

Appendix

Appendix 1: Additional Tables and Figures

Table A1: Number of publications in journals (2001-2014): UK and US.

| Field | publications UK | publications US | journals UK | journals US |
|-----------------|-----------------|-----------------|-------------|-------------|
| ACCOUNT | 1727 | 3478 | 35 | 24 |
| ECON | 13484 | 37101 | 174 | 86 |
| ENT-SBM | 975 | 968 | 14 | 6 |
| ETHICS-CSR-MAN | 2686 | 4604 | 31 | 13 |
| FINANCE | 3208 | 7986 | 60 | 18 |
| ECON HYST | 894 | 710 | 18 | 2 |
| HRM&EMP | 1849 | 1828 | 28 | 10 |
| IB&AREA | 1259 | 1325 | 24 | 8 |
| INFO MAN | 885 | 2977 | 24 | 14 |
| INNOV | 947 | 1215 | 21 | 2 |
| MDEV&EDU | 767 | 724 | 10 | 9 |
| MGDEV&ED | 31 | 7 | 1 | 1 |
| MKT | 2541 | 6721 | 50 | 14 |
| OPS&TECH | 2924 | 4571 | 44 | 10 |
| OR&MANSCI | 2966 | 8691 | 33 | 13 |
| ORG STUD | 1612 | 2194 | 16 | 9 |
| PLANNING | 858 | 546 | 7 | 3 |
| PSYCH (GENERAL) | 211 | 699 | 2 | 4 |
| PSYCH (WOP-OB) | 335 | 2339 | 6 | 10 |
| PUB SEC | 763 | 2044 | 11 | 4 |
| SECTOR | 3060 | 5089 | 55 | 23 |
| SOC SCI | 2077 | 2049 | 17 | 1 |
| STRAT | 552 | 1059 | 8 | 3 |
| Total | 46611 | 98925 | 688 | 287 |

Notes: This table reports the number of publications and journals by journal subject area. The journal subject categories are based on both, the Academic Journal Guide (AJG) journal classification and Scopus. This categories are then used to classify the publications into "Economics" and "Business".

Table A2: UK universities: outcomes averages (2001-2014)

| Universities of UK | (1) | (2) | (3) | (4) | (5) | (6) | (7) | Russell (R)/ Non- Russell(NR) | Remainers (Re)/ Leavers (L) |
|--|--------|--------|------|------|------|------|------|-------------------------------------|--------------------------------|
| University of Manchester | 250.93 | 153.00 | 1.19 | 0.74 | 0.24 | 0.46 | 0.69 | R | Re |
| University of Oxford | 231.86 | 123.64 | 1.45 | 0.81 | 0.45 | 0.64 | 0.52 | R | Re |
| LSE | 231.00 | 143.50 | 1.39 | 0.89 | 0.51 | 0.71 | 0.57 | R | Re |
| University of Warwick | 208.29 | 135.14 | 1.42 | 0.96 | 0.30 | 0.69 | 0.68 | R | Re |
| University of Cambridge | 202.93 | 117.57 | 1.27 | 0.75 | 0.37 | 0.60 | 0.60 | R | Re |
| University of Nottingham | 192.86 | 144.57 | 1.27 | 0.96 | 0.48 | 0.54 | 0.89 | R | Re |
| Cardiff University | 144.21 | 99.93 | 1.24 | 0.88 | 0.17 | 0.37 | 0.79 | R | |
| University College London | 127.14 | 72.79 | 1.35 | 0.83 | 0.54 | 0.74 | 0.49 | R | Re |
| Lancaster University | 124.57 | 89.43 | 1.18 | 0.86 | 0.20 | 0.42 | 0.81 | NR | |
| University of Leeds | 113.64 | 69.50 | 1.17 | 0.73 | 0.18 | 0.48 | 0.67 | R | |
| Imperial College London | 113.57 | 76.36 | 1.28 | 0.85 | 0.30 | 0.53 | 0.74 | R | |
| University of Birmingham | 113.36 | 48.43 | 1.32 | 0.58 | 0.26 | 0.45 | 0.44 | R | Re |
| University of Southampton | 108.00 | 68.64 | 1.20 | 0.80 | 0.30 | 0.63 | 0.69 | R | Re |
| City University London | 108.00 | 75.07 | 1.33 | 0.93 | 0.22 | 0.55 | 0.76 | NR | Re |
| University of Strathclyde | 103.36 | 64.21 | 1.20 | 0.74 | 0.15 | 0.41 | 0.66 | NR | |
| University of Sheffield | 100.21 | 48.07 | 1.22 | 0.58 | 0.19 | 0.31 | 0.51 | R | Re |
| University of Bath | 99.00 | 58.71 | 1.28 | 0.78 | 0.22 | 0.33 | 0.69 | NR | |
| Brunel University London | 94.93 | 45.86 | 1.23 | 0.58 | 0.24 | 0.38 | 0.52 | NR | Re |
| University of Reading | 87.79 | 42.57 | 1.18 | 0.59 | 0.28 | 0.42 | 0.54 | NR | |
| London Business School | 87.21 | 63.29 | 1.50 | 1.10 | 0.15 | 0.81 | 0.74 | NR | |
| University of Edinburgh | 85.71 | 45.00 | 1.28 | 0.71 | 0.17 | 0.63 | 0.55 | R | |
| Cranfield University | 84.21 | 48.14 | 1.03 | 0.60 | 0.08 | 0.12 | 0.62 | NR | |
| University of York | 81.50 | 40.36 | 1.32 | 0.67 | 0.52 | 0.57 | 0.51 | R | Re |
| University of Essex | 77.14 | 55.14 | 1.29 | 0.96 | 0.51 | 0.78 | 0.70 | NR | Re |
| Aston University | 74.93 | 50.71 | 1.44 | 0.98 | 0.13 | 0.24 | 0.75 | NR | |
| University of Surrey | 73.86 | 40.64 | 1.23 | 0.67 | 0.24 | 0.46 | 0.56 | NR | Re |
| University of Glasgow | 73.07 | 38.86 | 1.11 | 0.60 | 0.31 | 0.51 | 0.58 | R | Re |
| University of Leicester | 72.00 | 34.07 | 1.37 | 0.67 | 0.38 | 0.49 | 0.51 | NR | Re |
| Newcastle University | 70.64 | 34.71 | 1.12 | 0.56 | 0.32 | 0.52 | 0.51 | R | |
| University of Exeter | 70.64 | 43.64 | 1.24 | 0.77 | 0.26 | 0.66 | 0.62 | R | Re |
| University of East Anglia | 70.07 | 43.21 | 1.20 | 0.78 | 0.54 | 0.64 | 0.68 | NR | Re |
| University of Durham | 69.71 | 36.50 | 1.33 | 0.69 | 0.23 | 0.37 | 0.57 | R | |
| University of Bristol | 69.00 | 41.07 | 1.28 | 0.78 | 0.38 | 0.71 | 0.57 | R | Re |
| University of Kent | 64.36 | 34.29 | 1.37 | 0.76 | 0.38 | 0.53 | 0.56 | NR | Re |
| King's College London | 62.29 | 33.93 | 1.29 | 0.78 | 0.10 | 0.49 | 0.62 | R | |
| Queen Mary University of London | 62.21 | 35.36 | 1.53 | 0.89 | 0.49 | 0.66 | 0.53 | R | Re |
| University of Sussex | 61.79 | 35.93 | 1.11 | 0.64 | 0.26 | 0.38 | 0.67 | NR | Re |
| University of Liverpool | 60.21 | 28.21 | 1.19 | 0.59 | 0.12 | 0.53 | 0.49 | R | |
| Royal Holloway, University of London | 57.00 | 31.21 | 1.31 | 0.74 | 0.30 | 0.74 | 0.49 | NR | Re |
| University of Stirling | 55.00 | 26.71 | 1.35 | 0.71 | 0.28 | 0.54 | 0.54 | NR | L |
| Open University | 54.71 | 21.07 | 1.00 | 0.39 | 0.15 | 0.49 | 0.39 | NR | |
| Queen's University Belfast | 51.00 | 26.50 | 1.23 | 0.63 | 0.28 | 0.53 | 0.50 | R | |
| University of St Andrews | 48.00 | 28.36 | 1.54 | 0.91 | 0.42 | 0.48 | 0.69 | NR | Re |
| University of Salford | 47.86 | 17.79 | 1.05 | 0.40 | 0.08 | 0.16 | 0.40 | NR | |
| University of Ulster | 47.79 | 16.93 | 0.98 | 0.36 | 0.13 | 0.09 | 0.40 | NR | |
| University of Hull | 47.29 | 19.50 | 1.41 | 0.57 | 0.14 | 0.19 | 0.45 | NR | |
| Heriot-Watt University | 46.71 | 15.79 | 1.20 | 0.40 | 0.20 | 0.28 | 0.33 | NR | |
| University of Aberdeen | 45.07 | 21.86 | 1.22 | 0.59 | 0.40 | 0.44 | 0.56 | NR | Re |
| Manchester Metropolitan University | 44.00 | 12.71 | 1.14 | 0.35 | 0.09 | 0.13 | 0.32 | NR | L |
| University of the West of England, Bristol | 43.07 | 14.86 | 1.10 | 0.42 | 0.13 | 0.18 | 0.43 | NR | |
| Middlesex University | 42.93 | 16.57 | 1.22 | 0.43 | 0.22 | 0.22 | 0.46 | NR | |
| University of Bradford | 42.79 | 21.79 | 1.17 | 0.58 | 0.08 | 0.07 | 0.54 | NR | |
| Birkbeck College | 41.57 | 22.14 | 1.42 | 0.81 | 0.44 | 0.59 | 0.53 | NR | Re |
| Swansea University | 41.36 | 17.00 | 1.41 | 0.58 | 0.45 | 0.37 | 0.51 | NR | L |
| University of Portsmouth | 39.29 | 17.14 | 1.10 | 0.51 | 0.26 | 0.33 | 0.53 | NR | |
| University of Plymouth | 36.21 | 12.00 | 1.05 | 0.38 | 0.11 | 0.28 | 0.39 | NR | |
| Bournemouth University | 35.21 | 12.50 | 1.14 | 0.43 | 0.03 | 0.11 | 0.38 | NR | |
| Oxford Brookes University | 33.93 | 10.71 | 1.31 | 0.38 | 0.09 | 0.11 | 0.33 | NR | |
| Nottingham Trent University | 33.86 | 11.14 | 1.27 | 0.48 | 0.16 | 0.34 | 0.39 | NR | |
| Kingston University | 31.50 | 12.21 | 1.13 | 0.41 | 0.12 | 0.08 | 0.41 | NR | L |
| London Metropolitan University | 30.14 | 10.00 | 1.22 | 0.41 | 0.19 | 0.36 | 0.34 | NR | L |
| University of Westminster | 29.86 | 9.21 | 1.09 | 0.35 | 0.18 | 0.13 | 0.35 | NR | |
| De Montfort University | 29.57 | 15.64 | 1.18 | 0.69 | 0.04 | 0.17 | 0.61 | NR | |
| University of Northumbria at Newcastle | 28.50 | 7.29 | 1.07 | 0.36 | 0.03 | 0.02 | 0.35 | NR | |
| Leeds Beckett University | 27.71 | 4.36 | 1.15 | 0.21 | 0.03 | 0.17 | 0.18 | NR | |
| Sheffield Hallam University | 26.64 | 8.36 | 1.05 | 0.35 | 0.03 | 0.14 | 0.36 | NR | |
| Bangor University | 25.86 | 15.29 | 1.50 | 0.75 | 0.30 | 0.37 | 0.55 | NR | |
| Glasgow Caledonian University | 25.79 | 8.21 | 0.95 | 0.34 | 0.06 | 0.14 | 0.37 | NR | |
| University of Dundee | 25.36 | 15.57 | 1.07 | 0.67 | 0.29 | 0.40 | 0.71 | NR | L |
| University of Hertfordshire | 23.57 | 11.00 | 1.31 | 0.62 | 0.33 | 0.30 | 0.56 | NR | |
| Coventry University | 22.64 | 7.07 | 1.03 | 0.39 | 0.08 | 0.07 | 0.40 | NR | |
| University of South Wales | 21.86 | 4.43 | 1.12 | 0.27 | 0.02 | 0.00 | 0.25 | NR | |
| University of Greenwich | 21.86 | 7.86 | 1.21 | 0.49 | 0.09 | 0.02 | 0.48 | NR | |
| University of Central Lancashire | 21.79 | 6.14 | 1.68 | 0.48 | 0.04 | 0.18 | 0.31 | NR | |
| Edinburgh Napier University | 21.21 | 4.86 | 1.08 | 0.26 | 0.08 | 0.00 | 0.27 | NR | Re |
| University of Brighton | 20.36 | 7.43 | 1.01 | 0.42 | 0.04 | 0.10 | 0.45 | NR | |
| Keele University | 19.79 | 8.64 | 1.27 | 0.58 | 0.21 | 0.54 | 0.44 | NR | |
| Aberystwyth University | 18.36 | 7.21 | 1.27 | 0.53 | 0.19 | 0.39 | 0.43 | NR | |
| University of Wolverhampton | 17.14 | 2.43 | 0.95 | 0.13 | 0.03 | 0.00 | 0.16 | NR | |
| Robert Gordon University | 17.07 | 6.79 | 1.13 | 0.46 | 0.10 | 0.18 | 0.42 | NR | |
| London South Bank University | 14.29 | 4.36 | 1.28 | 0.35 | 0.10 | 0.15 | 0.34 | NR | |

Notes: This table reports the outcomes averages for each UK university for: 1) publications, (2) publications in top journals, (3) publications per author, (4) publications in top journals per author, (5) proportion of publications in Economics, (6) proportion of publications in Economics top journals, (7) proportion of publications in Business top journals, as described in Table 2. Universities are listed in decreasing order according to the number of publications. The last two columns classify the universities in Russell/Non-Russell and in Remainers/Leavers.

Table A3: US universities: outcomes averages (2001-2014)

| Universities of US | (1) | (2) | (3) | (4) | (5) | (6) | (7) | Selected |
|---|--------|--------|------|------|------|------|------|----------|
| Harvard University | 375.93 | 278.29 | 1.44 | 1.08 | 0.47 | 0.79 | 0.74 | Yes |
| University of California-Berkeley | 291.57 | 205.43 | 1.49 | 1.07 | 0.46 | 0.77 | 0.68 | |
| University of Michigan | 287.64 | 201.36 | 1.30 | 0.92 | 0.34 | 0.68 | 0.74 | Yes |
| University of Pennsylvania | 280.79 | 221.86 | 1.48 | 1.19 | 0.34 | 0.77 | 0.81 | |
| Pennsylvania State University | 270.71 | 161.57 | 1.19 | 0.73 | 0.21 | 0.57 | 0.63 | |
| Columbia University | 267.93 | 183.43 | 1.53 | 1.07 | 0.39 | 0.74 | 0.69 | |
| Texas A&M University | 259.14 | 146.21 | 1.28 | 0.76 | 0.30 | 0.61 | 0.60 | |
| Stanford University | 257.79 | 177.57 | 1.41 | 0.99 | 0.43 | 0.76 | 0.67 | |
| Cornell University | 251.43 | 158.86 | 1.36 | 0.87 | 0.40 | 0.63 | 0.66 | |
| New York University (NYU) | 250.64 | 182.07 | 1.46 | 1.08 | 0.37 | 0.77 | 0.73 | |
| University of Illinois at Urbana-Champaign | 233.64 | 143.43 | 1.29 | 0.81 | 0.32 | 0.61 | 0.65 | |
| Massachusetts Institute of Technology (MIT) | 230.86 | 179.64 | 1.47 | 1.15 | 0.38 | 0.83 | 0.77 | |
| Michigan State University | 220.00 | 155.21 | 1.29 | 0.94 | 0.29 | 0.58 | 0.78 | |
| Indiana University | 215.86 | 128.00 | 1.29 | 0.79 | 0.25 | 0.61 | 0.63 | |
| University of Maryland | 209.71 | 157.57 | 1.31 | 0.98 | 0.36 | 0.75 | 0.76 | |
| Northwestern University | 201.71 | 155.14 | 1.47 | 1.15 | 0.41 | 0.83 | 0.75 | |
| Arizona State University | 196.43 | 135.79 | 1.24 | 0.87 | 0.18 | 0.67 | 0.71 | |
| Rutgers University-New Brunswick | 196.21 | 116.07 | 1.25 | 0.75 | 0.23 | 0.50 | 0.64 | |
| Purdue University | 195.00 | 119.29 | 1.25 | 0.79 | 0.31 | 0.55 | 0.68 | |
| Ohio State University | 194.21 | 114.64 | 1.35 | 0.81 | 0.32 | 0.65 | 0.57 | |
| University of Chicago | 193.07 | 149.64 | 1.64 | 1.29 | 0.58 | 0.86 | 0.72 | |
| University of Texas-Austin | 187.29 | 137.71 | 1.31 | 0.99 | 0.23 | 0.71 | 0.77 | |
| University of Wisconsin-Madison | 186.64 | 115.64 | 1.37 | 0.86 | 0.40 | 0.69 | 0.60 | |
| University of Florida | 185.00 | 115.29 | 1.31 | 0.85 | 0.22 | 0.56 | 0.69 | |
| Duke University | 181.29 | 142.29 | 1.41 | 1.12 | 0.43 | 0.76 | 0.81 | |
| University of California-Los Angeles (UCLA) | 172.29 | 114.64 | 1.48 | 1.00 | 0.38 | 0.79 | 0.62 | |
| Yale University | 166.86 | 109.50 | 1.69 | 1.13 | 0.55 | 0.81 | 0.53 | |
| University of Washington | 164.43 | 98.71 | 1.31 | 0.81 | 0.22 | 0.61 | 0.64 | |
| University of Southern California | 158.07 | 109.71 | 1.31 | 0.93 | 0.29 | 0.72 | 0.71 | |
| University of Georgia | 154.57 | 88.29 | 1.26 | 0.72 | 0.25 | 0.50 | 0.61 | |
| University of Minnesota | 149.07 | 93.86 | 1.45 | 0.92 | 0.32 | 0.67 | 0.62 | |
| University of North Carolina-Chapel-Hill | 145.86 | 99.57 | 1.34 | 0.93 | 0.32 | 0.66 | 0.71 | |
| Georgia Institute of Technology | 144.64 | 108.79 | 1.12 | 0.85 | 0.15 | 0.53 | 0.81 | |
| Georgia State University | 137.57 | 87.86 | 1.43 | 0.92 | 0.26 | 0.54 | 0.70 | |
| George Mason University | 132.36 | 60.64 | 1.34 | 0.63 | 0.41 | 0.46 | 0.48 | |
| North Carolina State University | 129.50 | 67.36 | 1.23 | 0.65 | 0.34 | 0.69 | 0.45 | |
| City University of New York (CUNY) | 128.79 | 63.21 | 1.28 | 0.65 | 0.17 | 0.48 | 0.52 | |
| Iowa State University | 128.43 | 77.36 | 1.17 | 0.72 | 0.49 | 0.61 | 0.66 | |
| Princeton University | 127.86 | 87.29 | 1.49 | 1.05 | 0.56 | 0.85 | 0.53 | |
| Carnegie Mellon University | 126.57 | 104.36 | 1.08 | 0.90 | 0.33 | 0.82 | 0.85 | |
| University of California-Davis | 126.21 | 86.36 | 1.42 | 0.97 | 0.56 | 0.67 | 0.70 | |
| Florida State University | 122.93 | 74.07 | 1.34 | 0.80 | 0.20 | 0.56 | 0.61 | |
| University of Arizona | 116.14 | 77.86 | 1.37 | 0.92 | 0.23 | 0.68 | 0.68 | |
| George Washington University | 115.57 | 53.07 | 1.32 | 0.61 | 0.29 | 0.43 | 0.49 | |
| University of Connecticut | 113.71 | 75.64 | 1.32 | 0.91 | 0.31 | 0.51 | 0.77 | |
| Boston University | 105.07 | 69.29 | 1.35 | 0.92 | 0.37 | 0.81 | 0.63 | |
| University of Central Florida | 100.93 | 59.79 | 1.20 | 0.74 | 0.18 | 0.57 | 0.63 | |
| University of South Carolina | 100.43 | 63.64 | 1.30 | 0.86 | 0.14 | 0.48 | 0.70 | |
| University of California-Irvine | 98.07 | 61.79 | 1.43 | 0.92 | 0.31 | 0.69 | 0.63 | |
| Auburn University | 97.14 | 40.43 | 1.26 | 0.54 | 0.22 | 0.38 | 0.44 | |
| University of Virginia | 97.14 | 64.36 | 1.26 | 0.83 | 0.31 | 0.72 | 0.64 | |
| Temple University | 94.50 | 60.43 | 1.49 | 0.97 | 0.10 | 0.25 | 0.69 | |
| University of California-San Diego (UCSD) | 93.29 | 62.07 | 1.67 | 1.13 | 0.58 | 0.84 | 0.45 | |
| University of Pittsburgh | 92.57 | 63.21 | 1.19 | 0.80 | 0.27 | 0.66 | 0.69 | |
| Syracuse University | 92.29 | 52.86 | 1.34 | 0.77 | 0.32 | 0.58 | 0.58 | |
| University of Colorado at Boulder | 90.14 | 52.29 | 1.45 | 0.86 | 0.28 | 0.71 | 0.56 | |
| University of Alabama-Tuscaloosa | 90.00 | 45.36 | 1.27 | 0.66 | 0.21 | 0.48 | 0.54 | |
| University of Texas-Dallas | 89.43 | 78.36 | 1.52 | 1.35 | 0.23 | 0.52 | 0.95 | |
| University of Houston | 89.14 | 56.36 | 1.31 | 0.84 | 0.19 | 0.73 | 0.63 | |
| University of Missouri | 88.50 | 45.21 | 1.32 | 0.67 | 0.32 | 0.49 | 0.54 | |
| Johns Hopkins University | 86.71 | 45.07 | 1.31 | 0.70 | 0.41 | 0.70 | 0.44 | |

Notes: This table reports the outcomes averages for each UK university for: 1) publications, (2) publications in top journals, (3) publications per author, (4) publications in top journals per author, (5) proportion of publications in Economics, (6) proportion of Economics publications top journals, (7) proportion of publications in Business top journals, as described in Table 2. Universities are listed in decreasing order according to the number of publications. The last column reports the universities that are selected as control units in the SCM.

Table A4: US universities: outcomes averages (2001-2014)

| Universities of US (table continued) | (1) | (2) | (3) | (4) | (5) | (6) | (7) | Selected |
|--|-------|-------|------|------|------|------|------|----------|
| Louisiana State University | 85.79 | 41.86 | 1.32 | 0.66 | 0.23 | 0.42 | 0.54 | |
| Boston College | 83.71 | 63.36 | 1.47 | 1.13 | 0.26 | 0.78 | 0.77 | |
| Clemson University | 83.64 | 48.00 | 1.27 | 0.77 | 0.21 | 0.57 | 0.63 | |
| University of Iowa | 81.93 | 56.93 | 1.30 | 0.92 | 0.29 | 0.74 | 0.71 | |
| University of Illinois at Chicago | 80.29 | 39.64 | 1.20 | 0.60 | 0.27 | 0.46 | 0.54 | |
| University of Tennessee-Knoxville | 79.79 | 33.79 | 1.38 | 0.60 | 0.27 | 0.44 | 0.45 | |
| University of Kentucky | 79.50 | 41.29 | 1.20 | 0.67 | 0.30 | 0.53 | 0.56 | |
| Colorado State University | 79.29 | 32.43 | 1.29 | 0.54 | 0.29 | 0.44 | 0.42 | |
| Georgetown University | 78.14 | 49.71 | 1.34 | 0.86 | 0.37 | 0.71 | 0.61 | |
| Vanderbilt University | 75.86 | 43.86 | 1.45 | 0.85 | 0.43 | 0.65 | 0.54 | |
| Emory University | 75.64 | 54.71 | 1.35 | 0.98 | 0.28 | 0.73 | 0.74 | |
| Washington University in St. Louis | 74.43 | 56.64 | 1.43 | 1.11 | 0.35 | 0.76 | 0.78 | |
| University of Massachusetts-Amherst | 72.43 | 36.29 | 1.08 | 0.55 | 0.28 | 0.47 | 0.54 | Yes |
| University of Oklahoma | 72.43 | 46.86 | 1.18 | 0.78 | 0.14 | 0.61 | 0.68 | |
| University of Miami | 70.93 | 46.57 | 1.42 | 0.94 | 0.17 | 0.57 | 0.68 | |
| State University of New York-Buffalo (SUNY) | 69.00 | 46.21 | 1.24 | 0.86 | 0.15 | 0.49 | 0.75 | |
| University of Notre Dame | 66.21 | 45.00 | 1.29 | 0.89 | 0.24 | 0.67 | 0.69 | |
| Drexel University | 65.43 | 37.14 | 1.24 | 0.71 | 0.16 | 0.48 | 0.59 | |
| Rice University | 64.21 | 47.14 | 1.44 | 1.06 | 0.26 | 0.71 | 0.76 | |
| University of Rochester | 63.29 | 49.14 | 1.34 | 1.06 | 0.53 | 0.77 | 0.79 | Yes |
| Dartmouth College | 61.64 | 47.21 | 1.47 | 1.13 | 0.37 | 0.84 | 0.73 | |
| Brigham Young University | 61.07 | 39.29 | 1.04 | 0.68 | 0.26 | 0.53 | 0.69 | |
| American University | 60.64 | 28.71 | 1.42 | 0.68 | 0.26 | 0.44 | 0.50 | |
| Southern Methodist University | 60.57 | 39.07 | 1.42 | 0.94 | 0.41 | 0.67 | 0.68 | |
| University of Delaware | 60.00 | 27.64 | 1.22 | 0.59 | 0.29 | 0.50 | 0.48 | Yes |
| Oklahoma State University | 59.71 | 29.93 | 1.45 | 0.73 | 0.21 | 0.38 | 0.54 | Yes |
| University of California-Santa Barbara (UCSB) | 57.43 | 26.00 | 1.33 | 0.63 | 0.49 | 0.69 | 0.29 | |
| University of Kansas | 56.79 | 29.93 | 1.29 | 0.70 | 0.23 | 0.46 | 0.57 | |
| Rensselaer Polytechnic Institute | 55.29 | 41.00 | 1.40 | 1.04 | 0.13 | 0.60 | 0.79 | |
| University of Hawaii-Manoa | 54.71 | 20.64 | 1.36 | 0.54 | 0.19 | 0.43 | 0.41 | |
| West Virginia University | 54.36 | 19.14 | 1.31 | 0.50 | 0.33 | 0.48 | 0.33 | |
| University of Oregon | 53.36 | 29.43 | 1.36 | 0.78 | 0.40 | 0.65 | 0.52 | |
| Florida Atlantic University | 52.79 | 26.36 | 1.22 | 0.63 | 0.18 | 0.45 | 0.57 | |
| Brown University | 52.36 | 33.79 | 1.57 | 1.06 | 0.63 | 0.82 | 0.43 | |
| University of California-Riverside | 51.21 | 27.86 | 1.46 | 0.79 | 0.41 | 0.54 | 0.57 | |
| Fordham University | 50.71 | 24.21 | 1.55 | 0.68 | 0.25 | 0.27 | 0.49 | |
| Virginia Commonwealth University | 50.29 | 23.93 | 1.23 | 0.60 | 0.16 | 0.54 | 0.48 | Yes |
| Case Western Reserve University | 49.57 | 33.64 | 1.36 | 0.92 | 0.13 | 0.64 | 0.70 | |
| State University of New York-Binghamton (SUNY) | 45.57 | 29.86 | 1.37 | 0.89 | 0.39 | 0.46 | 0.77 | |
| DePaul University | 43.57 | 22.14 | 1.08 | 0.59 | 0.10 | 0.62 | 0.53 | |
| State University of New York-Albany (SUNY) | 42.43 | 23.36 | 1.23 | 0.67 | 0.23 | 0.67 | 0.51 | |
| University of Wyoming | 42.07 | 27.29 | 1.64 | 1.09 | 0.69 | 0.61 | 0.72 | Yes |
| Utah State University | 41.36 | 20.57 | 1.32 | 0.65 | 0.38 | 0.49 | 0.49 | |
| University of Colorado at Denver | 41.14 | 22.86 | 1.29 | 0.75 | 0.26 | 0.63 | 0.58 | |
| University of North Carolina-Greensboro | 41.14 | 17.71 | 1.25 | 0.57 | 0.16 | 0.44 | 0.50 | Yes |
| California Institute of Technology | 37.21 | 26.79 | 1.59 | 1.15 | 0.71 | 0.87 | 0.36 | |
| Baylor University | 36.64 | 22.71 | 1.22 | 0.76 | 0.15 | 0.37 | 0.68 | Yes |
| College of William & Mary | 35.64 | 21.57 | 1.30 | 0.81 | 0.37 | 0.55 | 0.69 | |
| University of California-Santa Cruz (UCSC) | 35.21 | 20.07 | 1.75 | 1.05 | 0.57 | 0.67 | 0.53 | Yes |
| Santa Clara University | 34.57 | 22.36 | 1.32 | 0.85 | 0.14 | 0.59 | 0.66 | |
| Tulane University | 33.93 | 19.71 | 1.45 | 0.88 | 0.26 | 0.53 | 0.66 | |
| Tufts University | 32.93 | 17.36 | 1.41 | 0.75 | 0.48 | 0.69 | 0.42 | |
| Appalachian State University | 31.36 | 9.71 | 1.13 | 0.39 | 0.35 | 0.48 | 0.29 | Yes |
| University of Nevada-Reno | 30.79 | 12.64 | 1.24 | 0.51 | 0.38 | 0.44 | 0.45 | Yes |
| Stony Brook University - SUNY | 29.36 | 12.86 | 1.56 | 0.73 | 0.36 | 0.69 | 0.35 | |
| University of Maryland-Baltimore County | 23.71 | 10.00 | 1.09 | 0.49 | 0.43 | 0.38 | 0.48 | Yes |
| Brandeis University | 21.36 | 12.64 | 1.38 | 0.85 | 0.68 | 0.47 | 0.54 | Yes |
| Middlebury College | 17.00 | 6.43 | 1.57 | 0.57 | 0.70 | 0.36 | 0.33 | Yes |
| Claremont McKenna College | 16.71 | 10.79 | 1.39 | 0.91 | 0.61 | 0.60 | 0.56 | Yes |
| Williams College | 12.50 | 6.93 | 1.33 | 0.74 | 0.68 | 0.65 | 0.25 | Yes |

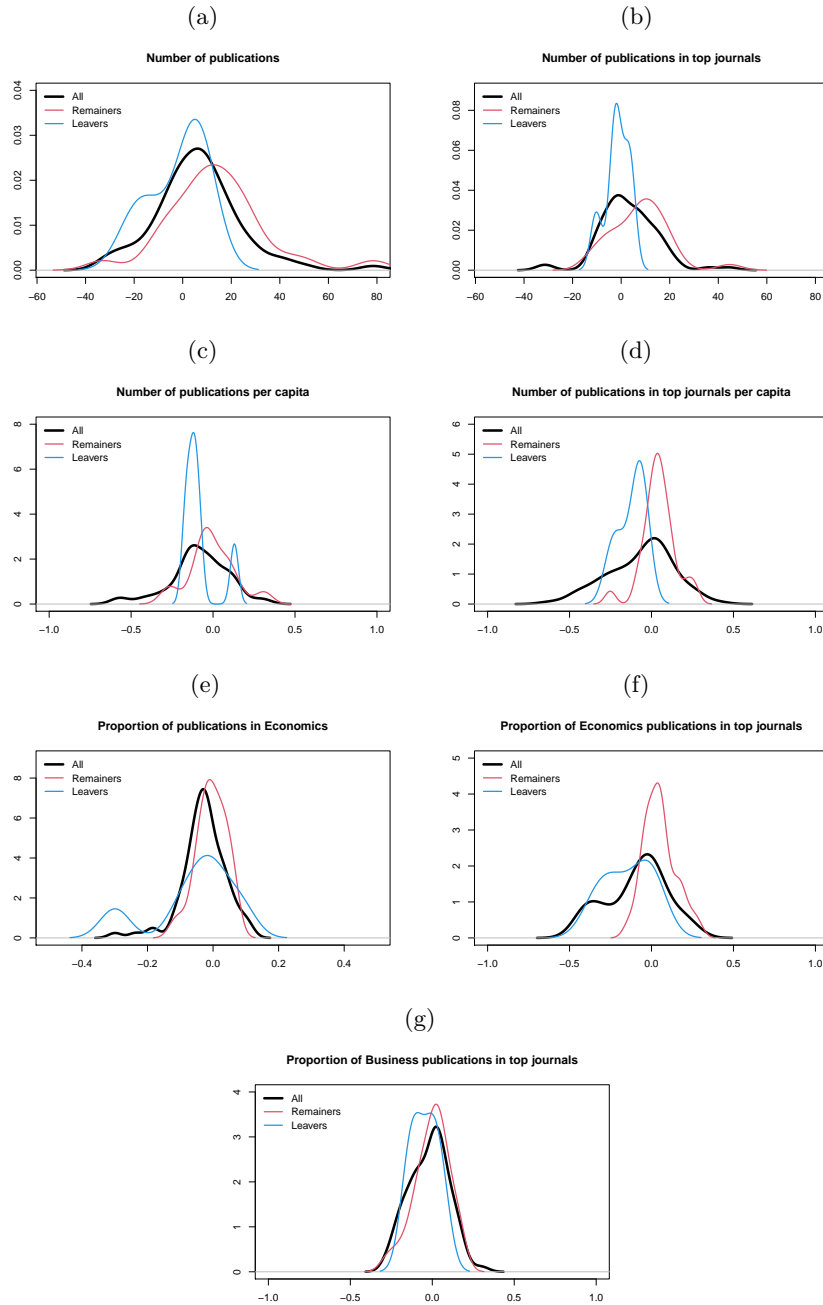
Notes: This table reports the outcomes averages for each US university for: (1) publications, (2) publications in top journals, (3) publications per author, (4) publications in top journals per author, (5) proportion of publications in Economics, (6) proportion of publications in Economics top journals, (7) proportion of publications in Business top journals, as described in Table 2. Universities are listed in a decreasing order according to the number of publications. The last column reports the universities that are selected as control units in the SCM.

Table A5: Cumulated treatment effects per university

| University (anonymised) | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------------|-------------|-------------|-----------|-----------|-----------|-----------|-----------|
| Russell 1 | 40.38 | 109.38* | 1.56**** | 0.42 | 0.42 | 0.48 | 1.02**** |
| Russell 2 | -25.26 | -21.18 | -0.24 | 0.02 | 0.42 | -0.06 | 0.90**** |
| Russell 3 | 173.1* | 118.44 | 0.72**** | 0.30 | 0.24 | -0.12 | 0.18 |
| Russell 4 | -29.82 | -32.10 | -0.30 | -0.02 | 0.02 | -0.24 | -0.06 |
| Russell 5 | 47.88 | 30.72 | -0.96**** | 0.06 | -0.30 | -0.24 | 0.06 |
| Russell 6 | -26.76 | -64.74 | 1.74**** | -1.50 | 0.06 | -0.84 | -0.72 |
| Russell 7 | 44.34 | -8.88 | -0.48 | 0.66 | -0.06 | 0.18 | 0.12 |
| Russell 8 | -2.10 | 4.80 | -1.50**** | 0.66 | 0.06 | 0.30 | 0.90* |
| Russell 9 | 13.86 | 130.02* | 0.48 | 1.62 | -0.24 | 1.20**** | 0.54 |
| Russell 10 | -18.00 | -36.30 | -0.24 | 0.24 | -0.54 | 0.30 | -0.48 |
| Russell 11 | 155.70**** | 53.05 | 0.42 | 0.06 | -0.06 | 0.24 | -0.48**** |
| Russell 12 | 106.56 | 51.78 | 1.02 | 0.36 | 0.36 | 1.08 | -0.78 |
| Russell 13 | 97.14 | 84.30 | 0.60 | 0.60 | -0.18 | -0.78 | -0.42 |
| Russell 14 | 61.62 | 33.72 | 0.30 | 0.30 | 0.12 | 0.18 | 0.30 |
| Russell 15 | 48.06 | -10.44 | -0.84 | -0.54 | -0.12 | -0.30 | 0.18 |
| Russell 16 | 93.72 | 54.30 | -0.60 | -0.12 | 0.24 | 1.68**** | -1.62 |
| Russell 17 | -3.84 | 53.70 | 0.78 | 0.18 | -0.12 | -0.66 | 0.42 |
| Russell 18 | -17.52 | 37.26 | -0.06 | 0.54 | -0.18 | -0.78 | 0.24 |
| Russell 19 | 146.82* | 81.30 | -0.06 | 0.30 | 0.06 | -0.24 | 0.02 |
| Russell 20 | 93.24 | 42.72 | 0.60 | 0.54 | -0.24 | 0.42 | 0.24 |
| Russell 21 | 300.84**** | 268.08**** | -0.30 | -0.30 | 0.30 | 0.36 | -0.48 |
| Russell 22 | 58.44 | -77.04 | -0.54 | -0.12 | -0.12 | 0.72 | -0.12 |
| Russell 23 | -3.90 | 48.12 | 0.18 | 0.90 | -0.18 | -0.12 | 0.66**** |
| Russell 24 | 470.58**** | 88.62 | -0.30 | 0.12 | 0.18 | 1.08**** | -0.48 |
| Total Russell | 59.67* | 39.07* | 0.26 | 0.58 | 0.17 | 0.12 | 0.86**** |
| Non-Russell 25 | 93.96 | 48.00 | 0.66 | 1.14**** | -0.06 | -0.36 | -0.12 |
| Non-Russell 26 | 56.40 | 18.18 | -1.14 | -1.02 | 0.60* | -0.66 | -0.06 |
| Non-Russell 27 | 141.66 | 69.72 | 0.06 | 0.48 | -0.06 | 0.18 | 0.06 |
| Non-Russell-Leaver 28 | 6.42 | -18.12 | 0.78**** | -1.50 | -0.12 | 0.12 | -0.66 |
| Non-Russell 29 | -122.04 | -186.78* | -1.98**** | -1.38**** | -0.12 | -1.62**** | -0.06 |
| Non-Russell-Leaver 30 | 43.38 | -5.40 | -0.90 | -0.48 | -1.80**** | -0.42 | -0.48 |
| Non-Russell 31 | 115.68 | -5.34 | -0.78 | -1.32 | -0.42 | -2.52**** | -1.44**** |
| Non-Russell 32 | 102.42 | 6.90 | -0.42 | -1.14 | -0.24 | -0.06 | -0.72**** |
| Non-Russell 33 | -51.66 | -37.98 | -3.42**** | -3.72**** | -0.36 | -2.52**** | -0.54 |
| Non-Russell 34 | -165.72* | -43.02 | -2.34**** | -2.64**** | -0.24 | -1.32**** | -1.20**** |
| Non-Russell 35 | 51.18 | -3.48 | -1.26 | -1.02 | -0.12 | -1.74**** | -0.78 |
| Non-Russell 36 | -15.90 | 24.84 | -0.78 | -1.86 | -0.42 | -1.62**** | -0.06 |
| Non-Russell 37 | -152.88* | -7.74 | -2.52**** | 0.06 | -0.12 | -2.40**** | 1.20**** |
| Non-Russell-Leaver 38 | -123.90**** | -61.62 | -0.72**** | -0.30 | -0.24 | -1.14* | 0.42 |
| Non-Russell 39 | -76.02 | -40.56 | -1.74 | -1.50 | -0.36 | -0.84 | -0.90* |
| Non-Russell 40 | -182.28* | -189.42**** | 1.44**** | 1.68**** | -0.30 | 1.20 | 0.84 |
| Non-Russell 41 | 177.72*** | 136.38*** | -0.12 | 0.30 | -0.30 | 0.48 | 0.36 |
| Non-Russell 42 | -5.16 | -24.18 | -0.84 | -1.38 | 0.24 | -0.48 | -1.14** |
| Non-Russell 43 | 168.66* | 86.28 | -0.78 | -2.10* | 0.12 | 1.56**** | -0.24 |
| Non-Russell 44 | -58.02 | -49.80 | -0.96**** | -0.30 | 0.06 | 0.12 | 0.78*** |
| Non-Russell 45 | -26.04 | 47.76 | -1.14**** | 0.24 | -1.08* | -0.36 | 0.24 |
| Non-Russell 46 | 13.50 | -3.00 | 0.84**** | 1.56 | -0.18 | -0.60 | 0.78 |
| Non-Russell 47 | 31.86 | 35.10 | -2.10* | -0.90 | -0.24 | -1.80**** | 0.18 |
| Non-Russell 48 | -57.54 | -70.56 | 0.54 | -0.42 | -0.30 | -0.06 | -1.26**** |
| Non-Russell 49 | 33.72 | -8.40 | -1.02 | -1.80**** | -0.54 | -2.64**** | -0.66**** |
| Non-Russell 50 | 116.52 | 95.82 | -0.48 | 0.60 | -0.18 | 0.06 | -0.06 |
| Non-Russell 51 | -5.94 | -36.60 | -2.70**** | -1.98**** | -0.72 | -2.10**** | -1.32**** |
| Non-Russell 52 | 10.86 | -49.14 | -0.78 | -1.86 | -0.48 | -2.52**** | -1.62**** |
| Non-Russell 53 | -88.68 | -26.16 | -1.08 | -2.58**** | 0.42 | -2.52**** | 0.24 |
| Non-Russell 54 | 65.64 | 34.98 | -0.90**** | -0.30 | -0.18 | -1.80**** | -0.42 |
| Non-Russell 55 | -20.22 | 40.74 | -0.90**** | -0.84 | -0.42 | -0.90 | 0.36 |
| Non-Russell 56 | 33.90 | 43.14 | -0.24 | -0.06 | -0.30 | -0.06 | 0.30 |
| Non-Russell 57 | 39.36 | 30.30 | -0.01 | 0.18 | 0.12 | -0.48 | 0.54 |
| Non-Russell 58 | -125.82**** | -5.70 | -3.30**** | -2.52**** | -0.06 | -2.28**** | 0.00 |
| Non-Russell 59 | -197.76* | 90.30 | -0.54 | 0.78 | 0.18 | 1.08 | 0.72 |
| Non-Russell 60 | 21.60 | 3.42 | -1.50 | -0.12 | -0.42 | -2.16**** | -0.48 |
| Non-Russell-Leaver 61 | -77.52 | -15.36 | -0.66 | -0.60 | -0.60* | -2.10**** | -0.96**** |
| Non-Russell 62 | 112.32 | 105.96* | 0.36 | 1.38 | -0.12 | 0.78 | 0.42 |
| Non-Russell 63 | 213.48* | 215.82**** | 0.12 | 0.90 | 0.24 | 0.72 | 0.90**** |
| Non-Russell 64 | 65.64 | 63.66 | -0.18 | 1.14**** | 0.12 | -0.12 | 1.02**** |
| Non-Russell 65 | 98.46 | 4.92 | -0.72 | -0.72 | -0.06 | -0.12 | -1.08**** |
| Non-Russell-Leaver 66 | 24.60 | 17.94 | -1.02 | -0.30 | 0.54 | -0.06 | 0.06 |
| Non-Russell 67 | -63.78 | -9.30 | -1.02**** | -0.18 | 0.66* | -1.80**** | 0.30 |
| Non-Russell 68 | 240.66* | 66.66 | 1.86**** | 1.62 | -0.72* | 1.38**** | 0.54 |
| Non-Russell 69 | 123.18**** | 103.08* | 0.84 | 2.40 | -0.42 | 0.12 | 1.80**** |
| Non-Russell 70 | 250.38**** | 86.64 | -0.90 | -1.02 | -0.30 | -1.02 | 0.12 |
| Non-Russell 71 | -40.02 | -58.08 | 0.00 | -1.74 | -0.72 | -2.28**** | -1.20**** |
| Non-Russell 72 | 54.18 | 84.42**** | 0.90 | 0.18 | -0.36 | -0.60 | 0.48 |
| Non-Russell 73 | 93.48 | -59.52 | 0.18 | 0.06 | 0.60 | -0.24 | 0.06 |
| Non-Russell 74 | -9.24 | -25.56 | 0.42 | -0.60 | -0.60* | -0.72 | -1.14**** |
| Non-Russell 75 | -67.92 | -59.46 | -0.78 | -1.86* | -1.08* | -2.94**** | -0.84 |
| Non-Russell 76 | 50.94 | -8.76 | -3.54**** | -2.40**** | -0.30 | -0.66 | -0.66 |
| Non-Russell 77 | 9.84 | -48.96 | -0.60 | -2.82**** | -0.48 | -2.40**** | -0.90* |
| Non-Russell 78 | 70.50 | 10.86 | 0.06 | -0.84 | -1.44* | -0.42 | -0.36 |
| Non-Russell 79 | 75.30 | -19.68 | -0.24 | -2.94**** | -0.36 | -1.14* | -1.14**** |
| Non-Russell 80 | 45.54 | 7.38 | 1.80* | 0.78 | -0.06 | 0.30 | -0.36 |
| Non-Russell-Leaver 81 | 52.62 | 24.42 | -0.48 | -1.20 | 0.12 | -1.62**** | -0.06 |
| Total Non-Russell | 35.98* | 5.78 | -0.052 | -0.231 | -0.167 | 0.581**** | 0.505**** |

Notes: This table provides the cumulated treatment effects per university (separating the universities by Russell and Non-Russell and Remainers and Leavers) for the: (1) number of publications, (2) number of publications in top journals, (3) number of publications per author, (4) number of publications in top journals per author, (5) proportion of publications in Economics, (6) proportion of publications in Economics top journals, (7) proportion of publications in Business top journals, as described in Table 2. Values are marked by *, **, ***, **** if they are significant at a level of, 0.10, 0.05, 0.01 or 0.001, respectively.

Figure A1: Distribution of the yearly treatment effects: All, Remainers and Leavers



Notes: This figure reports the distribution of the yearly treatment effects for all, Remainers and Leavers groups of universities for: number of publications (panel a), number of publications in top journals (panel b), number of publications per author (panel c), number of publications in top journals per author (panel d), proportion of publications in Economics (panel e), proportion of publications in Economics top journals (panel f), proportion of publications in Business top journals (panel g), as described in Table 2.

Appendix 2: Further Details on the Synthetic Control Method

2.1. Single treated unit: treatment effects

The SCM creates first the artificial matching unit, for each treated unit for each outcome measure, making use of the pre-treatment information of the treated unit and the set of available untreated units, or the so-called control pool. The matching algorithm follows an iterative two-step optimization process:

(i) The **inner optimization** estimates the weights that minimize the distance between treated and untreated units' covariates over the pre-treatment period

$$\mathbf{w}(\mathbf{V}) = \arg_{\mathbf{w}} \min \|\mathbf{X}_1 - \mathbf{X}_0 \mathbf{w}\|_{\mathbf{V}} = \arg_{\mathbf{w}} \min \sqrt{(\mathbf{X}_1 - \mathbf{X}_0 \mathbf{w})' \mathbf{V} (\mathbf{X}_1 - \mathbf{X}_0 \mathbf{w})} \quad (1)$$

where \mathbf{X}_1 is the 13×1 -matrix containing the values of the covariates over the pre-treatment period for the treated unit; \mathbf{X}_0 is the 13×121 -matrix containing the values for the untreated units; \mathbf{w} is the 121×1 -vector of optimal weights to create a convex combination of untreated units. \mathbf{V} is a positive-definite and diagonal 13×13 -matrix, which assigns weights to the variables used in the optimization process. This matrix is initialized at the identity matrix at the beginning of the iterative algorithm.

(ii) The **outer optimization** serves to improve the result by estimating \mathbf{V} . Specifically, \mathbf{V} is chosen such that the solution to the $\|\mathbf{X}_1 - \mathbf{X}_0 \mathbf{w}\|_{\mathbf{V}}$ optimization problem minimizes the (pre-intervention) mean square prediction error (MSPE) (Abadie et al. 2010) for the outcome measure over the pre-treatment period,

$$\text{MSPE} = \frac{1}{8} \sum_{t=2001}^{2008} (Y_t - Y_t^*)^2 \quad \text{where } Y_t^* = w(\mathbf{V})' Y_{jt} \quad (2)$$

where Y_{jt} is the 121×1 -vector containing the values of the outcome variable for the 121 US universities at time t .

Steps (i) and (ii) are repeated iteratively until convergence. We use the R packages *Synth* and *improveSynth* to perform the analysis. As iterative algorithm, R uses both Nelder-Mead and BFGS methods and then chooses the most performing one. The weights determine the artificial control unit. The estimated coefficients, \mathbf{w} , for each UK university, for one outcome measure, the number of publications, are reported in Table A6.

Then, the SCM computes the difference, $\hat{\alpha}_t$, between the actual values of the outcome measure with those Y^* of the artificial university during the intervention years t (2009-2014). The cumulated Treatment Effect (cTE) for each UK university i is calculated as the sum of the yearly treatment effects across all treatment years:

$$c\hat{\text{TE}}_i = \sum_{t=2009}^{2014} \hat{\alpha}_{it} \quad \text{where } \hat{\alpha}_{it} = Y_{it} - Y_{it}^* \quad (3)$$

2.2. Assessing the significance of the treatment effects

As mentioned above, the SCM does not generate standard p-values that can be used to test the significance of the treatment effects. To overcome this issue, Abadie et al. (2010) proposes to run the so-called placebo tests. Placebo analysis involves performing SCM for each unit in the controls' pool as if they were treated, using the rest of controls as their pool. This process generates a

distribution of placebo effect estimates. The placebo tests yield null distributions (i.e., distributions under the null hypothesis of no effect due to intervention) for both the yearly differences as well as for the cumulated treatment effect, against which one can compare the original effect estimates. In fact, by being non-parametric, the placebo test approach has the advantage of not imposing any distribution on the errors. If the intervention is the cause of the observed effect, then the gap between the treated units and its synthetic control should be largest for the actual treated unit than for the placebo units (Bouttelle et al. 2018). Otherwise, it is reasonable to think that the estimated effects are observed by chance.

The idea of the placebo tests proposed by Abadie et al. (2010) is akin to the classic framework for permutation inference. As in permutation tests, we apply the SCM to every potential control in our sample. This will assess whether the effects estimated by the SCM for the universities affected by the REF 2014 are large relative to the effect estimated for a control university chosen at random. This inferential exercise is exact in the sense that, regardless of the number of available comparison control universities, time periods, and whether the data are individual or aggregate, it is always possible to calculate the exact distribution of the estimated effect of the placebo interventions.

We consider each of the control US universities in the control set as if they were treated. Thus, we apply the SCM to create the best synthetic counterfactual for each US university in the control set using a combination of the remaining universities in the control set. This yields a group of yearly placebo treatment effects, α_{jt}^{PL} , as well as a cumulative placebo treatment effect cTE_j^{PL} for each university j in this potential control set. Following Abadie et al. (2010), we drop the yearly effects and the cumulative treatment effects of the US universities that have a pre-treatment Mean Squared Predictive Error (MPSR) greater or equal to twice that of the treated unit so that we only retain the N_{PL} placebos that are comparable to the treated unit.

Having a distribution of placebos allows us to conduct a two-sided hypothesis. If the REF 2014 did not have any effect, we would expect the effects on the treated UK universities to be similar to the ones computed for the untreated US universities. The p-values for a treated unit i associated to the yearly treatment effect t can be calculated as:

$$p_{it} = \frac{1}{N_{PL}} \sum_j \mathbb{1}\{|\alpha_{jt}^{PL}| \geq |\hat{\alpha}_{it}|\} \text{ for each } t, \quad (4)$$

where $\mathbb{1}\{\cdot\}$ is the indicator function that takes value one if the argument in parentheses is true and zero otherwise, and N_{PL} is the number of universities in the potential control set. Thus, the p_{it} is the proportion of universities in the placebo group for which the treatment for that year is larger than that of i . Similarly, the corresponding statistic when taking into account the aggregated effect for all years for unit i , cTE_i , is:

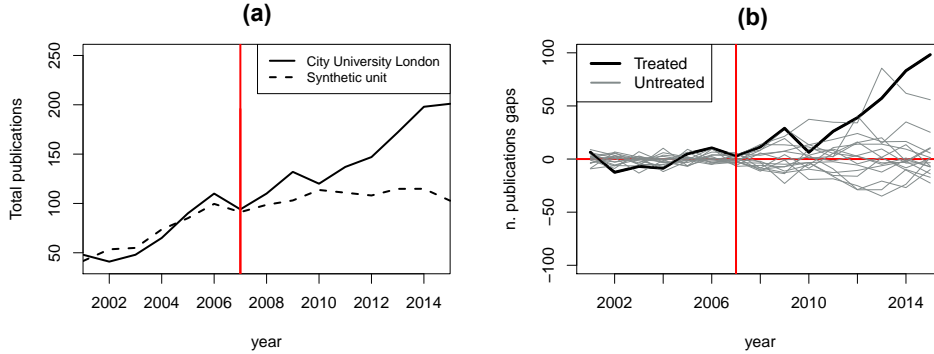
$$p_{cTE_i} = \frac{1}{N_{PL}} \sum_j \mathbb{1}\{|cTE_j^{PL}| \geq |c\hat{TE}_i|\}. \quad (5)$$

Panel (a) in Figure A2 shows, as an example, the evolution of the number of publications for City, University of London, and that of its artificial counterfactual university. In panel b, we show the treatment effects $\hat{\alpha}_{it}$ of City (bold line) and those of the control units for placebo tests.

2.3. Multiple treated units: average treatment effects and significance

Acemoglu et al. (2016) calculates the Average Treatment Effect on the Treated (ATT) for a group

Figure A2: Example: Number of Publications of City, University of London, and its synthetic control unit



of treated units by computing a fit-weighted ATT. The fit-weighted ATT is computed as

$$\widehat{ATT} = \frac{\sum_{i \in Treat} \frac{c\hat{T}E_i}{\hat{\sigma}_i}}{\sum_{i \in Treat} \frac{1}{\hat{\sigma}_i}}; \quad \text{where } \hat{\sigma}_i = \sqrt{\frac{\sum_{t=2001}^{t=2008} \hat{\alpha}_{it}^2}{8}} \quad (6)$$

where $\hat{\sigma}_i$ is the Root of the Mean Squared Predictive Error of the estimated effects over the pre-treatment period (RMSPE) for treated unit i , that is, the discrepancy between the actual and counterfactual patterns before the intervention. The \widehat{ATT} describes a weighted average of the cumulative effects over the intervention period, using the inverse of the RMSPE, $\frac{1}{\hat{\sigma}_i}$, as weights. This implies that universities with a better matching have a higher impact on the estimate of the ATT which provides an unbiased estimate of ATT.

To create our (pseudo) placebo tests, we follow the generalization proposed by Cavallo et al. (2013) of Abadie et al. (2010)’s placebo approach to do inferences about the average effect estimated across multiple treated units. A null distribution of placebo ATT effects is again needed. Following Acemoglu et al. (2016), we create 5,000 placebo treatment groups of the same size as the number of treated units, in our case the 81 UK universities, which are extracted with replacement through bootstrap from the set of control units (even if the control group is of smaller size than 81). We again index all these placebo ATTs over j . The p-values for the overall ATT are given by:

$$\hat{p}_{ATT} = \frac{1}{5000} \sum_j \mathbb{1}\{|ATT_j^{PL}| \geq |\widehat{ATT}|\}. \quad (7)$$

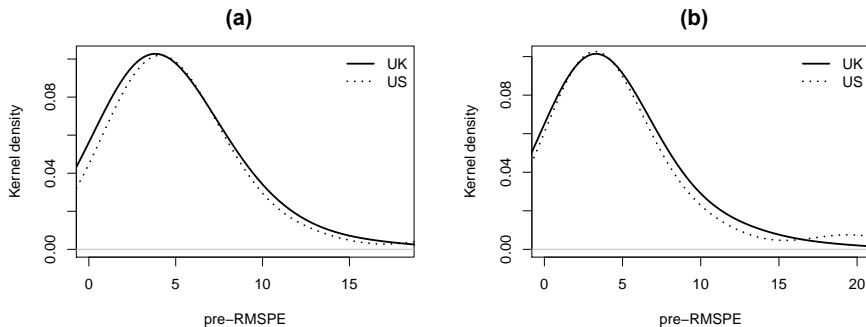
We base our placebo tests on the \hat{p}_{ATT} above and consider that, if it is less than 5%, the average effect of the REF 2014 is significant, i.e., not random or an artefact of the method.

2.4. Assessing the goodness of fit of the matching

There are several ways to check if a weighted average of controls is able to approximate the outcome of the treated unit in the pre-treatment period. One could visually compare the difference in pre-treatment outcomes between the treatment unit and its synthetic control. Or, one could look at the distributions of the root of the mean square predictive error over the pre-treatment (RMSPE). Nevertheless, although there is currently no consensus on what constitutes a ‘good fit’ or how to judge the similarity between treated and control units (Bouttell et al. 2018), most of the works

making use of the SCM compare the *distance* between the treatment and synthetic control unit/s during the pre-treatment period, i.e., the RMSPE, for the treated and for the placebo control (US) units. Figure A3 below shows the distributions of the pre-treatment RMSPEs for the treated UK universities and for the placebo US universities for the first two outcome measures of interest, the number of publications in journals and of the number of publications in top journals. As can be appreciated, the distributions of UK universities and US controls match well in both cases.

Figure A3: Kernel estimate distributions of pre-treatment RMSPE for control (US) and UK universities



Notes: It is used for the assessment of the quality of SCM matching for two of the outcomes: number of publications in journals (Panel a) and top journals (Panel b).

Following the placebo approach of Cavallo et al. (2013) (Cavallo, E., Galiani, S., Noy, I. Pantano, J. (2013), ‘Catastrophic natural disasters and economic growth.’, *Review of Economics and Statistics* 95(5), 1549–1561), we look at the proportion of placebos that have pre-treatment RMSPEs at least as large as the average RMSPEs of the treated units. But, instead of using the average of the pre-treatment treated unit RMSPE distribution as a reference for comparison, we consider the *median*, which is more robust to potential outliers or, in our case, UK universities that show a poor matching with their counterfactuals. These universities would be the ones discarded for the computation of the corrected ATTs, following the approach used by Acemoglu et al. (2016). We call the proportion of placebo p_{match} :

$$p_{match} = \frac{1}{N_{PL}} \sum_{j=1}^{N_{PL}} \mathbb{1}\{\text{RMSPE}_j^{PL} \geq \text{RMSPE}_{Median}^{UK}\}. \quad (8)$$

Note that p_{match} gives the proportion of the considered placebos that have RMSPEs above the median of the associated to the treated. If placebo RMSPEs are very frequently smaller than those of the treated, then the control group is not able to properly replicate the patterns of the treated units. Thus, the larger the p_{match} , the better the quality of the matching. However, the control units are somehow similar in that we should not expect their RMSPEs to be too high. Therefore, if the control group can reasonably reproduce the treated units, we expect their pre-treatment RMSPE distributions to be close to one another but not too often be the placebo ones smaller than the treated. Thus, we consider that a p_{match} of about 50% indicates an acceptable match.

For all the outcomes, the p_{match} values are reported in the first column of Table 3. For all outcomes, p_{match} is about 50% or higher, and, thus, we consider the quality of the match acceptable. Since the matching is done for each outcome variable, as explained in section 6, the set of matching coefficients is allowed to be different. As an example, Table A6 shows matching

coefficients for the outcome ‘Number of Publications’.

Table A6: SCM estimated coefficients: Number of Publications

| Treated | Synthetic control composition |
|------------------------------------|--|
| Aberystwyth University | Brandeis University (0.452), Claremont McKenna College (0.432), University of Maryland-Baltimore (0.104), Baylor University (0.013) |
| Aston University | Florida Atlantic University (0.791), University of Georgia (0.209) |
| Bangor University | Middlebury College (0.330), Claremont McKenna College (0.294), University of Maryland-Baltimore (0.231), Williams College (0.144) |
| Birkbeck College | Middlebury College (0.393), West Virginia University (0.269), Syracuse University (0.199), University of Rochester (0.056), University of Massachusetts-Amherst (0.046), Brandeis University (0.036) |
| Bournemouth University | Williams College (0.430), University of Maryland-Baltimore (0.240), Middlebury College (0.225), Appalachian State University (0.105) |
| Brunel University London | University of Texas-Dallas (0.777), Arizona State University (0.088), State University of New York-Buffalo (0.061), Purdue University (0.044), University of North Carolina-Greensboro (0.023), Florida Atlantic University (0.007) |
| Cardiff University | University of Chicago (0.274), Washington University in St. Louis (0.216), Vanderbilt University (0.197), New York University (0.158), Oklahoma State University (0.093), University of Illinois at Urbana-Champaign (0.038), University of Texas-Dallas (0.025) |
| City University London | University of Delaware (0.381), Florida Atlantic University (0.292), University of Georgia (0.254), Northwestern University (0.073) |
| Coventry University | Claremont McKenna College (0.423), Middlebury College (0.198), Fordham University (0.197), Appalachian State University (0.148), University of Maryland-Baltimore (0.024), Brandeis University (0.010) |
| Cranfield University | Florida Atlantic University (0.652), University of Georgia (0.288), Texas A&M University (0.040), University of Arizona (0.021) |
| De Montfort University | University of Nevada-Reno (0.423), Claremont McKenna College (0.352), University of North Carolina-Greensboro (0.133), College of William & Mary (0.091) |
| Edinburgh Napier University | Appalachian State University (0.631), University of Maryland-Baltimore (0.139), Claremont McKenna College (0.118), Baylor University (0.112) |
| Glasgow Caledonian University | Appalachian State University (0.562), Florida Atlantic University (0.293), Baylor University (0.116), West Virginia University (0.029) |
| Heriot-Watt University | Baylor University (0.410), West Virginia University (0.334), Florida Atlantic University (0.103), University of North Carolina-Greensboro (0.092), University of Alabama-Tuscaloosa (0.060) |
| Imperial College London | University of California-Santa Barbara (0.278), University of North Carolina-Greensboro (0.247), Stanford University (0.187), Georgia State University (0.180), University of California-Davis (0.068), University of California-Los Angeles (0.039) |
| Keele University | Brandeis University (0.548), University of Maryland-Baltimore (0.345), Fordham University (0.106) |
| King’s College London | Baylor University (0.304), University of North Carolina-Greensboro (0.304), Syracuse University (0.193), Williams College (0.100), Temple University (0.070), Harvard University (0.017), Florida Atlantic University (0.011) |
| Kingston University | Appalachian State University (0.271), Williams College (0.270), University of Maryland-Baltimore (0.250), Florida Atlantic University (0.105), Baylor University (0.057), Oklahoma State University (0.047) |
| Lancaster University | University of Texas-Dallas (0.626), University of Georgia (0.274), Texas A&M University (0.066), Florida Atlantic University (0.034) |
| Leeds Beckett University | Brandeis University (0.558), University of Maryland-Baltimore (0.242), Baylor University (0.106), Claremont McKenna College (0.095) |
| London Business School | State University of New York-Buffalo (0.755), Boston College (0.152), Harvard University (0.087), University of Oklahoma (0.006) |
| London Metropolitan University | University of Nevada-Reno (0.590), Middlebury College (0.204), Baylor University (0.148), Brandeis University (0.053) |
| LSE | Harvard University (0.336), University of Georgia (0.296), University of Connecticut (0.213), MIT (0.150) |
| London South Bank University | Williams College (0.504), Middlebury College (0.201), Fordham University (0.198), Brandeis University (0.091), Claremont McKenna College (0.007) |
| Manchester Metropolitan University | Middlebury College (0.264), Boston College (0.233), Baylor University (0.170), University of North Carolina-Greensboro (0.153), Florida Atlantic University (0.100), Syracuse University (0.078) |
| Middlesex University | Florida Atlantic University (0.275), University of Maryland-Baltimore (0.243), University of Nevada-Reno (0.168), Claremont McKenna College (0.135), University of Alabama-Tuscaloosa (0.131), Baylor University (0.048) |
| Newcastle University | University of Nevada-Reno (0.499), Baylor University (0.150), Tufts University (0.085), Princeton University (0.064), Rutgers University-New Brunswick (0.064), Auburn University (0.061), Syracuse University (0.040), Harvard University (0.037) |
| Nottingham Trent University | University of Colorado at Denver (0.345), Claremont McKenna College (0.253), Middlebury College (0.235), University of North Carolina-Greensboro (0.089), Williams College (0.052), University of Maryland-Baltimore (0.025) |
| Open University | Brandeis University (0.322), University of California-Riverside (0.248), University of Oklahoma (0.184), Baylor University (0.113), University of Iowa (0.098), University of Maryland-Baltimore (0.035) |
| Oxford Brookes University | Middlebury College (0.483), Baylor University (0.180), Florida Atlantic University (0.144), Oklahoma State University (0.109), University of Maryland-Baltimore (0.084) |

| Treated (Table continued) | Synthetic control composition |
|--------------------------------------|--|
| Queen Mary University of London | University of Maryland-Baltimore (0.293), Florida Atlantic University (0.282), University of Tennessee-Knoxville (0.252), University of North Carolina-Greensboro (0.089), University of Alabama-Tuscaloosa (0.070), University of Georgia (0.013) |
| Queen's University Belfast | University of North Carolina-Greensboro (0.588), University of California-Santa Barbara (0.227), University of Maryland-Baltimore (0.095), University of Texas-Dallas (0.043), Purdue University (0.036), Florida Atlantic University (0.010) |
| Robert Gordon University | Middlebury College (0.516), Claremont McKenna College (0.433), University of North Carolina-Greensboro (0.033), Williams College (0.018) |
| Royal Holloway, University of London | University of California-Santa Cruz (0.533), Florida Atlantic University (0.215), University of California-Santa Barbara (0.137), City University of New York (0.078), University of Texas-Dallas (0.029), Georgia State University (0.009) |
| Sheffield Hallam University | Brandeis University (0.437), University of Maryland-Baltimore (0.301), Baylor University (0.177), West Virginia University (0.085) |
| Staffordshire University | Claremont McKenna College (0.786), Williams College (0.214) |
| Swansea University | Fordham University (0.622), Appalachian State University (0.205), University of Texas-Dallas (0.102), University of Maryland-Baltimore (0.041), West Virginia University (0.030) |
| University College London | University of Chicago (0.315), Rice University (0.273), City University of New York (0.273), Fordham University (0.093), University of California-Santa Barbara (0.046) |
| University of Aberdeen | Brigham Young University (0.350), State University of New York-Albany (0.258), Stony Brook University (0.140), Washington University in St. Louis (0.091), Fordham University (0.070), University of Iowa (0.060), University of Minnesota (0.030) |
| University of Bath | Florida Atlantic University (0.488), University of Georgia (0.284), University of Alabama-Tuscaloosa (0.210), University of Michigan (0.010), West Virginia University (0.008) |
| University of Bedfordshire | Claremont McKenna College (0.702), Middlebury College (0.298) |
| University of Birmingham | Stanford Uni (0.237), Rensselaer Polytechnic Institute (0.196), Uni of California-Santa Cruz (0.186), Uni of Colorado at Denver (0.180), Uni of Rochester (0.116), Georgia State Uni (0.050), Temple Uni (0.034) |
| University of Bradford | University of Tennessee-Knoxville (0.473), Fordham University (0.204), Baylor University (0.152), University of Maryland-Baltimore (0.086), Claremont McKenna College (0.085) |
| University of Brighton | Williams College (0.596), University of Maryland-Baltimore (0.388), Florida Atlantic University (0.016) |
| University of Bristol | West Virginia University (0.393), University of Delaware (0.231), Brandeis University (0.170), Iowa State University (0.123), Syracuse University (0.053), Boston College (0.031) |
| University of Cambridge | University of California-Santa Barbara (0.433), Harvard University (0.261), Rensselaer Polytechnic Institute (0.150), MIT (0.069), Georgia State University (0.045), University of California-Los Angeles (0.042) |
| University of Central Lancashire | Claremont McKenna College (0.521), University of Maryland-Baltimore (0.433), Appalachian State University (0.045) |
| University of Dundee | West Virginia University (0.493), Middlebury College (0.353), University of Maryland-Baltimore (0.152) |
| University of Durham | University of Tennessee-Knoxville (0.533), University of Alabama-Tuscaloosa (0.237), Fordham University (0.117), Baylor University (0.059), University of Maryland-Baltimore (0.054) |
| University of East Anglia | Appalachian State University (0.337), Syracuse University (0.255), University of North Carolina-Greensboro (0.155), Oklahoma State University (0.132), University of Texas-Dallas (0.061), Iowa State University (0.046), University of Rochester (0.013) |
| University of East London | Claremont McKenna College (0.674), Middlebury College (0.315), University of Maryland-Baltimore (0.011) |
| University of Edinburgh | Claremont McKenna College (0.323), University of Texas-Dallas (0.294), Georgia State University (0.225), University of California-Santa Barbara (0.108), MIT (0.050) |
| University of Essex | University of Maryland-Baltimore (0.288), Georgia Institute of Technology (0.181), Oklahoma State University (0.164), University of Wyoming (0.158), University of Rochester (0.077), University of California-Santa Barbara (0.070), Iowa State University (0.056), University of Massachusetts-Amherst (0.006) |
| University of Exeter | University of Maryland-Baltimore (0.263), University of Delaware (0.250), University of California-Riverside (0.163), Arizona State University (0.157), Baylor University (0.115), University of Iowa (0.039), North Carolina State University (0.014) |
| University of Glasgow | University of Maryland-Baltimore (0.322), University of Massachusetts-Amherst (0.257), Iowa State University (0.169), University of North Carolina-Greensboro (0.100), George Washington University (0.086), Oklahoma State University (0.038), University of Tennessee-Knoxville (0.025) |
| University of Greenwich | Claremont McKenna College (0.747), University of North Carolina-Greensboro (0.126), Appalachian State University (0.069), University of Maryland-Baltimore (0.059) |
| University of Hertfordshire | Claremont McKenna College (0.737), University of Maryland-Baltimore (0.232), Baylor University (0.017), Fordham University (0.014) |
| University of Hull | University of Maryland-Baltimore (0.428), Oklahoma State University (0.375), Florida Atlantic University (0.193) |
| University of Kent | University of California-Santa Cruz (0.483), Florida Atlantic University (0.214), University of California-Santa Barbara (0.148), University of Texas-Dallas (0.134), University of Maryland-Baltimore (0.021) |
| University of Leeds | University of North Carolina-Greensboro (0.290), University of Georgia (0.264), University of Florida (0.226), University of Texas-Dallas (0.210), Arizona State University (0.010) |

| Treated (Table continued) | Synthetic control composition |
|--|--|
| University of Leicester | University of North Carolina-Greensboro (0.364), Williams College (0.225), Dartmouth College (0.195), Boston College (0.095), Harvard University (0.066), Rensselaer Polytechnic Institute (0.055) |
| University of Liverpool | University of California-Santa Cruz (0.405), College of William & Mary (0.290), University of Texas-Dallas (0.171), Claremont McKenna College (0.068), City University of New York (0.066) |
| University of Manchester | Pennsylvania State University (0.565), Texas A&M University (0.205), Purdue University (0.165), Northwestern University (0.064) |
| University of Northumbria at Newcastle | Middlebury College (0.691), Baylor University (0.174), Brandeis University (0.135) |
| University of Nottingham | Texas A&M University (0.739), Florida Atlantic University (0.124), Syracuse University (0.066), Columbia University (0.048), City University of New York (0.023) |
| University of Oxford | Harvard University (0.477), University of Chicago (0.231), Georgia State University (0.141), City University of New York (0.119), Stanford University (0.032) |
| University of Plymouth | University of Maryland-Baltimore (0.460), University of Nevada-Reno (0.377), Claremont McKenna College (0.074), University of Alabama-Tuscaloosa (0.061), Baylor University (0.028) |
| University of Portsmouth | University of North Carolina-Greensboro (0.586), Florida Atlantic University (0.193), University of California-Santa Barbara (0.110), Stony Brook University (0.100), University of Maryland-Baltimore (0.011) |
| University of Reading | Florida Atlantic University (0.298), Oklahoma State University (0.286), University of Florida (0.225), Syracuse University (0.190) |
| University of Salford | University of Maryland-Baltimore (0.552), Stony Brook University - SUNY (0.181), University of Chicago (0.102), Oklahoma State University (0.088), University of Texas-Dallas (0.077) |
| University of Sheffield | Oklahoma State University (0.547), University of Georgia (0.453) |
| University of Southampton | University of Maryland-Baltimore (0.625), Iowa State University (0.208), University of California-Berkeley (0.157), University of Illinois at Urbana-Champaign (0.011) |
| University of South Wales | Claremont McKenna College (0.289), University of Maryland-Baltimore (0.243), Stony Brook University (0.184), Brandeis University (0.177), Middlebury College (0.078), Fordham University (0.029) |
| University of St Andrews | University of Maryland-Baltimore (0.521), Colorado State University (0.135), Baylor University (0.125), California Institute of Technology (0.115), University of Texas-Dallas (0.074), Stony Brook University (0.030) |
| University of Stirling | University of California-Santa Barbara (0.391), University of North Carolina-Greensboro (0.361), Florida Atlantic University (0.229), City University of New York (0.009), University of Texas-Dallas (0.007) |
| University of Strathclyde | University of California-Santa Barbara (0.399), University of Virginia (0.357), University of California-Los Angeles (0.160), University of Minnesota (0.030), University of Pittsburgh (0.023), Stanford University (0.019), University of Illinois at Urbana-Champaign (0.011) |
| University of Sunderland | Claremont McKenna College (0.834), Middlebury College (0.166) |
| University of Surrey | Temple University (0.485), Syracuse University (0.245), West Virginia University (0.189), University of North Carolina-Greensboro (0.080) |
| University of Sussex | Fordham University (0.555), University of Texas-Dallas (0.259), University of Maryland-Baltimore (0.098), Iowa State University (0.049), Appalachian State University (0.026), University of Rochester (0.016) |
| University of the West of England, Bristol | Appalachian State University (0.311), University of Maryland-Baltimore (0.308), Florida Atlantic University (0.216), University of California-Santa Barbara (0.097), Oklahoma State University (0.069) |
| University of Ulster | Virginia Commonwealth University (0.434), Middlebury College (0.278), Boston College (0.144), Baylor University (0.054), Harvard University (0.033), Syracuse University (0.032), Florida Atlantic University (0.025) |
| University of Warwick | Pennsylvania State University (0.297), Yale University (0.257), Purdue University (0.231), University of Georgia (0.120), Florida State University (0.058), University of Chicago (0.037) |
| University of Westminster | University of Maryland-Baltimore (0.426), Middlebury College (0.248), Appalachian State University (0.183), University of North Carolina-Greensboro (0.105), Florida Atlantic University (0.038) |
| University of Wolverhampton | Middlebury College (0.535), Appalachian State University (0.304), University of Maryland-Baltimore (0.081), Williams College (0.080) |
| University of York | Dartmouth College (0.643), Princeton University (0.287), Boston College (0.059), University of North Carolina-Greensboro (0.011) |

Notes. This table provides the Synthetic control method (SCM) estimated coefficients (weights) for the Number of Publications in each UK university. The results for all other variables are available upon request.