Local Labor Markets and Human Capital Investments
Appendix: For Online Publication

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1 Data

1.1 Classifying Computer- and Finance Related Industries to Define Dot-Com Crash and Financial Crisis Exposure

I classify industries as computer-related using a BLS definition of high-technology industries by 1997 NAICS code (Hecker (2005)). I classify as computer-related industries the high-technology industries that are relevant for the computer industry. These include (2000 Census Classification Code in parentheses): "Manufacturing-Computers and Peripheral Equipment (336)", "Manufacturing-Communications, audio, and video equipment (337)", "Manufacturing-Navigational, measuring, electromedical, and control instruments (338)", "Manufacturing-Electronic components and products, n.e.c. (339)", "Software publishing (649)", "Internet publishing and broadcasting (667)", "Other telecommunications services (669)", "Data processing services (679)", "Computer systems design and related services (738)".

Hecker (2005) classifies industries using the 1997 NAICS codes, while I use the 2000 Census Classification Code. These match quite well, with several exceptions. There is no census code for "semiconductor and other electronic component manufacturing", but this industry is likely contained in one of the census codes I have

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included (potentially "electronic components and products, n.e.c." (339)). There is also no 2000 census industrial classification code for "internet service providers and web search portals." This is also likely included in one of the other codes that I have included. Hecker (2005) identifies several industries as "Level-1" in terms of high-technology employment. Of the Level-1 high technology industries, I classify those related to computers as "computer-related" industries, which I list above.

I include the FIRE industries, excluding insurance and real estate, as finance-related industries. This includes the following 2000 census classification codes: Banking; Savings institutions, including credit unions; credit agencies, n.e.c; security, commodity brokerage, and investment companies.

1.2 Classifying Majors in IPEDS/NSF Data

From 2003 through 2013, CIP code 52.08 refers to "Finance and Financial Management Services". From 2000-2002, CIP code 52.08 refers to "Financial Management and Services".

I classify computer science majors as computer and information sciences and support services.[1]

I classify business majors as business, management, marketing, and related support services. Starting in 2003, CIP code 52 refers to "Business, Management, Marketing, and Related Support Services". From 1992 through 2002, CIP code 52 refers to "Business Management and Administrative Services" while CIP code 8 refers to "Marketing Operations/Marketing Distribution". For 1990 and 1991, CIP code 6 refers to "Business and Management", CIP code 7 refers to "Business (Administrative Support)", and CIP code 8 refers to "Marketing Operations/Marketing Distribution". Thus from 2003 through 2013, business majors are defined by CIP code 52, from 1992 through 2002 business majors are defined by CIP codes 52 and 8, and for 1990 and 1991 business majors are defined by CIP codes 6, 7, and 8.

The Integrated Science and Engineering Resources Data System of the National Science Foundation is used to obtain university-level data on majors for studying Delaware's finance shock. Within this dataset, I use the NCES population of institutions. Prior to 1996, the sample includes all universities accredited at the college

[1] For 2003 through 2013, CIP code 11 refers to this entire group of majors. From 1990 through 2002, CIP code 11 refers to "Computer and information sciences" and there is no separate CIP code referring to support services for computer and information sciences.

level by an agency recognized by the US Department of Education. Starting in 1996, the sample includes only universities that are eligible for Title IV federal financial aid. I use the broad (standardized) academic discipline classifications in the data, and study the impact on business and management majors.

To study the impact of the fracking boom, I focus on geology majors. While petroleum engineering degrees are also very relevant for the oil and gas industry, they are generally offered only in fracking-exposed areas. In 2008, the year before graduates were first exposed to publicity of fracking success in 25% of shale plays, only 17 universities awarded petroleum engineering degrees and all but two of these are in states with high levels of new oil and gas production during the fracking boom.

2 Robustness: Impact of University Exposure to Sectoral Shocks

Students at more selective universities may have better information about labor demand and may be more geographically mobile. As a result, students at these universities may respond less to local demand. I test whether the university's geographic exposure to shocks has smaller effects at the top 20 US News and World Report-ranked universities (1999 rankings). I do not implement this analysis for Delaware's finance shock given there are no top 20 universities with $Exposure = 1$.

The medium-run effects on CS/CE majors are approximately 44% smaller for the top 20 universities and they are not statistically significant from zero. The effects for the non-top 20 universities are statistically significantly negative. The coefficients on $(t \geq t^*)(Exposure)(top20)$ and $(t \geq t^*)(t - t^*)(Exposure)(top20)$ are jointly significant from zero, although neither is significant from zero on its own (Appendix Table A6). Only two of the top 20 universities are in the top quartile of fracking exposure. The effect of local exposure is larger for these top 20 universities, but also statistically significant for non-top 20 universities. For the finance regressions, the $Exposure * top20$ interactions are not jointly significant, and only the immediate effect for non-top 20 universities is statistically significant from zero.[2]

The principal results are robust to $Ln(Majors)$ as the dependent variable, and

[2]Similarly, local exposure may also matter less at research universities. Interestingly, I still see large effects at research/doctoral universities, though there are differences relative to nonresearch/nondoctoral universities. See Appendix Table A8 and Appendix Figure A8.

controlling for $Ln(TotDegrees)$. The effects suggest CS/CE degrees decrease an additional 24% at universities in MSAs with 1990 computer-employment share higher by .1, for graduates five years after those first exposed. Geology degrees increase an additional 17% in top-quartile-exposed areas, for graduates five years after the first treated cohort. Finance degrees decrease an additional 6% at universities in MSAs with finance employment share higher by .05, though this is not statistically significant. Estimates suggest an additional 21% increase in business majors at Wilmington-area universities after Delaware's finance shock, for graduates five years after the first treated cohort (Appendix Table A7).[3]

For the dot-com crash and 2008 financial crisis, I alternatively define exposure as location in an MSA at the 90th percentile or above in the relevant employment share. These most exposed universities experienced greater decreases in the relevant majors, though the magnitudes are slightly smaller, and the effects of the financial crisis are not statistically significant. However, as discussed with the main results, the nonparametric specification is more likely to capture the true effect given the response to this shock begins before t^* (see Appendix Figure A2).

For the fracking boom, I use the cumulative value of new production within 200 miles of the county's centroid from 2004-2014. This is slightly more complicated when using the parametric specification because of the different timing of new production across shale plays.[4] The confidence intervals are much larger on the year*$Exposure$ interactions, and the parametric and nonparametric specifications are less similar. The fracking boom increased the share of geology majors an additional .04 percentage points (17%) if the cumulative value of exposure was higher by 24.5 billion dollars ($p \leq .01$), the difference between the 90th and 10th percentiles.

For Delaware's finance shock, I alternatively define $Exposure_c$ in three ways: distance between university j and Wilmington, an indicator for being within Delaware, and finally distance within 15 miles of Wilmington but only including universities within 100 miles of Wilmington as controls.

All three show Delaware's policy had large local effects on business majors (Appendix Table A2, Appendix Figure A2), though not significant ($p = .118$) when excluding farther universities. Not surprisingly the effect is smallest when using the

[3]The log specifications exclude university/years without sector-relevant degrees.

[4]In later years, the counties being exposed to fracking may be those with slightly lower cumulative values of exposure, which will affect estimation of the effect of exposure with years from the original shock.

continuous distance measure. This assumes the effects increase linearly in distance, and the impact of increasing distance might be quite small for universities not in the Wilmington area.

2.1 University funding

Following a local demand shock, particular academic programs may experience changes in funding from the university, local/state government, or corporations, and this may explain the change in majors. Credit card companies eventually supported The University of Delaware's business school, though not immediately, and so cannot explain short-run changes in business majors. The Center for Financial Institutions Research and Education was created at the University of Delaware, expected to be in full operation by the Fall of 1988 (seven years after the initial shock) ("College of Business and Economics" 1987). The business school building at the University of Delaware was named MBNA America Hall in October 1997 (16 years after the shock) ("History" 2016).

Other examples of financial firm involvement with Delaware's universities include the Lerner College of Business and Economics at The University of Delaware (Lerner was the chairman and CEO of the credit card company MBNA),[5] and the MBNA School of Professional Studies at Wesley College in Dover, Delaware (Beso 2005). MBNA was also very active in recruiting new hires on local college campuses (Agulnick 1999). While these funding ties did not cause the initial increase in majors, they are consistent with the finance shock having an effect on business majors at local universities.

Unfortunately the IPEDS Salaries, Tenure, and Fringe Benefits Survey, which contains data on total faculty and faculty salary outlays, does not exist at the department level. As a result, this dataset is not well-suited for studying whether the shock increased resources in the business schools at Wilmington-area universities, and this attracted more students. Further, IPEDS data on university revenue by source is available only starting in 1980. Given Delaware's shock was in 1981, this makes it difficult to identify whether changes are part of a preexisting trend.

[5] MBNA was one of the world's largest credit card companies (Epstein 2000) before being acquired by Bank of America in 2006. Headquartered in Delaware, it spun out of one of the original firms moving to Delaware following the FCDA.

References

[1] Agulnick, Seth (1999): "Careers Come Calling," *The News Journal* [Wilmington, DE], November 1, 1999.

[2] Beso, Michele (2005): "Delaware Colleges Look Ahead to a Post-MBNA World," *The News Journal* [Wilmington, DE], July 1, 2005.

[3] ."College of Business and Economics Center for Financial Institutions Research and Education, Executive Summary," University of Delaware, 1987.

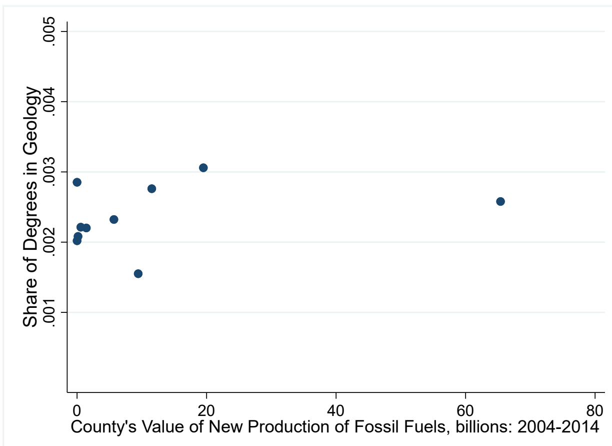
[4] Hecker, Daniel E. (2005): "High-technology employment: a NAICS based update," *Monthly Labor Review*, July.

[5] "History: Alfred Lerner Hall History," University of Delaware, http://lerner.udel.edu/about-us/history, accessed 7/18/2016.

Appendix Figure A1: Share of Degrees in Sector-Relevant Fields by Exposure to Sectoral Shocks

(a) CS/CE Degrees, 2002

(b) Geology Degrees, 2008

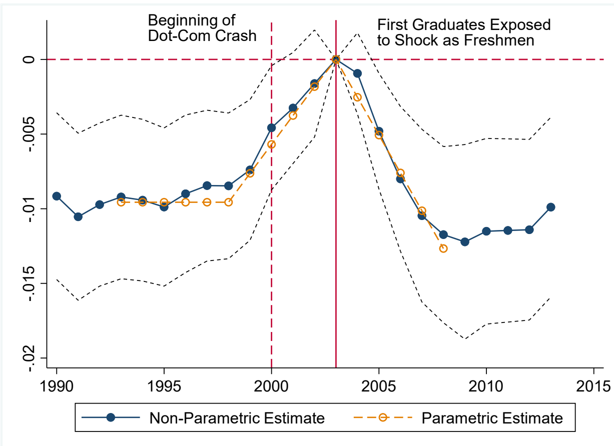


(c) Finance Degrees, 2010

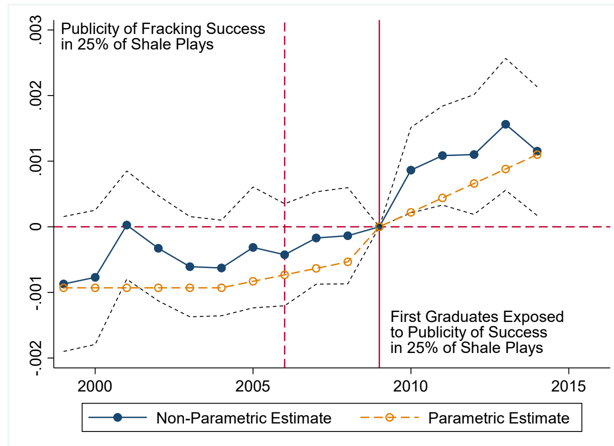
Notes: These figures show binned scatterplots, where the underlying data contain one observation per university. Universities are divided into roughly equally sized bins of exposure, weighting observations by total degrees awarded at the university, implying each bin produces roughly the same number of total degrees. In (a), each point represents the average share of degrees awarded in CS and CE across universities in the bin, weighting observations by total degrees awarded at the university. This weighted average implies each point represents the share of all degrees produced in the bin that are awarded in CS and CE. Plot (b) shows an analogous figure for geology degrees, and plot (c) for finance degrees. In (b) the x-axis is the cumulative value of new production of fossil fuels from 2004-2014 within 200 miles of the county's centroid. Degrees awarded are measured in the year preceding the first year the graduating class was exposed to the shock as freshmen. See text for details.

Appendix Figure A2: The Effect of Sectoral Shocks on College Majors, by University's Geographic Exposure to Shock: Alternative Definitions of Exposure

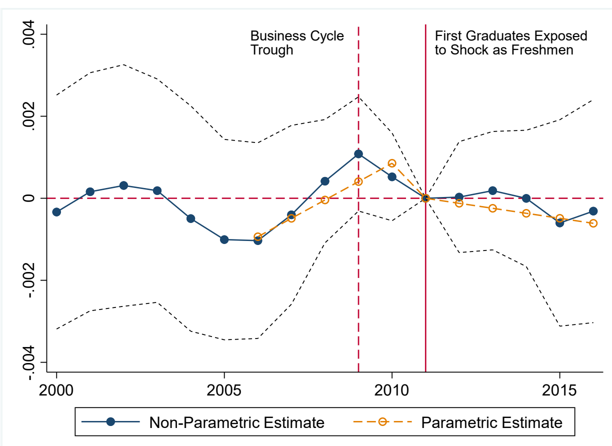
(a) MSA Computer Employment Share ≥ 90th percentile and the Effect on CS/CE Degrees, Relative to 2003



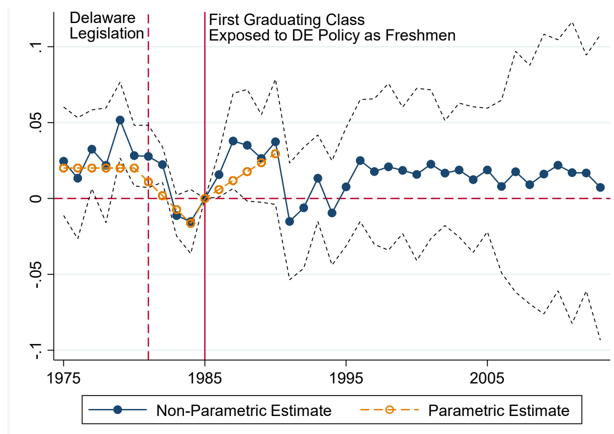
(b) Cumulative Value of New Fossil Fuel Production within 200 miles, and the Effect on Geology Degrees, Relative to 2009



(c) MSA Finance Employment Share ≥ 90th percentile and the Effect on Finance Degrees, Relative to 2011

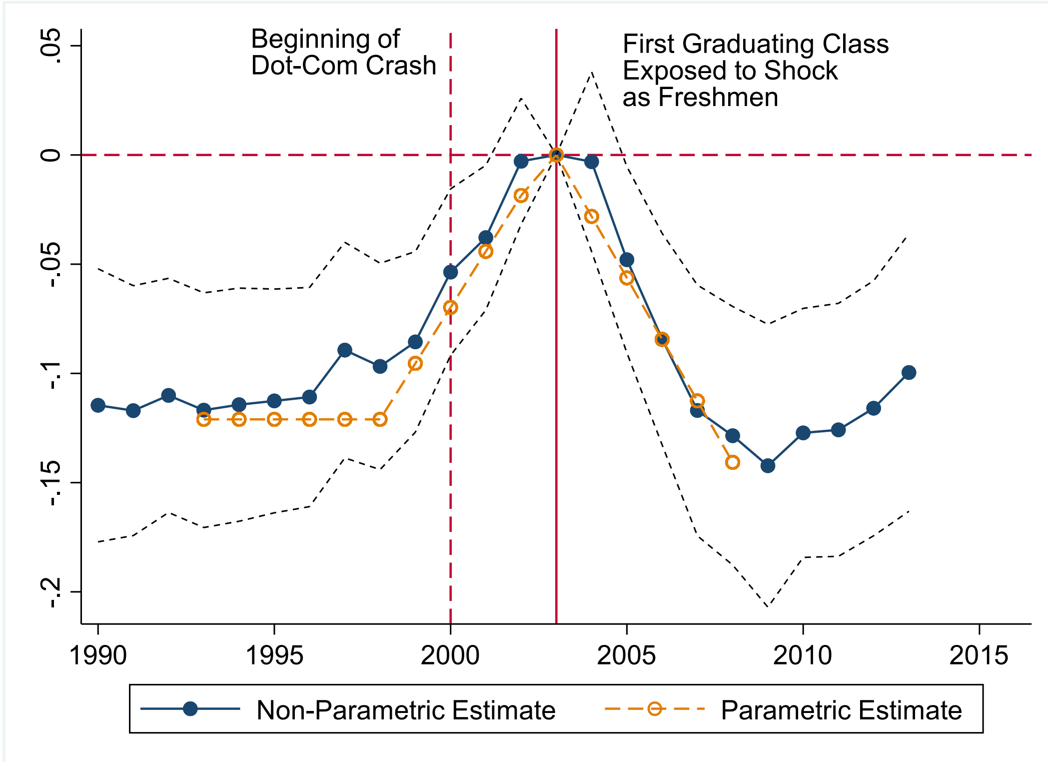


(d) Effect of Being within the State of Delaware on Share Business Degrees, Relative to 1985



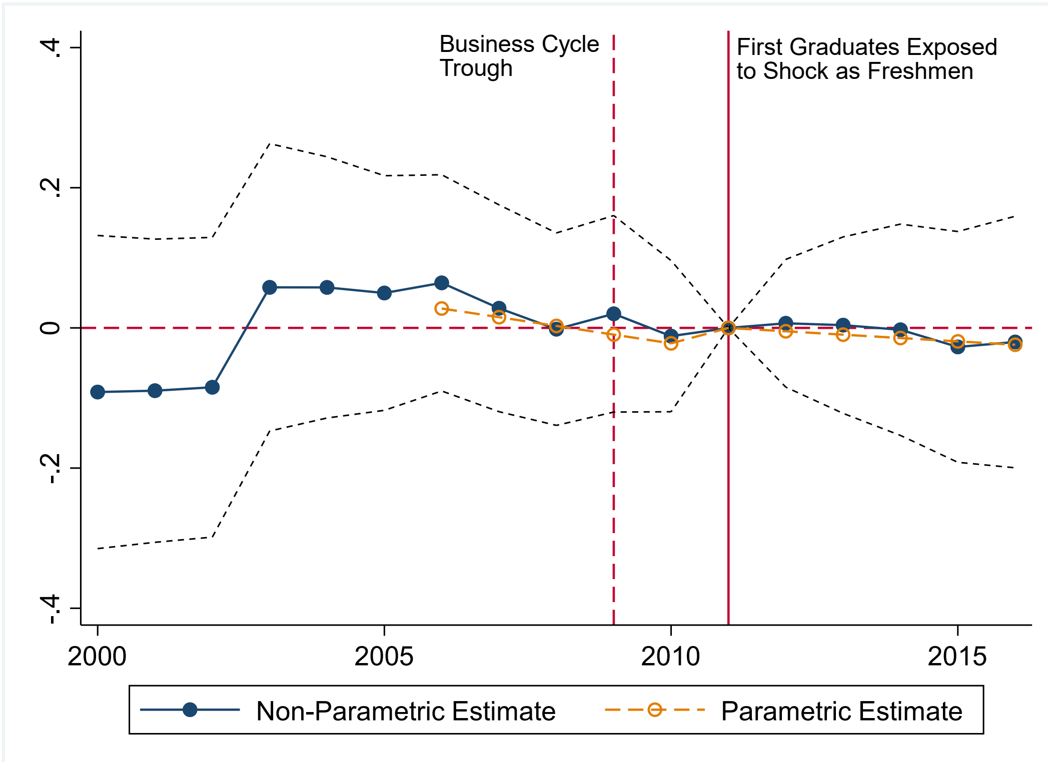
Note: Closed circles show interaction between year fixed effects and university's geographic exposure to the shock (indicator for MSA computer employment share ≥ 90th percentile in (a), cumulative value of new fossil fuel production within 200 miles of the university's county centroid (in hundreds of billions of dollars) from 2004 to 2014 in (b), indicator for MSA finance employment share ≥ 90th percentile in (c), and university in the state of Delaware in (d)). Dotted lines are 95% confidence intervals for these coefficients. These regressions also include year fixed effects, university fixed effects, and total degrees. Open circles show fitted values for the effect of university's exposure to the shock, based on coefficients from the parametric regression (interactions between geographic exposure to the shock, indicators for post shock, and years relative to first treated year). Fitted values are relative to the value in the first treated year. The parametric regressions also include total degrees, university fixed effects, and lower-level interaction terms. Observations are weighted by total degrees awarded.

Appendix Figure A3: Effect of MSA Computer Employment Share on Share Computer Science Degrees, Relative to 2003



Note: Dependent variable here is share of degrees awarded in computer science, rather than computer science and computer engineering (as in Figure 3). Closed circles show interaction between year fixed effects and university's geographic exposure to the shock (MSA computer employment share). Dotted lines are 95% confidence intervals for these coefficients. These regressions also include year fixed effects, university fixed effects, and total degrees. Open circles show fitted values for the effect of university's exposure to the shock, based on coefficients from the parametric regression (interactions between geographic exposure to the shock, indicators for post shock, and years relative to first treated year). Fitted values are relative to the value in the first treated year. The parametric regressions also include total degrees, university fixed effects, and lower-level interaction terms.

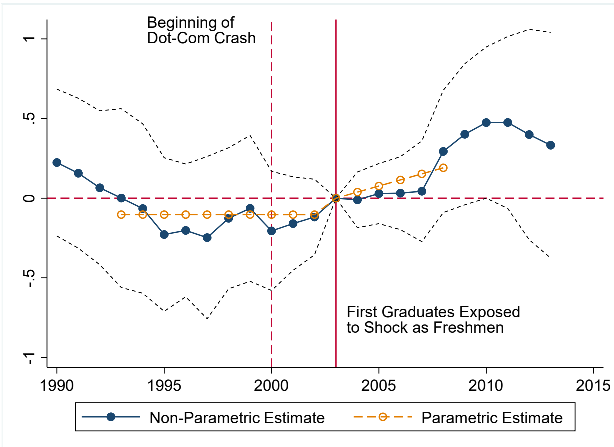
Appendix Figure A4: The Effect of the Financial Crisis on Share Business Degrees, by University's Geographic Exposure to the Shock



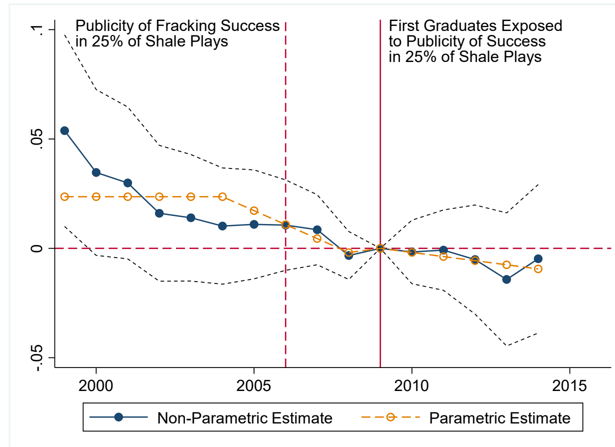
Notes: This plot is similar to Figure 3c, but with share business majors as the dependent variable. See text and Figure 3c for details.

Appendix Figure A5: The Effect of Sectoral Shocks on Ln(Total Degrees), by University's Geographic Exposure to the Shock

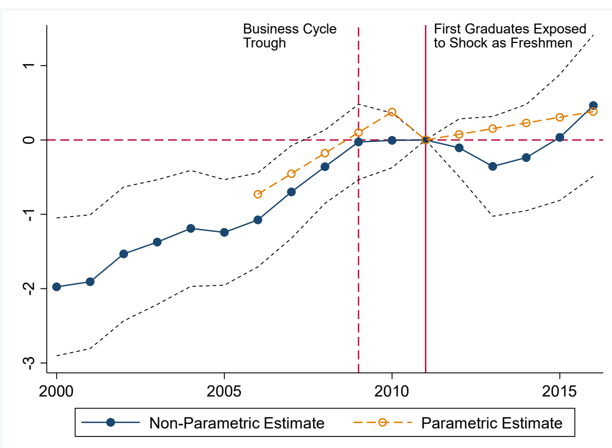
(a) MSA Computer Employment Share and the Effect on Total Degrees, Relative to 2003



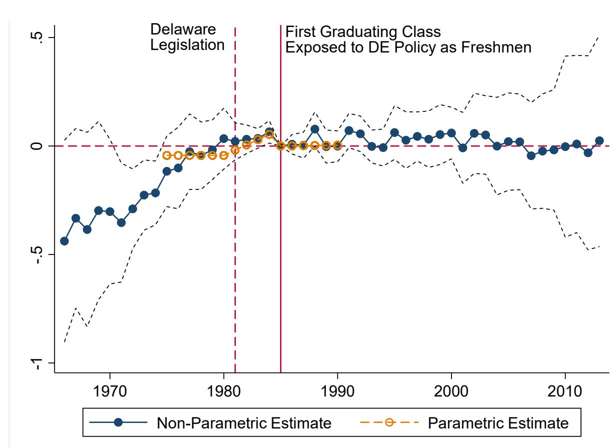
(b) Top Quartile, Cumulative Value of New Fossil Fuel Production within 200 miles, and the Effect on Total Degrees, Relative to 2009



(c) MSA Finance Employment Share and the Effect on Total Degrees, Relative to 2011



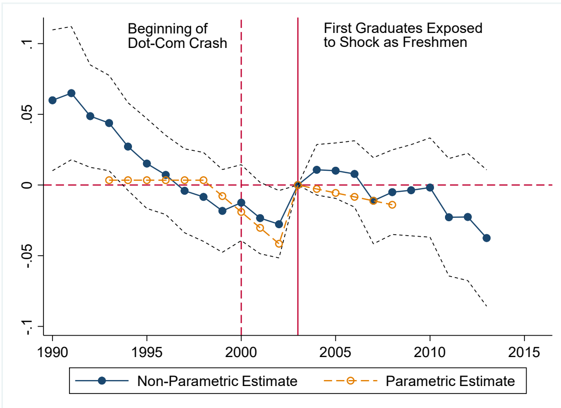
(d) Distance ≤ 15 Miles of Wilmington, DE and the Effect on Total Degrees, Relative to 1985



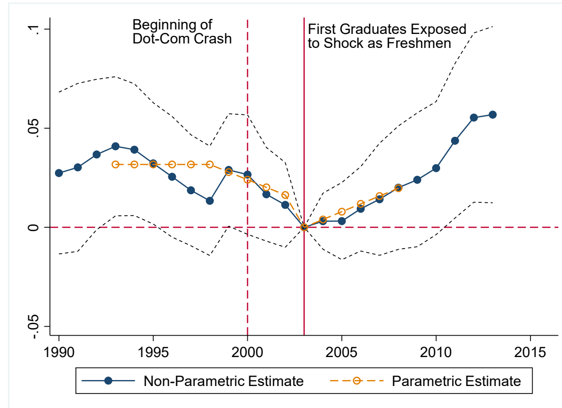
Note: Dependent variable is ln(Total Degrees Awarded by the University). Closed circles show interaction between year fixed effects and university's geographic exposure to the shock (MSA computer employment share in (a), university's county is within the top quartile in terms of cumulative value of new fossil fuel production within 200 miles of the county's centroid from 2004 to 2014 in (b), MSA finance employment share in (c), and university within 15 miles of Wilmington, DE in (d)). Dotted lines are 95% confidence intervals for these coefficients. These regressions also include year fixed effects and university fixed effects. Open circles show fitted values for the effect of university's exposure to the shock, based on coefficients from the parametric regression (interactions between geographic exposure to the shock, indicators for post shock, and years relative to first treated year when the first graduates were exposed to the shock as freshmen). Fitted values are relative to the value in the first treated year. The parametric regressions also include university fixed effects, and lower-level interaction terms. Observations are weighted by total degrees awarded.

Appendix Figure A6: The Effect of the Dot-Com Bust on Sector-Distant Degrees, by University's Geographic Exposure to the Shock

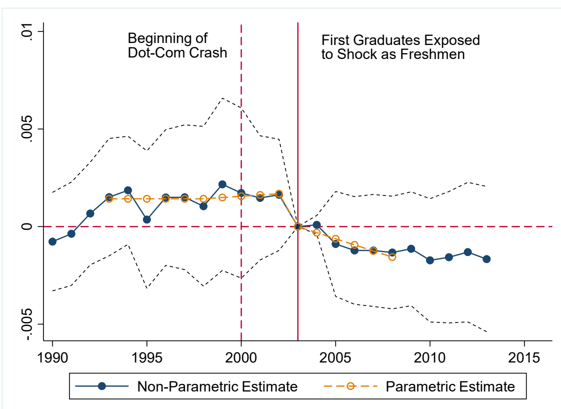
(a) Leisure



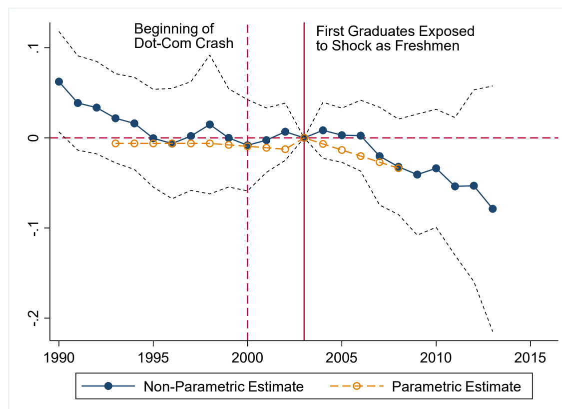
(b) Family Sciences



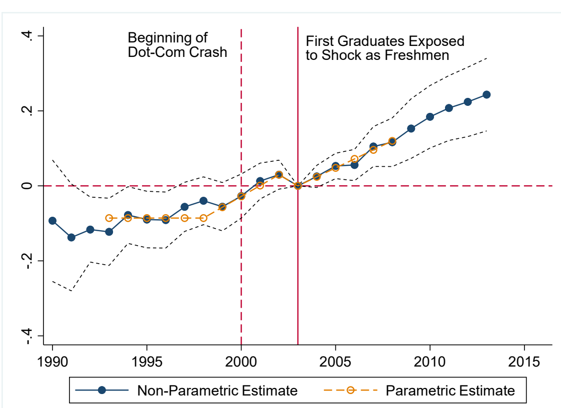
(c) Construction Services



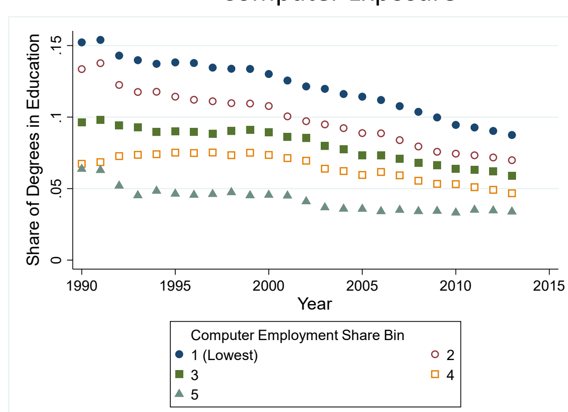
(d) Health



(e) Education



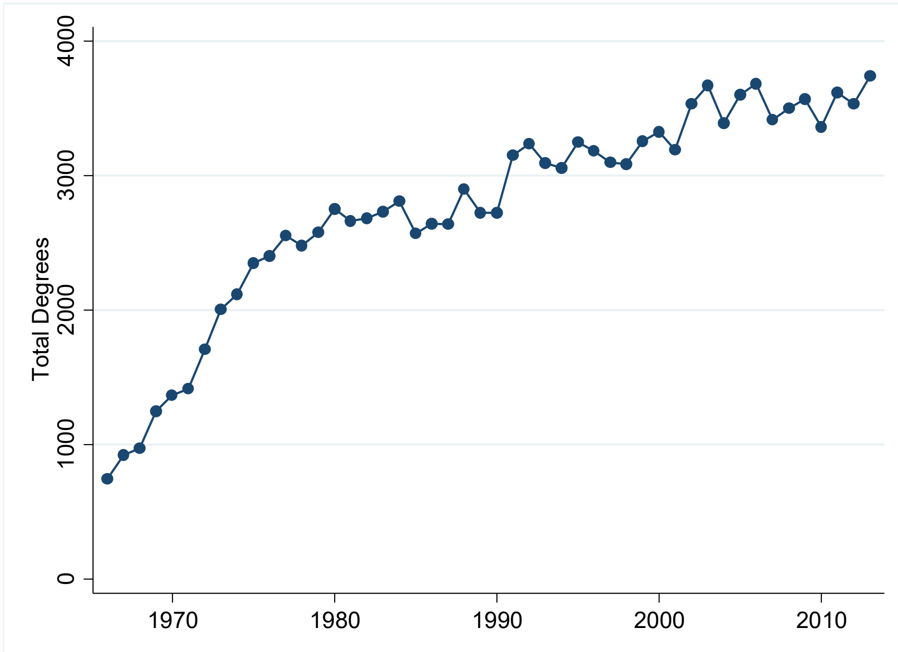
(f) Education Degrees Over Time by Computer Exposure



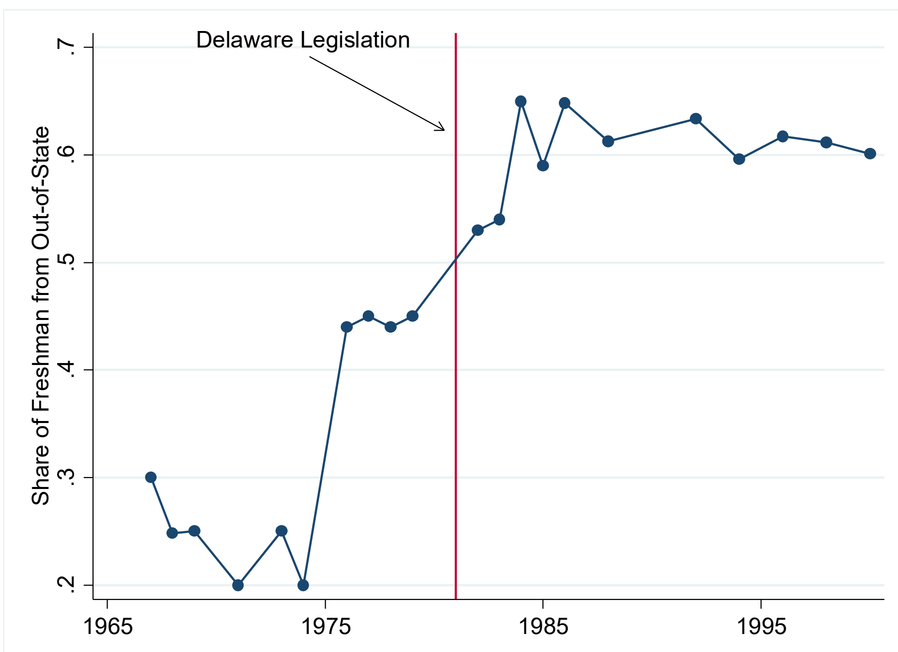
Note: Plots (a) through (e) show separate regressions for each of the bottom five majors ranked by likelihood of working in the computer industry (see Table 1). Closed circles show interaction between year fixed effects and MSA computer employment share. See Figure 3 for description of the regressions. Plot (f) shows binned scatterplots, where the underlying data contain one observation per university and year. Universities are divided into roughly equally sized bins of MSA computer employment share in 2000, weighting observations by total degrees awarded at the university, implying each bin produces roughly the same number of total degrees. Each point in the scatterplot represents the average share of degrees awarded in education across universities in the bin, where observations are weighted by total degrees awarded. See text for details.

Appendix Figure A7: Changes in Enrollment at the University of Delaware

(a) Total Bachelor's Degrees Awarded at the University of Delaware



(b) Out-of-State Freshman at the University of Delaware

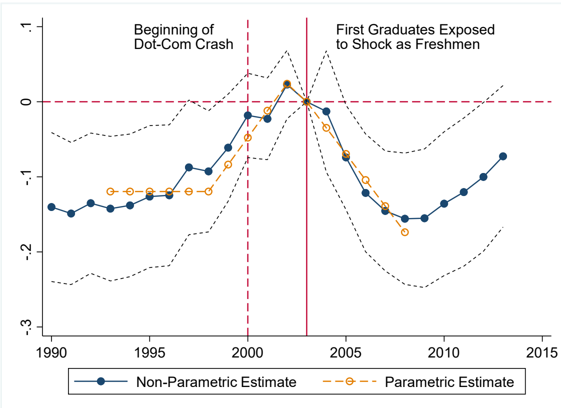


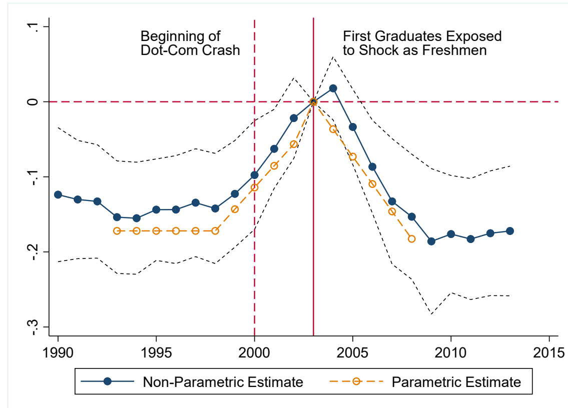
Note: Source for (a) is IPEDS (accessed through the Integrated Science and Engineering Resources Data System of the NSF). Sources for (b) include college guides (Peterson's and the College Board), as well as IPEDS.

Appendix Figure A8: The Effect of Sectoral Shocks on Universities, by Geographic Exposure to the Shock and University Type

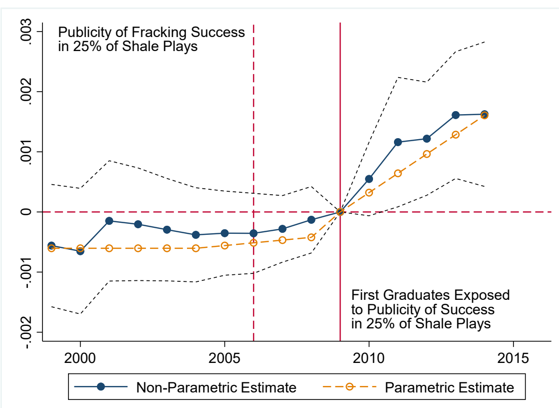
Research/Doctoral Universities | Master's/Baccalaureate Universities

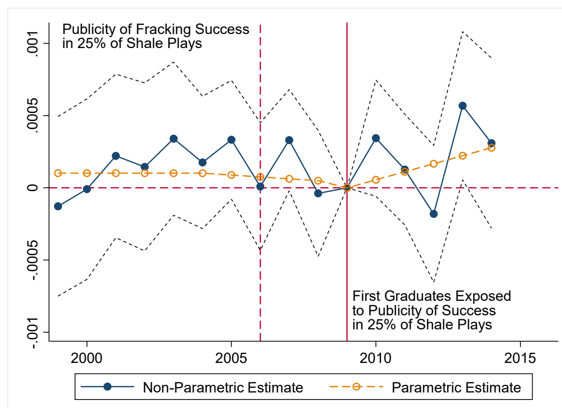
(a) Effect of MSA Computer Employment Share on Share Computer Science and Computer Engineering Degrees, Relative to 2003



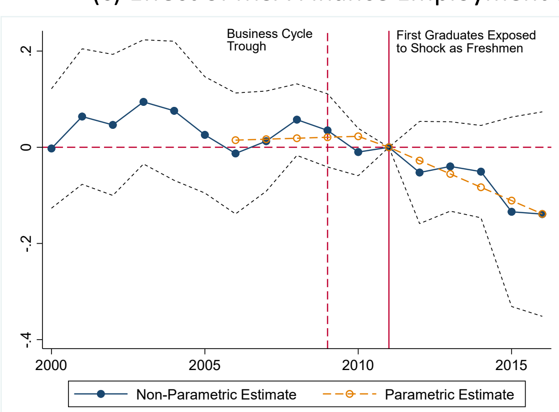


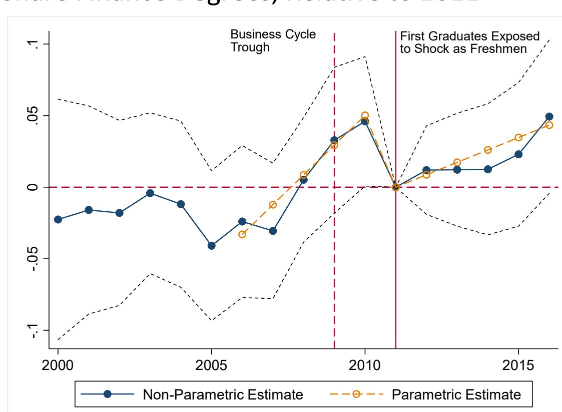
(b) Effect of Fracking Exposure on Share Geology Degrees, Relative to 2009



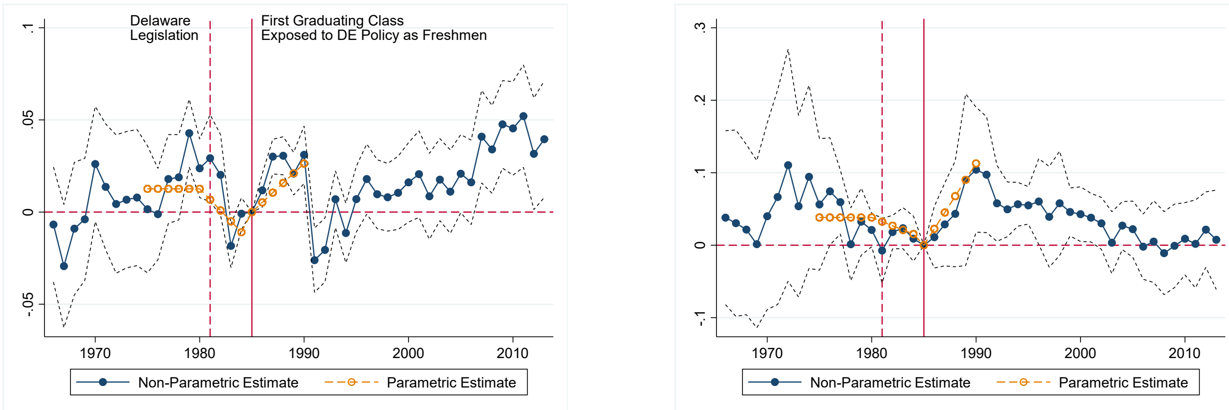


(c) Effect of MSA Finance Employment Share on Share Finance Degrees, Relative to 2011





(d) Effect of Being within 15 Miles of Wilmington, DE on Share Business Degrees, Relative to 1985

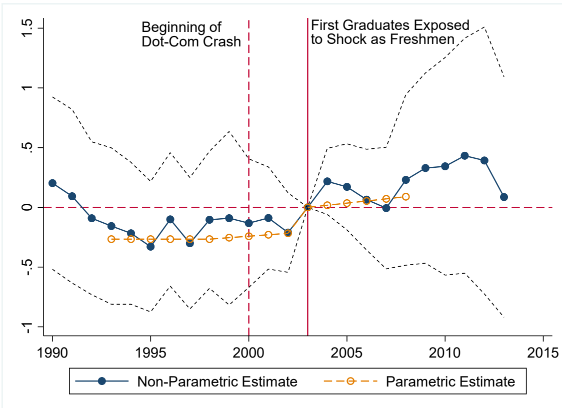


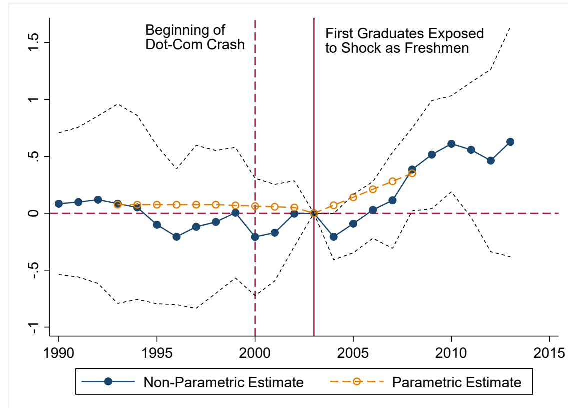
Note: Plots are the same as those described in Figure 3, but with regressions estimated separately for research/doctoral universities and master’s/baccalaureate universities (including Master's, Baccalaureate, and Baccalaureate/Associates Colleges). University classifications are based on the 2000 Carnegie rankings.

Appendix Figure A9: The Effect of Sectoral Shocks on Ln(Total Degrees), by University's Geographic Exposure to Shock and University Classification

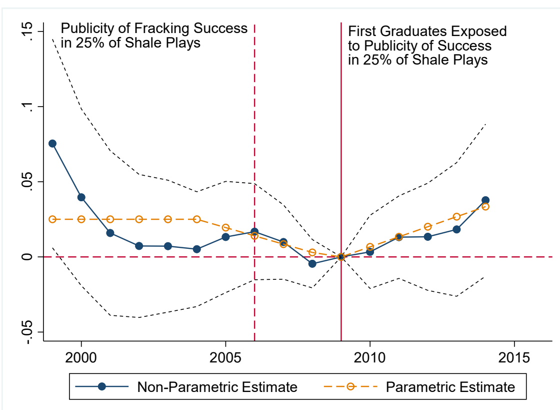
Research/Doctoral Universities | Master's/Baccalaureate Universities

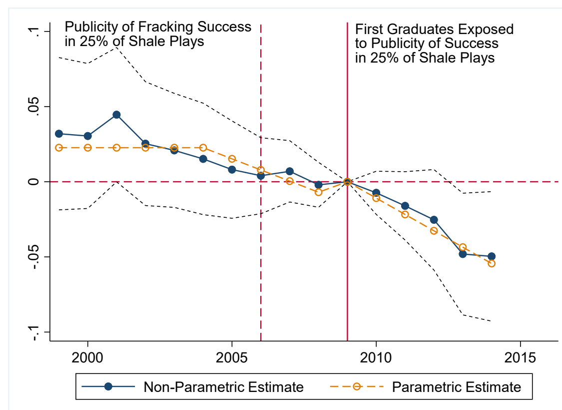
(a) Effect of MSA Computer Employment Share on Total Degrees, Relative to 2003



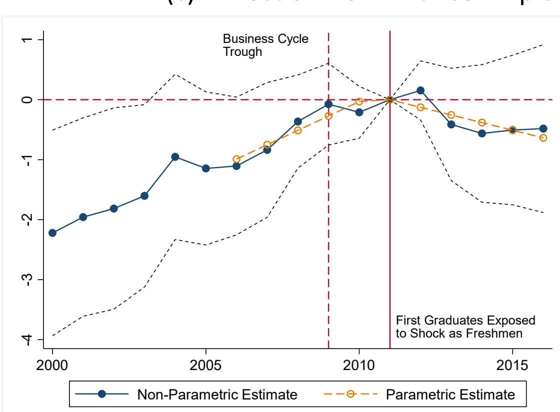


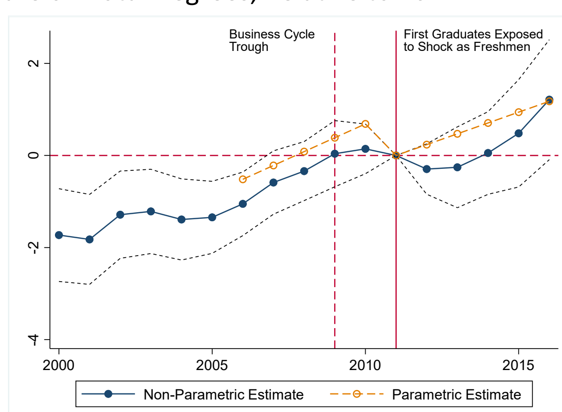
(b) Effect of Fracking Exposure on Total Degrees, Relative to 2009



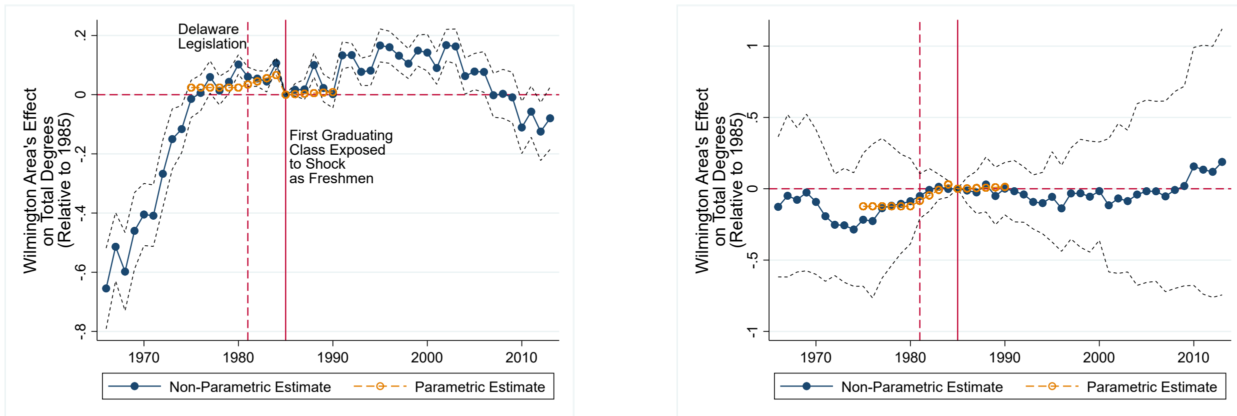


(c) Effect of MSA Finance Employment Share on Total Degrees, Relative to 2011





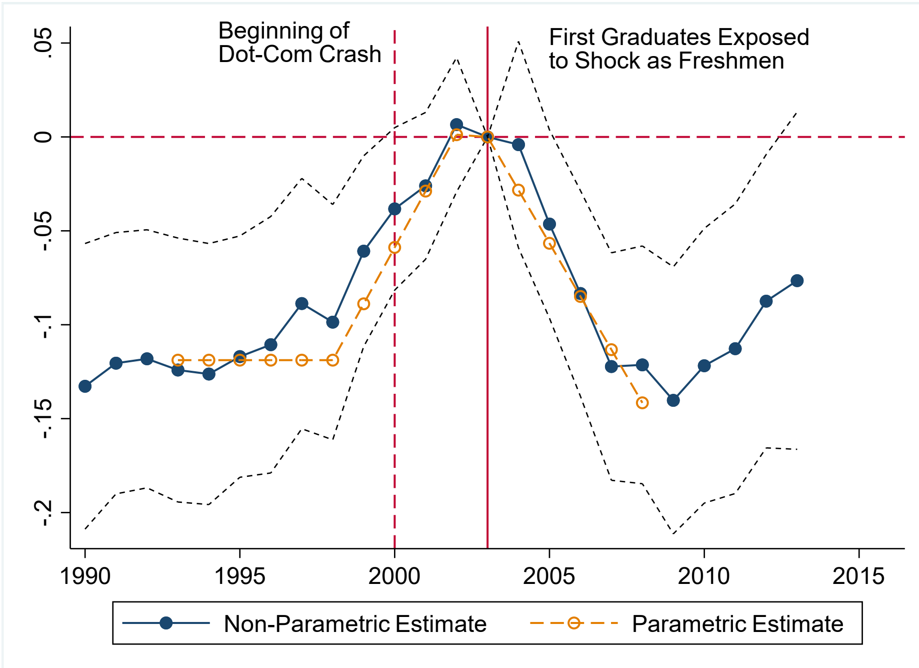
(d) Effect of Being within 15 Miles of Wilmington, DE on Total Degrees, Relative to 1985



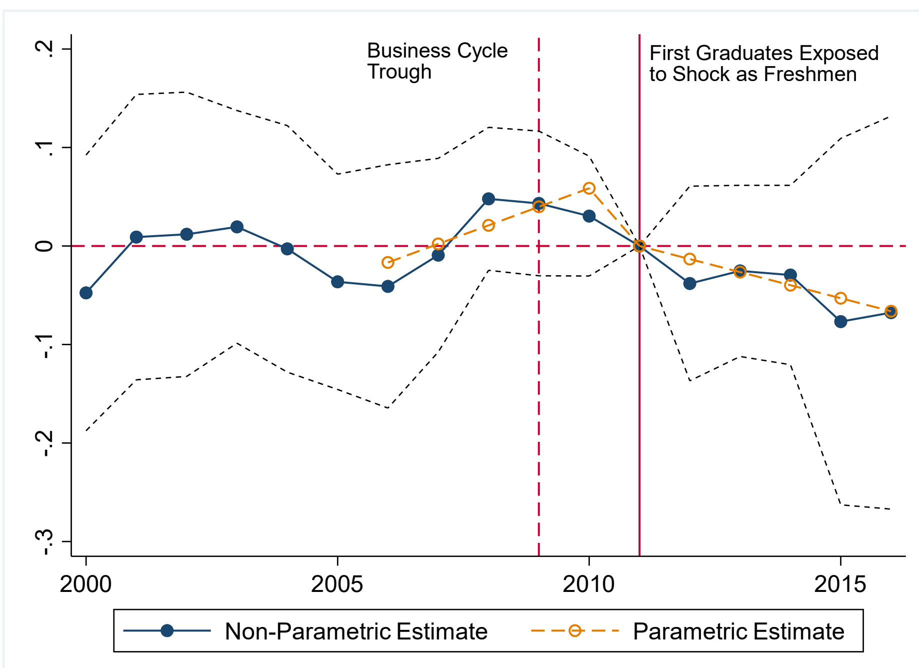
Note: Plots are the same as those described in Appendix Figure A5, but with regressions estimated separately for research/doctoral universities and master's/baccalaureate universities (including Master's, Baccalaureate, and Baccalaureate/Associates Colleges). University classifications are based on the 2000 Carnegie rankings.

Appendix Figure A10: The Effect of Sectoral Shocks on College Majors, by University's Exposure to the Shock, Excluding Universities Outside of MSAs, or with MSAs not represented in the Census

(a) MSA Computer Employment Share and the Effect on Share CS/CE Degrees, Relative to 2003



(b) MSA Finance Employment Share and the Effect on Share Finance Degrees, Relative to 2011



Notes: This figure presents estimates from the same specification as in Figure 3, but excluding universities which are not located in MSAs, or the MSA was not represented in the Census. In Figure 3, I set the MSA employment share for these universities to zero.

Appendix Table A1: The Effect of Sectoral Shocks on College Majors by University's Exposure to the Shock, Alternative Definition of Exposure

		(1)	(2)	(3)
	Y_{ct}: Share of Majors in	CS/CE	Geology	Finance
(1)	Post	-0.001	0.0001	-0.0030***
		(0.001)	(0.0001)	(0.0004)
(2)	Post*Alt_Exposure	-0.0001	0.0004	-0.0013
		(0.002)	(0.0004)	(0.0008)
(3)	Post*Alt_Exposure*Years Elapsed	-0.004***	0.0001	-0.0006
		(0.001)	(0.0001)	(0.0005)
(4)	Post*Years Elapsed	-0.007***	0.0002***	-0.0002
		(0.0004)	(0.00003)	(0.0002)
(5)	Alt_Exposure*Years Elapsed	0.002***	0.0001	0.0004
		(0.001)	(0.0001)	(0.0003)
(6)	Years Elapsed	0.003***	-0.00001	0.0003**
		(0.0002)	(0.00003)	(0.0001)
Differential Impact in Exposed Areas, relative to t*-1				
(7)	Immediate	0.002	0.0001	-0.001
		(.0019)	(.0001)	(.0007)
(8)	Medium Run	-0.011***	0.0004***	-0.001
		(.003)	(.0001)	(.002)
	Shock	Dot-Com	Fracking Boom	Financial Crisis
	Observations	22,200	22,281	15,289
	R-squared	0.783	0.7567	0.9203

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. Regressions are the same as in Table 3, but with different exposure variables. The variable *Alt_Exposure* is an indicator for MSA computer employment share ≥ 90th percentile in (a), cumulative value of new fossil fuel production within 200 miles of the university's county centroid (in hundreds of billions of dollars) from 2004 to 2014 in (b), and an indicator for MSA finance employment share ≥ 90th percentile in (c). To calculate the effects in rows (7) and (8) I use Alt_Exposure = 1 in columns 1 and 3, and Alt_Exposure = .245 in column (2). See text for details.

Appendix Table A2: The Effect of Delaware's Finance Shock on College Majors by University's Exposure to the Shock, Alternative Definitions of Exposure

	Y_{ct}: Share of Majors in Business	(1)	(2)	(3)
(1)	Post	-0.028***	-0.017**	-0.019***
		(0.005)	(0.008)	(0.007)
(2)	Post*Exposure	0.026***	-0.008	-0.005
		(0.007)	(0.005)	(0.018)
(3)	Post*Exposure*Years Elapsed	0.015***	-0.005**	0.012*
		(0.006)	(0.002)	(0.007)
(4)	Post*Years Elapsed	-0.019***	-0.012***	-0.012***
		(0.002)	(0.004)	(0.003)
(5)	Exposure*Years Elapsed	-0.009**	0.003*	-0.002
		(0.004)	(0.002)	(0.004)
(6)	Years Elapsed	0.020***	0.015***	0.016***
		(0.002)	(0.003)	(0.003)
	Differential Impact in Exposed Areas, relative to t^{*}*-1*			
(7)	Immediate	0.016**	-0.005	-0.008
		(.007)	(.004)	(.015)
(8)	Medium Run	0.046**	-0.012**	0.040
		(.022)	(.005)	(.025)
	Exposure	University in Delaware	Distance to Wilmington (Hundreds of Miles)	Distance ≤ 15 miles, Nonexposed Distance ≤ 100 miles
	Observations	3,381	3,381	1,536
	R-squared	0.882	0.882	0.920

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. Regressions are the same as in Table 3, but with different exposure variables. In column 1, this is an indicator for whether the university is located in the state of Delaware. In column 2, this is distance to Wilmington, DE in hundreds of miles. In column 3, this is an indicator for distance within 15 miles, but including in the regression only those universities within 100 miles of Wilmington, DE. To calculate the effects in rows (7) and (8), I use exposure = 1 in columns 1 through 3.

Appendix Table A3: The Effect of Sectoral Shocks on College Majors, by University's Exposure to the Shock

	Y_{ct}: Share of Majors in	CS
(1)	Post	-0.001
		(0.001)
(2)	Post*Exposure	-0.007
		(0.026)
(3)	Post*Exposure*Years Elapsed	-0.054***
		(0.012)
(4)	Post*Years Elapsed	-0.006***
		(0.0004)
(5)	Exposure*Years Elapsed	0.026***
		(0.006)
(6)	Years Elapsed	0.003***
		(0.0002)
Differential Impact in Exposed Areas, relative to t^* *-1*		
(7)	t^*	0.002
		(.002)
(8)	$t^* + 5$	-0.012***
		(.004)
	Shock	Dot-Com
	Observations	22,200
	R-squared	0.785

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. Observations are at the university, year level. Standard errors clustered at the university level in parentheses. This is the same regression reported in Table 3, column 1, but the dependent variable in this table is the share of degrees awarded in computer science, rather than computer science and computer engineering.

Appendix Table A4: The Effect of Sectoral Shocks on College Majors, by University's Exposure to the Shock, Excluding Universities Outside of MSAs, or with MSAs not represented in the Census

		(1)	(2)
	Y_{ct}: Share of Majors in	Computer Science & Computer Engineering	Finance
(1)	Post	0.001	-0.001
		(0.002)	(0.002)
(2)	Post*Exposure	-0.031	-0.077
		(0.031)	(0.051)
(3)	Post*Exposure*Years Elapsed	-0.058***	-0.032
		(0.014)	(0.031)
(4)	Post*Years Elapsed	-0.007***	0.001
		(0.001)	(0.001)
(5)	Exposure*Years Elapsed	0.030***	0.019
		(0.009)	(0.017)
(6)	Years Elapsed	0.003***	-0.00005
		-0.0004	(0.001)
	Differential Impact in Exposed Areas, relative to t^{*}*-1*		
(7)	Immediate	-0.0001	-0.003
		(.003)	(.002)
(8)	Medium Run	-0.014***	-0.006
		(.004)	(.006)
	Shock	Dot-Com	Financial Crisis
	Observations	15,035	10,354
	R-squared	0.786	0.924

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. This table presents estimates from the same specification as in Table 3, but excluding universities which are not located in MSAs, or the MSA was not represented in the Census. In Table 3, I set the MSA employment share for these universities to zero.

Appendix Table A5: The Effect of Sectoral Shocks on Ln(Total Degrees), by University's Exposure to the Shock

	Y_{ct}: Ln(Total Degrees Awarded)	(1)	(2)	(3)	(4)
(1)	Post	0.021***	-0.0539***	0.040***	-0.016*
		(0.006)	(0.0046)	(0.013)	(0.009)
(2)	Post*Exposure	0.103	0.0083	-0.653*	-0.078***
		(0.124)	(0.0091)	(0.370)	(0.026)
(3)	Post*Exposure*Years Elapsed	0.038	0.0045	-0.200	-0.023*
		(0.054)	(0.0048)	(0.147)	(0.013)
(4)	Post*Years Elapsed	-0.006***	-0.0186***	0.007**	0.011**
		(0.003)	(0.0030)	(0.003)	(0.005)
(5)	Exposure*Years Elapsed	-0.0001	-0.0064*	0.277***	0.024
		(0.044)	(0.0035)	(0.089)	(0.016)
(6)	Years Elapsed	0.030***	0.0474***	0.011***	0.005
		(0.002)	(0.0017)	(0.002)	(0.004)
	Differential Impact in Exposed Areas, relative to $t^{*}-1$				
(7)	Immediate	0.010	0.002	-0.019	-0.054***
		(.013)	(.008)	(.016)	(.015)
(8)	Medium Run	0.029	-0.008	0.0003	-0.05
		(.022)	(.018)	(.029)	(.037)
	Shock	Dot-Com	Fracking Boom	Financial Crisis	Delaware
	Observations	22,200	22,281	15,289	3,381
	R-squared	0.986	0.9829	0.988	0.985

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. Observations are at the university, year level. Standard errors clustered at the university level in parentheses. Each regression includes university fixed effects. Observations are weighted by total degrees awarded. See notes to Table 3 for definition of variables, years in sample, regression details, and construction of difference-in-difference.

Appendix Table A6: The Effect of Sectoral Shocks on College Majors, by University's Exposure to the Shock and US News Rank

	Y_{ct}: Share of Majors in	(1) CS/CE	(2) Geology	(3) Finance
(1)	Post	-0.0002	0.0001	-0.002***
		(0.001)	(0.0001)	(0.001)
(2)	Post*Top20	-0.010	-0.0003	-0.002
		(0.008)	(0.0006)	(0.003)
(3)	Post*Exposure	0.001	0.0002	-0.063**
		(0.024)	(0.0002)	(0.027)
(4)	Post*Exposure*Top20	-0.064	0.0019	0.126
		(0.112)	(0.0018)	(0.080)
(5)	Post*Exposure*Years Elapsed	-0.072***	0.0002**	-0.019
		(0.013)	(0.0001)	(0.016)
(6)	Post*Exposure*Years Elapsed*Top20	0.042	0.0006	0.005
		(0.056)	(0.0006)	(0.026)
(7)	Post*Years Elapsed	-0.006***	0.0002***	0.0001
		(0.0004)	(0.00003)	(0.0003)
(8)	Post*Years Elapsed*Top20	-0.003	-0.0002	-0.0001
		(0.003)	(0.0003)	(0.0004)
(9)	Exposure*Years Elapsed	0.033***	0.00003	0.014
		(0.007)	(0.0001)	(0.009)
(10)	Exposure*Years Elapsed*Top20	-0.013	-0.0004*	-0.038
		(0.034)	(0.0002)	(0.032)
(11)	Years Elapsed	0.003***	-0.00002	0.0001
		(0.0002)	(0.00003)	(0.0002)
(12)	Years Elapsed*Top20	0.002	0.0003	0.001
		(0.002)	(0.0002)	(0.001)
	Differential Impact in Exposed Areas, relative to t^*-1			
	Immediate, Non-Top 20 Universities	0.003	0.0002	-0.002**
		(.002)	(.0002)	(.001)
	Immediate, Top 20 Universities	-0.004	0.002	0.002
		(.008)	(.002)	(.002)
	Medium Run, Non-Top 20 Universities	-0.016***	0.001***	-0.004
		(.004)	(.0004)	(.003)
	Medium Run, Top 20 Universities	-0.009	0.004***	-0.007
		(.018)	(.001)	(.005)
	p-value on joint test of Post*Exposure*Top20 coefficients	0.0108	0.0266	0.289
	Shock	Dot-Com	Fracking Boom	Financial Crisis
	Observations	22,200	22,281	15,289
	R-squared	0.783	0.7579	0.921

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. This table presents coefficients from regressions similar to Table 3, but additionally including the triple interaction between Post, Exposure, Years Elapsed, and Top 20 Ranking in US News, and lower-level interaction terms. I use the US News Rankings of universities in 1999.

Appendix Table A7: The Effect of Sectoral Shocks on Ln(College Majors), by University's Exposure to the Shock

		(1)	(2)	(3)	(4)
	Y_{ct}: Ln(Majors)	CS/CE	Geology	Finance	Business
(1)	Post	-0.019	0.1283***	-0.133***	-0.150***
		(0.027)	(0.0400)	(0.030)	(0.026)
(2)	Post*Exposure	-0.340	0.0422	-0.719	0.107
		(0.549)	(0.0752)	(0.978)	(0.067)
(3)	Post*Exposure*Years Elapsed	-0.868***	-0.0099	-0.592	0.078***
		(0.218)	(0.0279)	(0.702)	(0.021)
(4)	Post*Years Elapsed	-0.245***	0.0990***	0.003	-0.100***
		(0.010)	(0.0145)	(0.015)	(0.011)
(5)	Exposure*Years Elapsed	0.376**	0.0300	0.408	-0.048**
		(0.150)	(0.0244)	(0.304)	(0.019)
(6)	Years Elapsed	0.113***	-0.0256**	0.001	0.104***
		(0.007)	(0.0100)	(0.010)	(0.011)
	Differential Impact in Exposed Areas, relative to t^**-1*				
(7)	Immediate	0.004	0.072	-0.016	0.059
		(.046)	(.062)	(.044)	(.055)
(8)	Medium Run	-0.242***	0.173**	-0.0616	0.212***
		(.078)	(.083)	(.132)	(.052)
	Shock	Dot-Com	Fracking Boom	Financial Crisis	Delaware
	Observations	17,110	6,274	5,705	2,851
	R-squared	0.899	0.7061	0.944	0.927

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. This table presents coefficients from a regression similar to Table 3, but the dependent variable is Ln(Majors) in the relevant field. Similarly, these regressions include controls for Ln(Total Degrees) rather than Total Degrees.

Appendix Table A8: The Effect of Sectoral Shocks on College Majors, by University's Exposure to the Shock and University Classification

		(1)	(2)	(3)	(4)	(5)	(6)
	Y_{ct}: Share of Majors in	Computer Science and Computer Engineering		Geology		Finance	
(1)	Post	0.001	-0.001	0.0002	0.00003	-0.004***	-0.001*
		(0.002)	(0.001)	(0.0001)	(0.0001)	(0.001)	(0.001)
(2)	Post*Exposure	-0.060	0.028	0.0004	-0.00004	-0.025	-0.071**
		(0.042)	(0.040)	(0.0003)	(0.0002)	(0.039)	(0.036)
(3)	Post*Exposure*Years Elapsed	-0.071***	-0.065***	0.0003**	0.0001	-0.030	-0.012
		(0.020)	(0.016)	(0.0001)	(0.0001)	(0.031)	(0.012)
(4)	Post*Years Elapsed	-0.007***	-0.006***	0.0002***	0.0001***	0.0003	-0.0002
		(0.001)	(0.0005)	(0.0001)	(0.00003)	(0.001)	(0.0003)
(5)	Exposure*Years Elapsed	0.036***	0.029***	0.00005	-0.00001	0.002	0.021**
		(0.012)	(0.009)	(0.0001)	(0.0001)	(0.015)	(0.010)
(6)	Years Elapsed	0.003***	0.003***	-0.00004	0.00004	0.0004	0.00002
		(0.0005)	(0.0003)	-0.00005	(0.00003)	(0.0004)	(0.0002)
	Differential Impact in Exposed Areas, relative to t^{*}*-1*						
(7)	Immediate	-0.002	0.006	0.0004	-0.00005	-0.001	-0.003*
		(.004)	(.004)	(.0003)	(.0002)	(.002)	(.001)
(8)	Medium Run	-.02***	-.013**	0.002***	0.0002	-0.008	-0.0003
		(.006)	(.005)	(.0006)	(.0003)	(.006)	(.002)
	Shock	Dot-Com		Fracking Boom		Financial Crisis	
	Universities	Research/ Doctoral	Master's/ Bacc.	Research/ Doctoral	Master's/ Bacc.	Research/ Doctoral	Master's/ Bacc.
	Observations	4,028	18,172	4,034	18,247	2,771	12,518
	R-squared	0.814	0.767	0.7143	0.7788	0.912	0.921

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. This table presents coefficients from the same specifications as those shown in Table 3, but estimated separately for universities that are classified as research/doctoral and master's/baccalaureate (including Master's, Baccalaureate, and Baccalaureate/Associates Colleges). University classifications are based on the 2000 Carnegie rankings. Standard errors clustered at the university level in parentheses.

Appendix Table A9: The Effect of Sectoral Shocks on Share Sector-Distant Degrees, by University's Exposure to the Shock

	Y_{ct}: Share Sector-Distant Degrees	(1)	(2)	(3)	(4)
(1)	Post	-0.007***	-0.0008	-0.001	-0.009***
		(0.001)	(0.0006)	(0.001)	(0.002)
(2)	Post*Exposure	-0.006	0.0002	-0.038	0.032***
		(0.028)	(0.0009)	(0.046)	(0.012)
(3)	Post*Exposure*Years Elapsed	0.006	0.0009**	0.002	0.002
		(0.012)	(0.0005)	(0.023)	(0.003)
(4)	Post*Years Elapsed	0.005***	-0.0019***	0.002***	-0.012***
		(0.001)	(0.0003)	(0.001)	(0.002)
(5)	Exposure*Years Elapsed	0.012	-0.0008**	0.003	-0.006***
		(0.009)	(0.0003)	(0.015)	(0.002)
(6)	Years Elapsed	-0.003***	0.0015***	0.003***	0.007***
		(0.001)	(0.0002)	(0.0004)	(0.002)
	Differential Impact in Exposed Areas, relative to t^**-1*				
(7)	Immediate	0.0006	-0.0006	-0.0018	0.026**
		(.003)	(.001)	(.002)	(.011)
(8)	Medium Run	0.001**	-0.0001	-0.0005	0.010
		(.005)	(.001)	(.007)	(.014)
	Shock	Dot-Com	Fracking Boom	Financial Crisis	Delaware
	Observations	22,200	22,281	15,289	3,381
	R-squared	0.923	0.9032	0.913	0.953

Notes: *** p-value ≤ .01, ** p-value ≤ .05, * p-value ≤ .1. Observations are at the university, year level. Standard errors clustered at the university level in parentheses. Each regression includes university fixed effects. Observations are weighted by total degrees awarded. See notes to Table 3 for definition of variables, sector-distant degrees, years in sample, regression details, and construction of difference-in-difference.