Employment Impacts of the CHIPS Act

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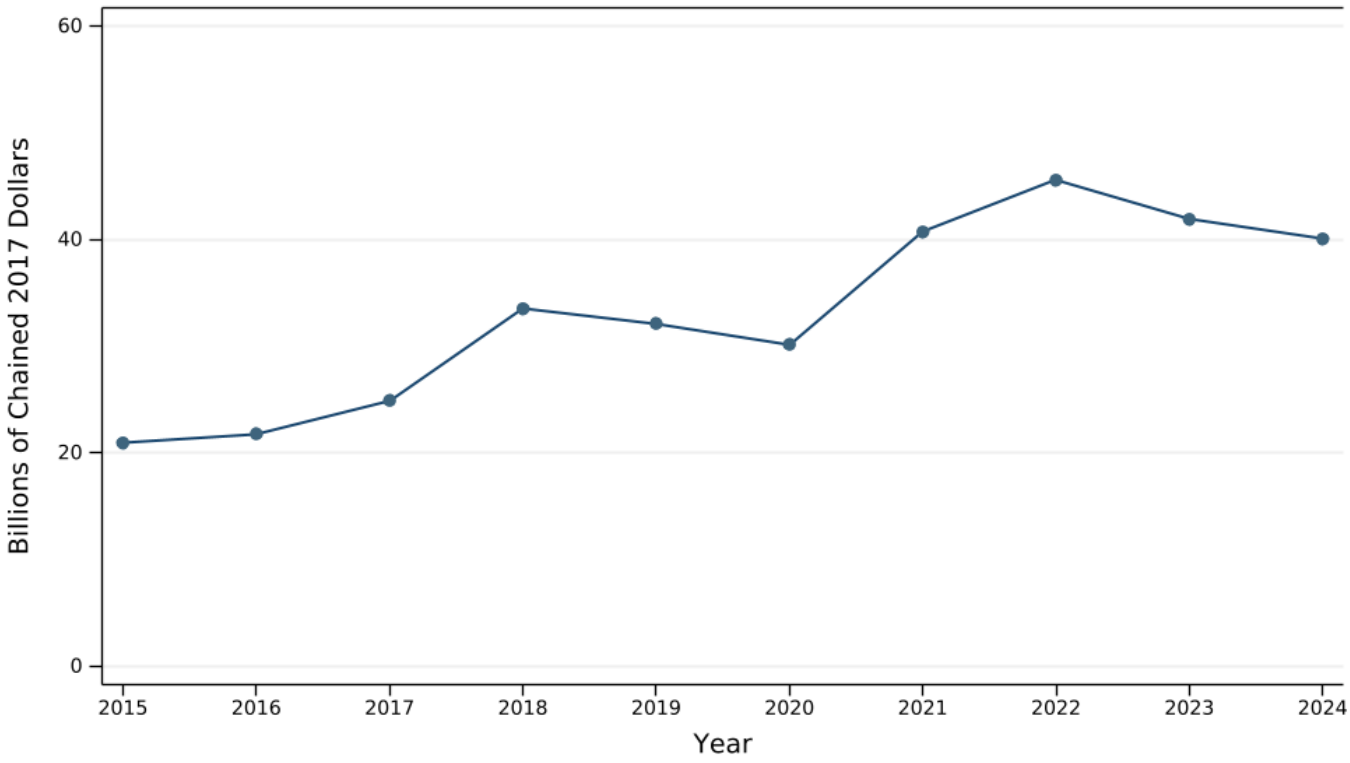
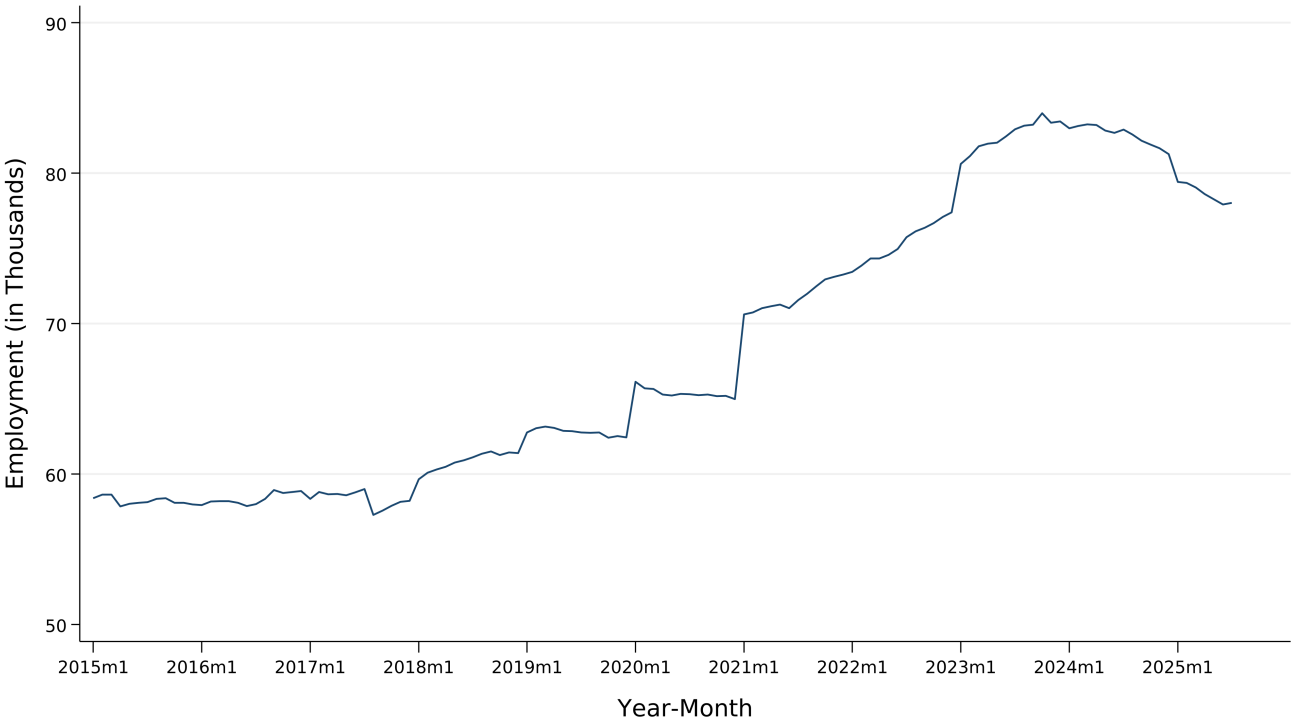
ONLINE APPENDIX

FIGURE A1: REAL PURCHASES OF PROPERTY, PLANT AND EQUIPMENT BY SEMICONDUCTOR FIRMS



Notes: Source is Security and Exchange Commission Form 10-K filings by semiconductor firms. Following the Semiconductor Industry Association, the following firms are included: Akoustis, AMD, Analog Devices, Broadcom, Cirrus Logic, Global Foundaries, Intel, Lattice Semiconductor, Littelfuse, Luminar, Marvell, Microchip, Micron, Nvidia, ONSEMI, Qorvo, Qualcomm, Silicon Labs, Skywater, SkyWorks, Texas Instruments, Western Digital, and Wolfspeed. The y-axis variable is total purchases of property, plant and equipment for the above firms in billions of 2017 dollars. The 10-K forms report purchases for entire calendar year; 2021 thus includes more than six months following the Senate passage of USICA on June 8, 2021.

FIGURE A2: EMPLOYMENT IN ELECTRONIC COMPONENTS: GERMANY



Notes: Source is Monthly Report on Manufacturing, generated by the Federal Statistical Office of Germany (Statisches Bundesamt), for industry WZ 261: Manufacture of Electronic Components and Boards (equivalent of ISIC rev 4 industry 2610). Data can be accessed at `https://www-genesis.destatis.de/datenbank/online/url/937eb0e8`.

TABLE A1: CHIPS ACT APPROPRIATION BY FUND

Fund	Appropriation	Agency	Description
CHIPS for America Fund	$50 billion	Department of Commerce	Incentives to develop domestic manufacturing capacity, R&D, and workforce development.
CHIPS for America Defense Fund	$2 billion	Department of Defense	Establishes a Microelectronics Commons, an onshore network of university based research institutions.
CHIPS for America International Technology Security and Innovation Fund	$500 million	Department of State	Coordination with foreign government partners to support international security and supply chain activities.
CHIPS for America Workforce and Education Fund	$200 million	National Science Foundation	Promote growth of semiconductor workforce.

Notes: The funding descriptions and amounts come from Blevins, Sutter, and Grossman (2023).

TABLE A2: NOTICE OF FUNDING OPPORTUNITIES FOR THE CHIPS ACT

NOFO Name	Agency	Funding Amount	Date of Release	Description	Award Status
Commercial Fabrication Facilities NOFO	CHIPS Program Office	$38.2 billion in direct funding $75 billion in direct loans or loan guarantees	February 28, 2023	Awards funding for projects related to the construction, expansion, or modernization of commercial facilities for fabrication, wafer manufacturing, and materials used to manufacture semiconductors.	19 awards up to $30.7 billion in direct funding and $5.5 billion in loans. 15 non-binding PMTs totaling up to $1.9 billion in direct funding and $350 million in loans.
Facilities for Semiconductor Materials and Manufacturing Equipment NOFO	CHIPS Program Office	$500 million in direct funding through grants, cooperative agreements, and other transactional agreements (OTAs)	September 29, 2023	Awards funding for projects for the construction, expansion, or modernization for commercial facilities for semiconductor materials and manufacturing equipment with capital investments of less than $300 million.	No awards have been made yet, applications were accepted until July 1, 2024.
National Advanced Packaging Manufacturing Program (NAPMP) Materials and Substrates NOFO	CHIPS R&D Office	$300 million in funding	February 28, 2024	Awards funding for projects that establish and accelerate domestic R&D for advanced packaging substrates and substrate materials. Substrates are the foundation on which elements of a semiconductor are attached.	3 awards totaling $300 million in direct funding.
NAPMP Advanced Packaging Research and Development NOFO	CHIPS R&D Office	$1.5 billion in OTAs with individual awards up to $150 million	October 18, 2024	Awards funding for projects accelerating R&D in equipment integration, power delivery, connector technology, chiplets ecosystem, and co-design automation.	No awards have been made yet, concept papers were due on December 20, 2024.
CHIPS Manufacturing USA Institute Competition NOFO	CHIPS R&D Office	$285 million in funding	May 6, 2024	Awards to establish and operate a CHIPS Manufacturing USA Institute to join the existing network of 17 institutes to strengthen national manufacturing competitiveness and R&D infrastructure.	The Semiconductor Research Corporation Manufacturing Consortium Corporation was awarded $285 million to establish an institute known as SMART USA on January 3, 2025.
Measurement Science and Engineering Research Grant Program NOFO	CHIPS R&D Office	Expected 300 awards between $5,000 to $250,000 per year, with performance periods of up to 5 years	May 14, 2025	Offers financial assistance within multiple National Institute of Standards and Technology (NIST) programs including CHIPS. Support is provided for programs focusing on conducting metrology critical to semiconductor R&D.	8 awards as of January 31, 2025, totaling $1.1 million.
Small Business Innovation Research Program NOFO	CHIPS R&D Office	Expected 24 awards in two phases. Phase I with individual awards up to $283,500 and phase II with individual awards up to $1.9 million through cooperative agreements.	April 16, 2024	Awards eligible small businesses that want to explore the technical merit or feasibility of an innovative technology with the goal of developing a viable product for the commercial microelectronic marketplace.	17 awards in Phase I totaling to $4.8 million. Progress reports are required within 4 and 7 months, and projects with commercial viability will be developed into Phase II.
CHIPS AI-Powered AE for Rapid, Industry-Informed Sustainable Semiconductor Materials and Processes Competition NOFO	CHIPS R&D Office	$100 million through OTAs. Multiple awards ranging from $20-$40 million with a 5 year performance period.	October 30, 2024	Seeks to fund research into sustainable materials and processes for semiconductor through the application of artificial intelligence (AI) and autonomous experimentation (AE).	No awards have been made yet, concept papers were due January 13, 2025.

Notes: The table describes all Notice of Funding Opportunities (NOFOs) released by the National Institute of Standards and Technology (NIST) relating to the CHIPS Act programs. Information taken from Department of Commerce Office of Inspector General (2025) and is updated as of May 14, 2025.

TABLE A3: CUMULATIVE ABNORMAL RETURNS

Event Window								
(-1,1)			(-3,3)			(-5,5)		
CAAR	SE	p-val	CAAR	SE	p-val	CAAR	SE	p-val
Panel A: USICA Introduction (May 18, 2021)								
0.0273***	0.4848	0.0000	0.0338***	0.4002	0.0000	0.0430***	0.4698	0.0000
Panel B: USICA Senate Passage (June 8, 2021)								
-0.0117***	0.5856	0.0070	-0.0105	0.6266	0.1440	0.0014	0.6169	0.5490
Panel C: CHIPS Senate Passage (July 28, 2022)								
-0.0152	1.5295	0.1580	-0.0016	0.9623	0.6600	-0.0107	0.9821	0.3940

Notes: Cumulative Average Abnormal Returns (CAARs) around major semiconductor policy events are calculated as follows (using the Stata estudy command). We first calculate Abnormal Returns (ARs) by estimating the regression $R_{it} = \gamma_i R_{mt} + \alpha_i + \varepsilon_{it}$, where R_{it} is firm i's return and R_{mt} is the S&P 500's return, over the period 250 days to 30 days before the event, and then defining $AR_{it} = R_{it} - \widehat{\gamma}_i R_{mt} - \widehat{\alpha}_i$ for the indicated event window. The ARs are averaged across firms and then summed across the event window to get CAARs. Inference is based on the Boehmer–Musumeci–Poulsen (BMP) test. Windows are indicated in days. The sample is the set of firms included in Figure A1, excluding Global Foundries and Skywater, who began trading on October 28, 2021 and April 21, 2021, respectively. *p <0.10; **p <0.05; ***p <0.01. See also Fig. 3.

TABLE A4: EMPLOYMENT IN SEMICONDUCTORS: SIMPLE DID, NO IMPUTATION

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: Semiconductor vs. Non-Semiconductor Counties			
Treated x Post-USICA	176.68**	68.04**	244.72**
	(75.98)	(33.37)	(97.15)
Observations	27157	27157	27157
Pre-USICA outcome mean (treated counties)	1596.5	287.8	1884.3
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Panel B: Fab vs. Fabless Counties			
Treated x Post-USICA	374.80**	190.15***	564.95***
	(157.47)	(66.03)	(196.92)
Observations	3314	3314	3314
Pre-USICA outcome mean (treated counties)	3161.4	471.8	3633.2
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y

Notes: Estimates are from simple difference-in-difference (DID) specification, equation (2) in text. Comparison groups are defined in Section 4. Post-USICA indicator identifies quarters after USICA passed in the U.S. Senate (2021Q3 or later). Outcome in Column 1 is the number of workers employed in the semiconductor sector (NAICS industry code 334413). Outcome in Column 2 is the number of workers employed in the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. Outcome in Column 3 is the number of workers employed in either the semiconductor industry or the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. The pre-USICA outcome mean is the outcome mean for treated counties for the 2015Q1-2021Q2 period. County-industry-quarters with data suppressed for confidentiality are omitted from regressions. *p <0.10; **p <0.05; ***p <0.01.

TABLE A5: EMPLOYMENT IN SEMICONDUCTORS: SIMPLE DID, ALTERNATIVE DEFINITION OF POST

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: Semiconductor vs. Non-Semiconductor Counties			
Treated x Post-CHIPS	127.54***	36.09**	163.63***
	(46.91)	(18.25)	(58.00)
Observations	31535	31535	31535
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Panel B: Fab vs. Fabless Counties			
Treated x Post-CHIPS	229.12***	82.93**	312.05***
	(83.15)	(34.25)	(102.71)
Observations	5215	5215	5215
Pre-USICA outcome mean (treated counties)	1523.6	239.4	1763.0
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y

Notes: Estimates are from simple difference-in-difference (DID) specification, equation (2) in text. Comparison groups are defined in Section 4. Post-CHIPS indicator identifies quarters after CHIPS Act was signed (2022Q4 or later). Quarters from 2021Q3-2022Q3 are omitted. Outcome in Column 1 is the number of workers employed in the semiconductor sector (NAICS industry code 334413). Outcome in Column 2 is the number of workers employed in the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. Outcome in Column 3 is the number of workers employed in either the semiconductor industry or the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. The pre-USICA outcome mean is the outcome mean for treated counties for the 2015Q1-2021Q2 period. *p <0.10; **p <0.05; ***p <0.01.

TABLE A6: EMPLOYMENT IN SEMICONDUCTORS: SYNTHETIC DID, ALTERNATIVE DEFINITION OF POST

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: Semiconductor vs. Non-Semiconductor Counties			
Treated x Post-CHIPS	133.06***	13.84	142.39***
	(43.52)	(15.05)	(48.34)
Observations	31535	31535	31535
Pre-USICA outcome mean (treated counties)	868.8	164.5	1033.3
Panel B: Fab vs. Fabless Counties			
Treated x Post-CHIPS	217.93***	28.45	252.68***
	(62.16)	(20.64)	(76.55)
Observations	5215	5215	5215
Pre-USICA outcome mean (treated counties)	1523.5	238.1	1761.6

Notes: Estimates are from synthetic difference-in-difference (SDID) specification, equation (3) in text, using Stata sdid command. Comparison groups are defined in Section 4. Post-CHIPS indicator identifies quarters after CHIPS Act was signed (2022Q4 or later). Quarters from 2021Q3-2022Q3 are omitted. Outcome in Column 1 is the number of workers employed in the semiconductor sector (NAICS industry code 334413). Outcome in Column 2 is the number of workers employed in the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. Outcome in Column 3 is the number of workers employed in either the semiconductor industry or the manufacturing of equipment (NAICS 333242) or material inputs (NAICS 325120, 325180) for semiconductors. The pre-USICA outcome mean is the outcome mean for treated counties for the 2015Q1-2021Q2 period. *p <0.10; **p <0.05; ***p <0.01.

TABLE A7: EMPLOYMENT IN SEMICONDUCTORS: ROBUSTNESS USING QWI/QCEW 4-DIGIT DATA

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: Semiconductor vs. Non-Semiconductor Counties, Simple DID			
Treated x Post-USICA	89.73**	86.71***	176.43***
	(45.23)	(25.58)	(62.11)
Observations	36040	36040	36040
Pre-USICA outcome mean (treated counties)	1717.3	551.3	2268.5
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Panel B: Fab vs. Fabless Counties, Simple DID			
Treated x Post-USICA	178.69**	115.15**	293.84***
	(79.44)	(46.08)	(109.48)
Observations	5960	5960	5960
Pre-USICA outcome mean (treated counties)	2893.0	643.9	3536.9
County FE	Y	Y	Y
Year-Quarter FE	Y	Y	Y
Panel C: Semiconductor vs. Non-Semiconductor Counties, Synthetic DID			
Treated x Post-USICA	104.38**	59.95***	173.38***
	(44.72)	(17.18)	(52.18)
Observations	36040	36040	36040
Pre-USICA outcome mean (treated counties)	1716.4	552.6	2269
Panel D: Fab vs. Fabless Counties, Synthetic DID			
Treated x Post-USICA	177.37***	86.18***	262.07***
	(54.15)	(31.39)	(75.80)
Observations	5960	5960	5960
Pre-USICA outcome mean (treated counties)	2892	646.3	3538.3

Notes: Data are from QWI/QCEW combined data at 4-digit level. Estimates in Panels A & B are of simple difference-in-difference (DID) specification, equation (1) in text. Panels C & D are of synthetic difference-in-difference (SDID) specification, equation (3) in text. Comparison groups are defined in Section 4. Post-USICA indicator identifies quarters after USICA passed in the U.S. Senate (2021Q3 or later). Outcome in Column 1 is the number of workers employed in the semiconductor sector (NAICS industry code 3344). Outcome in Column 2 is the number of workers employed the manufacturing of equipment (NAICS 3332) or material inputs (NAICS 3251) for semiconductors. Outcome in Column 3 is the number of workers employed in either the semiconductor industry or the manufacturing of equipment (NAICS 3332) or material inputs (NAICS 3251) for semiconductors. The pre-USICA outcome mean is the outcome mean for treated counties for the 2015Q1-2021Q1 period. The standard errors included in parentheses are clustered at the county level. *p <0.10; **p <0.05; ***p <0.01.

TABLE A8: ROBUSTNESS: INCLUDING ADDITIONAL CONTROLS

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: Including Demographic Controls			
i. Semiconductor vs. Non-Semiconductor			
Treated x Post-USICA	110.31***	15.55	123.91***
	(40.58)	(14.02)	(43.64)
Observations	36900	36900	36900
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0
ii. Fab vs. Fabless			
Treated x Post-USICA	179.83***	25.19	209.79***
	(52.48)	(16.82)	(63.11)
Observations	6109	6109	6109
Pre-USICA outcome mean (treated counties)	1523.6	239.4	1763.0
Panel B: Including 2010 Rural Share Interaction			
i. Semiconductor vs. Non-Semiconductor			
Treated x Post-USICA	96.65***	38.64***	140.97***
	(34.76)	(13.10)	(42.03)
Observations	36941	36941	36941
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0
ii. Fab vs. Fabless			
Treated x Post-USICA	236.30***	34.87	197.35***
	(61.95)	(22.02)	(72.97)
Observations	6109	6109	6109
Pre-USICA outcome mean (treated counties)	1523.6	239.4	1763.0

Notes: Regressions are similar to those in Table 3 but with additional controls. In Panel A, the demographic controls include percent of county population that is female, white, black, asian, hispanic, younger than 19, between ages 20 to 24, 25 to 34, 35 to 44, 45 to 54, and 55 to 64. County demographic data from SEER U.S. County Population Data, 1969-2023 (`https://seer.cancer.gov/popdata/download.html`). In Panel B, rural share was controlled for by interacting the rural share for a county in 2010 with county FIPS code. Initial rural share for each county in 2010 data taken from the Census Bureau Urban and Rural Geographic Area data, found at `https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html` *p <0.10; **p <0.05; ***p <0.01.

TABLE A9: ROBUSTNESS: ALTERNATIVE CUTOFFS FOR HIGH-TECH EMPLOYMENT

	Semiconductor production employment	Semiconductor equipment & materials employment	Semiconductor production, equipment & materials employment
	(1)	(2)	(3)
Panel A: High Tech Employment > 0			
Treated x Post-USICA	110.67***	14.35	122.05***
	(34.66)	(12.63)	(38.54)
Observations	70807	70807	70807
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0
Panel B: High Tech Employment > 500			
Treated x Post-USICA	110.06***	15.51	124.36***
	(40.20)	(15.08)	(46.92)
Observations	21566	21566	21566
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0
Panel C: High Tech Employment > 1000			
Treated x Post-USICA	109.88***	13.13	118.63***
	(36.02)	(12.33)	(39.16)
Observations	16810	16810	16810
Pre-USICA outcome mean (treated counties)	868.7	165.3	1034.0

Notes: Regressions are similar to those in Table 3 Panel A, but use different values of the cutoff for a country to be a high-tech county (and hence included in the control group if it does not have a semiconductor facility). *p <0.10; **p <0.05; ***p <0.01.

TABLE A10: LOCAL SPILLOVERS: SYNTHETIC DID, ALTERNATIVE DEFINITION OF POST

	Semiconductor inputs employment (1)	Non-residential construction employment (2)	Total county employment (3)	County GDP (00,000s USD) (4)
Panel A: Semiconductor vs. Non-Semiconductor Counties				
Treated x Post-CHIPS	59.48*	159.82**	-3238.83	-5.38
	(34.65)	(78.21)	(3155.70)	(5.95)
Observations	31535	31535	31535	7040
Pre-USICA outcome mean (treated counties)	1069.3	1800.3	307456.4	590.9
Panel B: Fab vs. Fabless Counties				
Treated x Post-CHIPS	-56.56	250.03*	11471.05*	12.98
	(63.85)	(138.99)	(6709.18)	(9.93)
Observations	5215	5215	5215	1168
Pre-USICA outcome mean (treated counties)	1519.2	2056.8	386279.3	706.2

Notes: Estimates are from synthetic difference-in-difference (SDID) specification, equation (3) in text. Comparison groups are defined in Section 4. Post-CHIPS indicator identifies quarters after after CHIPS Act was signed (2022Q4 or later). Quarters from 2021Q3-2022Q3 are omitted. Outcome in Column 1 is the aggregate number of workers employed in the input sectors for semiconductors (NAICS codes 331410, 334418, 334412, 334416, 334417, 334419, 326112, 326113, 334118, 334515 and 811310; see Section 5.3 for sector descriptions.). Outcome in Column 2 is the number of workers employed in non-residential construction building construction (NAICS 541713 and 541715). Outcome in Column 3 is the total county employment (All 6-digit NAICS industries aggregated). The pre-USICA outcome mean is the outcome mean for treated counties for the 2015Q1-2021Q1 period. Outcome in Column 4 is the yearly county GDP in hundred thousands of chained US dollars (from the Bureau of Economic Analysis, available only through 2023). *p <0.10; **p <0.05; ***p <0.01.