.48	0.54	+	0.46
Age at Initial Degree	36.91	35.39	**	37.04
Military Service	0.04	0.02	*	0.02
Rural	0.27	0.30		0.25
Urban	0.47	0.44	**	0.49
Suburban	0.16	0.16		0.17
<i>Initial Credential Characteristics</i>				
Short-term certificate	0.65	0.51	***	0.64
Long-term certificate	0.21	0.15	***	0.19
Applied Associate	0.14	0.34	***	0.17
N graduates	809	1,747		809

*Notes:* Compares individuals who completed a stack ("stackers" - earned two non-concurrent credentials at VCCS) to individuals who attempted but did not complete a second credential ("stack attempted" - completed one credential at VCCS and re-enrolled without earning a second credential after their initial graduation) overall and for a matched subsample of attempters (using nearest neighbor 1:1 matching without replacement). First-generation indicates that the highest recorded graduation of the student's parents of record is less than college graduation. Ever received Pell indicates whether individual received a Pell grant prior to their first graduation. Age is age at first graduation from VCCS.

+p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Appendix Table 6***Effect of Stacking on Labor Market Outcomes, Relative to Matched Attempters*

	Employed	Quarterly Wages	Log Quarterly Wages
<i>Panel A: Full Sample</i>			
Stack*Post	0.057 ** (0.020)	721.41 ** (276.37)	0.105 ** (0.039)
Comparison Mean	0.707	6020.24	8.712
N graduates	1,618	1,618	1,618
N observations	76,798	76,798	60,437
<i>Panel B: Health</i>			
Stack*Post	0.121 *** (0.034)	1400.26 *** (444.91)	0.175 ** (0.066)
Comparison Mean	0.694	5333.16	8.605
N graduates	709	709	709
N observations	32,984	32,984	25,766
<i>Panel C: Business</i>			
Stack*Post	0.058 (0.040)	434.42 (579.20)	0.092 (0.074)
Comparison Mean	0.729	7001.20	8.886
N graduates	337	337	337
N observations	16,261	16,261	13,142
<i>Panel D: Other Fields</i>			
Stack*Post	-0.022 (0.030)	-25.79 (431.91)	0.022 (0.061)
Comparison Mean	0.710	6327.34	8.741
N graduates	572	572	572
N observations	27,553	27,553	21,529

*Notes:* Robust standard errors in parentheses. Models include individual-specific time trends and individual fixed effects, as well as indicators for each quarter in the panel, indicators for quarters when students were enrolled at VCCS and controls for the number of credits enrolled each quarter, as well as an Ashenfelter's Dip indicator for the two quarters prior to students first VCCS enrollment and an Ashenfelter's Dip indicator for the two quarters prior to students' second VCCS enrollment.

+p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

**Appendix Table 7***Effect of Stacking on Labor Market Outcomes, by Second Credential Type*

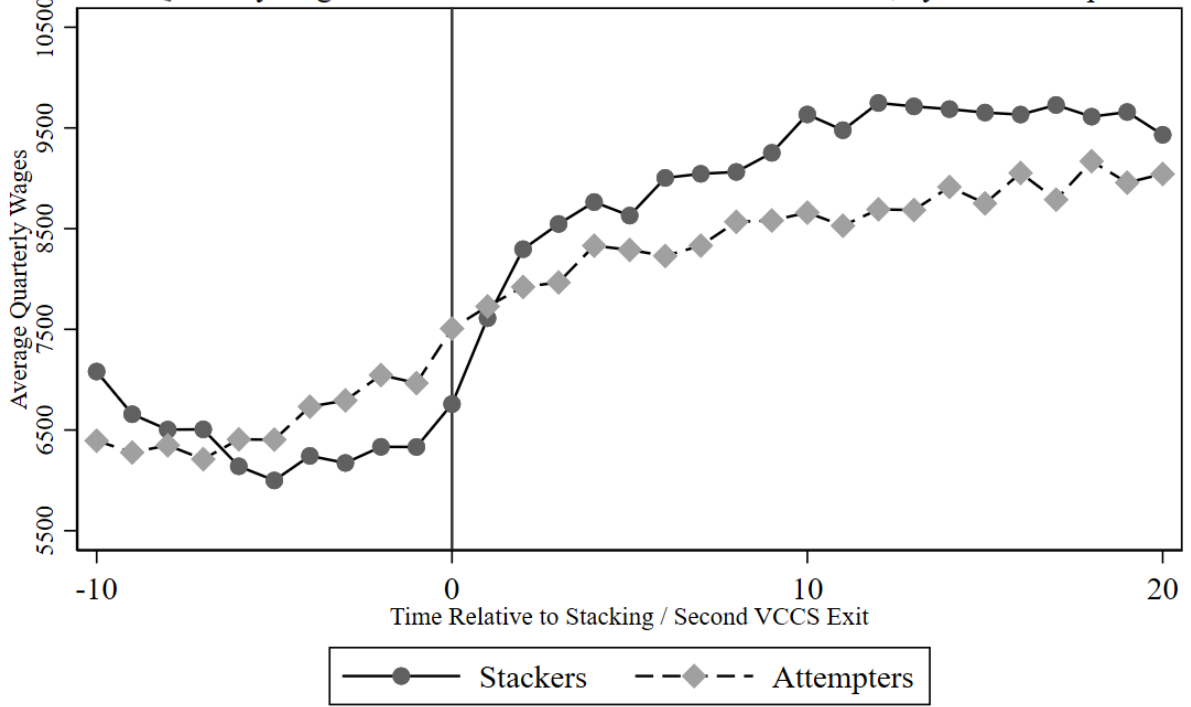
	Employed	Quarterly Wages	Log Quarterly Wages
Short-term Certificate	-0.010 (0.024)	-224.77 (319.52)	-0.006 (0.041)
Long-term Certificate	0.079 + (0.048)	-169.1 (404.46)	-0.007 (0.085)
Associate	0.036 (0.023)	1,167.31 *** (293.01)	0.274 *** (0.049)
Test of short-term = long-term = associate	0.167	0.002	0.000
<i>Comparison means</i>			
Short-term certificate	0.785	7,631.32	8.894
Long-term certificate	0.707	5,621.29	8.619
Applied Associate	0.719	6,034.82	8.691
N graduates	2,556	2,556	2,556
N observations	119,534	119,534	92,914

*Notes:* Robust standard errors in parentheses. Models include individual-specific time trends as well as an individual fixed effect, as well as indicators for each quarter in the panel, indicators for quarters when students were enrolled at VCCS and controls for the number of credits enrolled each quarter, as well as an Ashenfelter's Dip indicator for the two quarters prior to students first VCCS enrollment and an Ashenfelter's Dip indicator for the two quarters prior to students' second VCCS enrollment. An associate degree as a second credential could include an applied associate or a transfer-intending associate. Test of differences reports the p-value on the postestimation test of equality of coefficients for the three groups.

+p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Appendix Figure 1

Raw Quarterly wages before and after last enrollment at VCCS, by Stack Completion



Notes: Graphs raw quarterly wages for the full sample of stackers and attempters  
N=2,556