Appendix A. Results of Monte Carlo Experiment

Table A1. RMSE of Direct Impacts Without OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | OLS | | SLX | | SAR | | SEM | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0321 | 0.0350\* | 0.0322 | 0.0350 | 0.0321 | 0.0351 | 0.0321 | 0.0350 | 0.0323 | 0.0353 | 0.0321\* | 0.0351 | 0.0322 | 0.0350 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.0348 | 0.0376 | 0.0346 | 0.0373 | 0.0337\* | 0.0365\* | 0.0361 | 0.0514 | 0.0339 | 0.0375 | 0.0346 | 0.0374 | 0.0341 | 0.0369 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0308\* | 0.0281\* | 0.0325 | 0.0363 | 0.0308 | 0.0304 | 0.0308 | 0.0282 | 0.0310 | 0.0354 | 0.0326 | 0.0363 | 0.0325 | 0.0363 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0433 | 0.1459 | 0.0325 | 0.0353 | 0.0322\* | 0.0313\* | 0.0335 | 0.0471 | 0.0323 | 0.0338 | 0.0326 | 0.0347 | 0.0325 | 0.0348 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.0345 | 0.0372 | 0.0346 | 0.0373 | 0.0346 | 0.0427 | 0.0317\* | 0.0346\* | 0.0325 | 0.0373 | 0.0346 | 0.0372 | 0.0341 | 0.0370 |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.0432 | 0.0456 | 0.0433 | 0.0455 | 0.0421 | 0.0663 | 0.0377 | 0.0623 | 0.0348\* | 0.0436 | 0.0433 | 0.0470 | 0.0380 | 0.0416\* |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.0368 | 0.0379 | 0.0324 | 0.0352 | 0.0336 | 0.0655 | 0.0323\* | 0.0334\* | 0.0325 | 0.0344 | 0.0326 | 0.0348 | 0.0325 | 0.0347 |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.0570 | 0.1547 | 0.0360 | 0.0363 | 0.0367 | 0.0513 | 0.0360 | 0.0392 | 0.0341\* | 0.0351\* | 0.0366 | 0.0352 | 0.0350 | 0.0353 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0334 | 0.0372 | 0.0322 | 0.0350\* | 0.0333 | 0.0411 | 0.0336 | 0.0463 | 0.0317\* | 0.0504 | 0.0323 | 0.0350 | 0.0322 | 0.0350 |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0388 | 0.0441 | 0.0348 | 0.0377 | 0.0363 | 0.0875 | 0.0517 | 0.2033 | 0.0361 | 0.0422 | 0.0347 | 0.0373\* | 0.0344\* | 0.0402 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0375 | 0.2843 | 0.0325 | 0.0363 | 0.0313 | 0.1256 | 0.0347 | 0.1820 | 0.0303\* | 0.1016 | 0.0325 | 0.0363\* | 0.0325 | 0.0363 |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0684 | 0.5806 | 0.0329 | 0.0397 | 0.0341 | 0.0861 | 0.0507 | 0.1096 | 0.0320\* | 0.1068 | 0.0326 | 0.0347\* | 0.0328 | 0.0360 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.0357 | 0.0393 | 0.0346 | 0.0373 | 0.0345 | 0.0478 | 0.0351 | 0.1047 | 0.0352 | 0.0390 | 0.0349 | 0.0379 | 0.0341\* | 0.0370\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.0466 | 0.0510 | 0.0434 | 0.0458\* | 0.0396 | 0.0749 | 0.0555 | 0.2369 | 0.0390 | 0.0853 | 0.0440 | 0.0537 | 0.0388\* | 0.0583 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.0428 | 0.2866 | 0.0324\* | 0.0352 | 0.0325 | 0.0644 | 0.0347 | 0.0482 | 0.0327 | 0.0568 | 0.0327 | 0.0349 | 0.0325 | 0.0347\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.0781 | 0.5844 | 0.0364 | 0.0404 | 0.0375 | 0.0533 | 0.0512 | 0.1381 | 0.0375 | 0.0532 | 0.0372 | 0.0356\* | 0.0355\* | 0.0370 |
| Average | | | | 0.0434 | 0.1518 | 0.0348 | 0.0379 | 0.0347 | 0.0587 | 0.0386 | 0.0875 | 0.0336\* | 0.0517 | 0.0350 | 0.0377\* | 0.0340 | 0.0379 |
|  | | | | 0.0976 | | 0.0363 | | 0.0467 | | 0.0631 | | 0.0427 | | 0.0363 | | 0.0359\* | |

\* Lowest RMSE for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A2. RMSE of Indirect Impacts Without OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | SLX | | SAR | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0903 | 0.0929 | 0.0121\* | 0.0302\* | 0.0366 | 0.0914 | 0.0909 | 0.0927 | 0.0907 | 0.0928 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.1371 | 0.1807 | 0.0449\* | 0.0843\* | 0.0876 | 0.2049 | 0.1766 | 0.1796 | 0.1302 | 0.2053 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0745 | 0.0610 | 0.0113\* | 0.0280\* | 0.0240 | 0.0587 | 0.0748 | 0.0610 | 0.0748 | 0.0609 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.1143 | 0.1090 | 0.0406\* | 0.0644\* | 0.0572 | 0.1091 | 0.1368 | 0.0988 | 0.1098 | 0.1315 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.1292 | 0.1307 | 0.1728 | 0.4297 | 0.0570\* | 0.1415 | 0.1754 | 0.1789 | 0.1136 | 0.1165\* |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.2150 | 0.2402\* | 0.5339 | 1.3185 | 0.1666 | 0.4097 | 0.4925 | 0.6443 | 0.1535\* | 0.2453 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.1082 | 0.0838 | 0.1377 | 0.3076 | 0.0317\* | 0.0760\* | 0.1363 | 0.0980 | 0.0968 | 0.0773 |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.1837 | 0.1526\* | 0.3835 | 0.8000 | 0.0882\* | 0.1904 | 0.3674 | 0.3380 | 0.1374 | 0.1802 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0903 | 0.0929 | 0.0467\* | 0.6617 | 0.1640 | 0.1566 | 0.0909 | 0.0953 | 0.0907 | 0.0928\* |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.1648 | 0.5762 | 0.0820\* | 1.1564 | 0.3560 | 0.3315 | 0.1781 | 0.1999\* | 0.1771 | 0.7493 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0745 | 0.0610 | 0.0341\* | 0.4238 | 0.1511 | 0.0726 | 0.0749 | 0.0618 | 0.0748 | 0.0609\* |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.1373\* | 0.3220 | 0.1817 | 0.3776 | 0.3614 | 0.3485 | 0.1381 | 0.1104\* | 0.1500 | 0.4798 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.1292 | 0.1307 | 0.1388 | 0.2855 | 0.2987 | 0.2354 | 0.1831 | 0.4253 | 0.1136\* | 0.1165\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.2328 | 0.5913 | 0.5372 | 0.3217\* | 0.4937 | 0.4227 | 0.5462 | 1.6884 | 0.2103\* | 0.8949 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.1082 | 0.0838 | 0.1610 | 0.1220 | 0.2438 | 0.1807 | 0.1404 | 0.2072 | 0.0968\* | 0.0773\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.1983 | 0.3353\* | 0.5526 | 0.6058 | 0.5483 | 0.6037 | 0.3837 | 0.8393 | 0.1870\* | 0.6627 |
| Average | | | | 0.1367 | 0.2028\* | 0.1919 | 0.4386 | 0.1979 | 0.2271 | 0.2116 | 0.3324 | 0.1254\* | 0.2652 |
|  | | | | 0.1697\* | | 0.3153 | | 0.2125 | | 0.2720 | | 0.1953 | |

\* Lowest RMSE for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A3. RMSE of Direct Impacts with OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | OLS | | SLX | | SAR | | SEM | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.3011 | 0.0350\* | 0.3010\* | 0.0350 | 0.3014 | 0.0350 | 0.3011 | 0.0350 | 0.3021 | 0.0354 | 0.3010 | 0.0352 | 0.3010 | 0.0350 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.3148 | 0.0379 | 0.3152 | 0.0373 | 0.3152 | 0.0366\* | 0.2736\* | 0.0520 | 0.3162 | 0.0374 | 0.3154 | 0.0374 | 0.3112 | 0.0369 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.3014 | 0.0281\* | 0.3007 | 0.0363 | 0.3015 | 0.0301 | 0.3014 | 0.0282 | 0.3014 | 0.0330 | 0.3007\* | 0.0364 | 0.3007 | 0.0363 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.3668 | 0.1462 | 0.3137 | 0.0353 | 0.3153 | 0.0311\* | 0.2951\* | 0.0451 | 0.3156 | 0.0326 | 0.3147 | 0.0348 | 0.3137 | 0.0348 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.3151 | 0.0373 | 0.3153 | 0.0373 | 0.3213 | 0.0424 | 0.2906\* | 0.0347\* | 0.3056 | 0.0391 | 0.3154 | 0.0374 | 0.3128 | 0.0370 |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.3499 | 0.0466 | 0.3504 | 0.0456 | 0.3655 | 0.0655 | 0.2453\* | 0.0627 | 0.3301 | 0.0474 | 0.3583 | 0.0469 | 0.3226 | 0.0416\* |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.3464 | 0.0384 | 0.3141 | 0.0352 | 0.3121 | 0.0651 | 0.3067\* | 0.0336\* | 0.3130 | 0.0355 | 0.3147 | 0.0347 | 0.3141 | 0.0347 |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.4507 | 0.1559 | 0.3466 | 0.0363 | 0.3527 | 0.0511 | 0.2680\* | 0.0405 | 0.3345 | 0.0352\* | 0.3531 | 0.0353 | 0.3318 | 0.0353 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.3009 | 0.0372 | 0.3010 | 0.0350\* | 0.3018 | 0.0408 | 0.2975 | 0.0463 | 0.2884\* | 0.0505 | 0.3009 | 0.0351 | 0.3010 | 0.0350 |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.3149 | 0.0445 | 0.3152 | 0.0377 | 0.3184 | 0.0876 | 0.2464\* | 0.2050 | 0.3297 | 0.0449 | 0.3155 | 0.0373\* | 0.3094 | 0.0403 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.3159 | 0.2843 | 0.3007 | 0.0363 | 0.2929 | 0.1314 | 0.3051 | 0.1820 | 0.2472\* | 0.1203 | 0.3007 | 0.0363\* | 0.3007 | 0.0363 |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.3896 | 0.5807 | 0.3135 | 0.0397 | 0.3195 | 0.0902 | 0.2530\* | 0.1114 | 0.3018 | 0.1151 | 0.3147 | 0.0347\* | 0.3131 | 0.0360 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.3149 | 0.0395 | 0.3153 | 0.0373 | 0.3210 | 0.0478 | 0.2762\* | 0.1057 | 0.3262 | 0.0405 | 0.3158 | 0.0380 | 0.3128 | 0.0370\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.3499 | 0.0522 | 0.3505 | 0.0459\* | 0.3641 | 0.0754 | 0.2205\* | 0.2382 | 0.3588 | 0.0870 | 0.3593 | 0.0534 | 0.3181 | 0.0584 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.3609 | 0.2867 | 0.3141 | 0.0352 | 0.3128 | 0.0669 | 0.2900\* | 0.0463 | 0.3055 | 0.0633 | 0.3147 | 0.0349 | 0.3141 | 0.0347\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.4732 | 0.5848 | 0.3464 | 0.0404 | 0.3603 | 0.0545 | 0.2388\* | 0.1409 | 0.3603 | 0.0535 | 0.3523 | 0.0356\* | 0.3283 | 0.0372 |
| Average | | | | 0.3479 | 0.1522 | 0.3196 | 0.0379 | 0.3235 | 0.0595 | 0.2756\* | 0.0880 | 0.3148 | 0.0544 | 0.3217 | 0.0377\* | 0.3128 | 0.0379 |
|  | | | | 0.2501 | | 0.1787 | | 0.1915 | | 0.1818 | | 0.1846 | | 0.1797 | | 0.1754\* | |

\* Lowest RMSE for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A4. RMSE of Indirect Impacts with OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | SLX | | SAR | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0903 | 0.0929 | 0.0288\* | 0.0290\* | 0.0690 | 0.0693 | 0.0907 | 0.0927 | 0.0907 | 0.0928 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.2049 | 0.1807 | 0.3058 | 0.0818\* | 0.3601 | 0.1662 | 0.3477 | 0.1797 | 0.1629\* | 0.2053 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0745 | 0.0610 | 0.0265\* | 0.0266\* | 0.0486 | 0.0482 | 0.0747 | 0.0611 | 0.0748 | 0.0609 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.2153 | 0.1091 | 0.2993 | 0.0615\* | 0.3197 | 0.0945 | 0.3266 | 0.0988 | 0.1764\* | 0.1315 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.2492 | 0.1307 | 0.4181 | 0.4194 | 0.1948\* | 0.1961 | 0.3467 | 0.1791 | 0.2189 | 0.1164\* |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.5124 | 0.2405\* | 1.5642 | 1.2857 | 0.7623 | 0.5244 | 1.5075 | 0.6378 | 0.2954\* | 0.2454 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.2529 | 0.0839 | 0.3516 | 0.3032 | 0.1300\* | 0.1194 | 0.3261 | 0.0983 | 0.2270 | 0.0773\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.5703 | 0.1533\* | 1.2656 | 0.7828 | 0.5845 | 0.2854 | 1.3652 | 0.3336 | 0.3490\* | 0.1807 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0903 | 0.0929 | 0.0562\* | 0.6666 | 0.4080 | 0.2711 | 0.0910 | 0.0954 | 0.0907 | 0.0928\* |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.1685 | 0.5761 | 0.5023 | 1.1710 | 1.1624 | 0.4710 | 0.3491 | 0.1994\* | 0.1234\* | 0.7496 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0745\* | 0.0610 | 0.1867 | 0.4442 | 0.4065 | 0.1267 | 0.0750 | 0.0618 | 0.0748 | 0.0609\* |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.1833 | 0.3220 | 0.8884 | 0.4307 | 1.2033 | 0.2167 | 0.3272 | 0.1098\* | 0.1325\* | 0.4804 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.2492 | 0.1307 | 0.4806 | 0.2946 | 0.7523 | 0.1748 | 0.3824 | 0.4252 | 0.2189\* | 0.1164\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.4647 | 0.5912 | 1.8671 | 0.3076\* | 1.7147 | 0.4123 | 1.5691 | 1.6597 | 0.2219\* | 0.8959 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.2529 | 0.0839 | 0.5336 | 0.1372 | 0.6841 | 0.1186 | 0.3490 | 0.2067 | 0.2270\* | 0.0773\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.5318 | 0.3355\* | 1.8952 | 0.5415 | 1.8538 | 0.5077 | 1.3240 | 0.8206 | 0.2762\* | 0.6655 |
| Average | | | | 0.2616 | 0.2028\* | 0.6669 | 0.4365 | 0.6659 | 0.2376 | 0.5533 | 0.3287 | 0.1850\* | 0.2656 |
|  | | | | 0.2322 | | 0.5517 | | 0.4518 | | 0.4410 | | 0.2253\* | |

\* Lowest RMSE for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A5. Bias of Direct Impacts Without OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | OLS | | SLX | | SAR | | SEM | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | -0.0006 | 0.0027 | -0.0007 | 0.0027 | -0.0004 | 0.0030 | -0.0007 | 0.0028 | -0.0000\* | 0.0045 | -0.0007 | 0.0026\* | -0.0007 | 0.0027 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | -0.0003 | 0.0029 | -0.0002 | 0.0031 | -0.0005 | 0.0031 | -0.0172 | -0.0378 | -0.0001\* | 0.0045 | -0.0001 | 0.0033 | -0.0019 | -0.0009\* |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | -0.0002 | 0.0029 | -0.0011 | 0.0021 | -0.0001\* | 0.0031 | -0.0002 | 0.0029 | -0.0002 | 0.0028 | -0.0011 | 0.0021\* | -0.0011 | 0.0022 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0209 | 0.1401 | -0.0010 | -0.0021\* | 0.0000\* | 0.0035 | -0.0080 | 0.0301 | 0.0001 | 0.0042 | -0.0006 | 0.0023 | -0.0010 | 0.0035 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.0001\* | 0.0034 | -0.0001 | 0.0034 | 0.0073 | 0.0223 | -0.0011 | 0.0023\* | 0.0009 | 0.0075 | -0.0002 | 0.0033 | -0.0003 | 0.0031 |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.0007 | 0.0041\* | 0.0007\* | 0.0044 | 0.0192 | 0.0524 | -0.0232 | -0.0530 | 0.0024 | 0.0112 | 0.0033 | 0.0106 | -0.0044 | -0.0072 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.0006 | 0.0040 | -0.0006 | 0.0023\* | -0.0060 | -0.0570 | -0.0008 | 0.0029 | -0.0002\* | 0.0026 | -0.0006 | 0.0025 | -0.0006 | 0.0025 |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.0222 | 0.1422 | -0.0003\* | -0.0018 | 0.0035 | -0.0376 | -0.0176 | -0.0168 | 0.0003 | 0.0046 | 0.0011 | 0.0037 | -0.0028 | 0.0004\* |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | -0.0010 | 0.0020\* | -0.0007 | 0.0027 | -0.0025 | -0.0182 | -0.0044 | -0.0229 | -0.0032 | 0.0363 | -0.0006\* | 0.0026 | -0.0007 | 0.0027 |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | -0.0007 | 0.0015\* | -0.0002 | 0.0024 | -0.0068 | -0.0781 | -0.0400 | -0.1998 | 0.0039 | -0.0071 | -0.0001\* | 0.0034 | -0.0036 | -0.0144 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0140 | 0.2816 | -0.0011 | 0.0021 | -0.0003\* | 0.1214 | 0.0032 | 0.1737 | -0.0137 | 0.0976 | -0.0011 | 0.0019\* | -0.0011 | 0.0022 |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0420 | 0.5754 | -0.0012 | -0.0164 | 0.0004\* | 0.0794 | -0.0366 | -0.1011 | -0.0005 | 0.1023 | -0.0005 | 0.0023\* | -0.0014 | 0.0067 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | -0.0003 | 0.0026\* | -0.0001\* | 0.0034 | 0.0033 | -0.0298 | -0.0138 | -0.0981 | 0.0058 | -0.0032 | 0.0003 | 0.0070 | -0.0003 | 0.0031 |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.0003\* | 0.0027\* | 0.0007 | 0.0036 | 0.0092 | -0.0617 | -0.0464 | -0.2344 | 0.0075 | -0.0718 | 0.0049 | 0.0280 | -0.0086 | -0.0410 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.0148 | 0.2828 | -0.0006 | 0.0023\* | -0.0016 | 0.0562 | -0.0087 | 0.0237 | -0.0061 | 0.0478 | -0.0006\* | 0.0041 | -0.0006 | 0.0025 |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.0432 | 0.5776 | -0.0006\* | -0.0160 | 0.0061 | 0.0405 | -0.0394 | -0.1326 | 0.0065 | 0.0402 | 0.0014 | 0.0047\* | -0.0056 | -0.0085 |
| Average (absolute bias) | | | | 0.0101 | 0.1268 | 0.0006\* | 0.0044\* | 0.0042 | 0.0417 | 0.0163 | 0.0709 | 0.0032 | 0.0280 | 0.0011 | 0.0053 | 0.0022 | 0.0065 |
|  | | | | 0.0684 | | 0.0025\* | | 0.0230 | | 0.0436 | | 0.0156 | | 0.0032 | | 0.0043 | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A6. Bias of Indirect Impacts without OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | SLX | | SAR | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0064 | 0.0060 | 0.0013\* | 0.0030\* | 0.0105 | 0.0264 | 0.0067 | 0.0058 | 0.0065 | 0.0058 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | -0.0457 | -0.1252 | 0.0030\* | 0.0110\* | 0.0175 | 0.0474 | 0.0120 | 0.0138 | -0.0637 | -0.1689 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0055 | 0.0022 | 0.0006\* | 0.0008\* | 0.0043 | 0.0078 | 0.0057 | 0.0023 | 0.0055 | 0.0021 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | -0.0358 | -0.0696 | 0.0016\* | 0.0051\* | 0.0073 | 0.0159 | 0.0098 | 0.0059 | -0.0514 | -0.1060 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.0086 | 0.0108 | 0.1679 | 0.4225 | 0.0243 | 0.0613 | 0.0127 | 0.0130 | 0.0068\* | 0.0076\* |
| 0.5 | 0, 0 | 0.5 | 0, 0 | -0.0421\* | -0.1169\* | 0.5107 | 1.2887 | 0.0857 | 0.2210 | 0.1971 | 0.4513 | -0.0786 | -0.2038 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.0070 | 0.0053 | 0.1335 | 0.3030 | 0.0104 | 0.0233 | 0.0102 | 0.0059 | 0.0067\* | 0.0044\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | -0.0331 | -0.0641 | 0.3629 | 0.7805 | 0.0256\* | 0.0600\* | 0.1546 | 0.2556 | -0.0672 | -0.1484 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0064\* | 0.0060 | -0.0427 | -0.6605 | 0.1543 | -0.1062 | 0.0065 | 0.0068 | 0.0065 | 0.0058\* |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | -0.0995 | -0.5606 | -0.0322 | -1.1496 | 0.3229 | -0.1349 | 0.0119\* | 0.0165\* | -0.1349 | -0.7393 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0055\* | 0.0022 | 0.0223 | -0.4209 | 0.1448 | -0.0178 | 0.0056 | 0.0025 | 0.0055 | 0.0021\* |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | -0.0777 | -0.3093 | 0.1544 | -0.3544 | 0.3395 | 0.2994 | 0.0096\* | 0.0057\* | -0.1110 | -0.4720 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.0086 | 0.0108 | 0.1286 | -0.2720 | 0.2828 | 0.1264 | 0.0570 | 0.3836 | 0.0068\* | 0.0076\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | -0.0958\* | -0.5523 | 0.5008 | 0.0649\* | 0.4480 | -0.0739 | 0.3238 | 1.6066 | -0.1637 | -0.8841 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.0070 | 0.0053 | 0.1526 | -0.0948 | 0.2333 | 0.1365 | 0.0413 | 0.1804 | 0.0067\* | 0.0044\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | -0.0750\* | -0.3038\* | 0.5222 | 0.5486 | 0.5172 | 0.5282 | 0.2208 | 0.7967 | -0.1425 | -0.6537 |
| Average (absolute bias) | | | | 0.0350\* | 0.1344 | 0.1711 | 0.3988 | 0.1643 | 0.1179\* | 0.0678 | 0.2345 | 0.0540 | 0.2135 |
|  | | | | 0.0847\* | | 0.2849 | | 0.1411 | | 0.1512 | | 0.1338 | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A7. Bias of Direct Impacts with OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | OLS | | SLX | | SAR | | SEM | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.2994 | 0.0027 | 0.2993\* | 0.0027 | 0.2997 | 0.0030 | 0.2993 | 0.0028 | 0.3004 | 0.0040 | 0.2993 | 0.0027\* | 0.2993 | 0.0027 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.3128 | 0.0029 | 0.3133 | 0.0032 | 0.3133 | 0.0032 | 0.2718\* | -0.0384 | 0.3143 | 0.0043 | 0.3135 | 0.0034 | 0.3093 | -0.0009\* |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.2998 | 0.0029 | 0.2989 | 0.0021\* | 0.2999 | 0.0030 | 0.2998 | 0.0029 | 0.2998 | 0.0026 | 0.2989\* | 0.0022 | 0.2989 | 0.0022 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.3647 | 0.1401 | 0.3120 | -0.0021\* | 0.3137 | 0.0034 | 0.2933\* | 0.0267 | 0.3139 | 0.0036 | 0.3130 | 0.0024 | 0.3120 | 0.0035 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.3132 | 0.0033 | 0.3134 | 0.0034 | 0.3195 | 0.0217 | 0.2889\* | 0.0022\* | 0.3036 | 0.0145 | 0.3135 | 0.0033 | 0.3109 | 0.0031 |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.3469 | 0.0041\* | 0.3477 | 0.0045 | 0.3635 | 0.0514 | 0.2435\* | -0.0534 | 0.3277 | 0.0255 | 0.3557 | 0.0105 | 0.3204 | -0.0072 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.3443 | 0.0041 | 0.3124 | 0.0023\* | 0.3104 | -0.0566 | 0.3050\* | 0.0028 | 0.3112 | -0.0064 | 0.3130 | 0.0025 | 0.3124 | 0.0025 |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.4470 | 0.1423 | 0.3447 | -0.0017 | 0.3508 | -0.0373 | 0.2661\* | -0.0194 | 0.3325 | 0.0012 | 0.3512 | 0.0036 | 0.3299 | 0.0004\* |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.2990 | 0.0020\* | 0.2993 | 0.0027 | 0.2999 | -0.0177 | 0.2956 | -0.0229 | 0.2865\* | 0.0354 | 0.2992 | 0.0027 | 0.2993 | 0.0027 |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.3124 | 0.0015\* | 0.3133 | 0.0024 | 0.3164 | -0.0782 | 0.2442\* | -0.2015 | 0.3277 | -0.0150 | 0.3135 | 0.0034 | 0.3075 | -0.0145 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.3140 | 0.2816 | 0.2989 | 0.0021 | 0.2912 | 0.1274 | 0.3032 | 0.1737 | 0.2454\* | 0.1169 | 0.2990 | 0.0019\* | 0.2989 | 0.0022 |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.3857 | 0.5754 | 0.3117 | -0.0163 | 0.3177 | 0.0838 | 0.2505\* | -0.1030 | 0.3000 | 0.1109 | 0.3131 | 0.0022\* | 0.3114 | 0.0067 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.3128 | 0.0026\* | 0.3134 | 0.0034 | 0.3191 | -0.0299 | 0.2743\* | -0.0991 | 0.3244 | -0.0094 | 0.3139 | 0.0070 | 0.3109 | 0.0031 |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.3465 | 0.0027\* | 0.3477 | 0.0037 | 0.3620 | -0.0624 | 0.2184\* | -0.2358 | 0.3566 | -0.0739 | 0.3566 | 0.0274 | 0.3158 | -0.0412 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.3585 | 0.2828 | 0.3124 | 0.0023\* | 0.3112 | 0.0591 | 0.2881\* | 0.0200 | 0.3038 | 0.0554 | 0.3130 | 0.0040 | 0.3124 | 0.0025 |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.4680 | 0.5776 | 0.3445 | -0.0159 | 0.3584 | 0.0421 | 0.2365\* | -0.1355 | 0.3584 | 0.0404 | 0.3504 | 0.0047\* | 0.3264 | -0.0089 |
| Average (absolute bias) | | | | 0.3453 | 0.1268 | 0.3177 | 0.0044\* | 0.3217 | 0.0425 | 0.2736\* | 0.0713 | 0.3129 | 0.0325 | 0.3198 | 0.0052 | 0.3110 | 0.0065 |
|  | | | | 0.2361 | | 0.1611 | | 0.1821 | | 0.1724 | | 0.1727 | | 0.1625 | | 0.1588\* | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table A8. Bias of Indirect Impacts with OMV. , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | SLX | | SAR | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0064 | 0.0060 | 0.0032\* | 0.0031\* | 0.0176 | 0.0177 | 0.0067 | 0.0059 | 0.0065 | 0.0058 |
| 0.5 | 0, 0 | 0.0 | 0, 0 | 0.1588 | -0.1251 | 0.2947 | 0.0113\* | 0.3220 | 0.0388 | 0.2989 | 0.0143 | 0.1165\* | -0.1689 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0055 | 0.0022 | 0.0018\* | 0.0011\* | 0.0083 | 0.0064 | 0.0057 | 0.0021 | 0.0055 | 0.0021 |
| 0.5 | 0.4, 0.7 | 0.0 | 0, 0 | 0.1858 | -0.0696 | 0.2910 | 0.0058 | 0.3019 | 0.0143 | 0.2960 | 0.0058\* | 0.1471\* | -0.1060 |
| 0.0 | 0, 0 | 0.5 | 0, 0 | 0.2131 | 0.0109 | 0.4112 | 0.4127 | 0.1437\* | 0.1455 | 0.2985 | 0.0137 | 0.1871 | 0.0077\* |
| 0.5 | 0, 0 | 0.5 | 0, 0 | 0.4664 | -0.1164\* | 1.5406 | 1.2576 | 0.6997 | 0.4293 | 1.4320 | 0.4455 | 0.2638\* | -0.2040 |
| 0.0 | 0.4, 0.7 | 0.5 | 0, 0 | 0.2286 | 0.0053 | 0.3459 | 0.2990 | 0.1003\* | 0.0930 | 0.2961 | 0.0061 | 0.2054 | 0.0045\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0, 0 | 0.5404 | -0.0639\* | 1.2476 | 0.7650 | 0.5493 | 0.2298 | 1.3194 | 0.2504 | 0.3272\* | -0.1488 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.0064\* | 0.0060 | 0.0396 | -0.6655 | 0.3985 | -0.2498 | 0.0066 | 0.0068 | 0.0065 | 0.0058\* |
| 0.5 | 0, 0 | 0.0 | 0.1, 0.8 | 0.1050 | -0.5605 | 0.4865 | -1.1647 | 1.1389 | -0.3839 | 0.2992 | 0.0162\* | 0.0445\* | -0.7396 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.0055\* | 0.0022 | 0.1817 | -0.4417 | 0.4020 | -0.1071 | 0.0056 | 0.0024 | 0.0055 | 0.0021\* |
| 0.5 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.1439 | -0.3093 | 0.8781 | -0.4118 | 1.1915 | 0.1341 | 0.2960 | 0.0057\* | 0.0855\* | -0.4725 |
| 0.0 | 0, 0 | 0.5 | 0.1, 0.8 | 0.2131 | 0.0109 | 0.4718 | -0.2825 | 0.7329 | -0.0184 | 0.3400 | 0.3834 | 0.1871\* | 0.0077\* |
| 0.5 | 0, 0 | 0.5 | 0.1, 0.8 | 0.4127 | -0.5518 | 1.8377 | 0.0338\* | 1.6697 | -0.1388 | 1.4996 | 1.5784 | 0.1775\* | -0.8851 |
| 0.0 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.2286 | 0.0053 | 0.5274 | -0.1162 | 0.6751 | 0.0508 | 0.3217 | 0.1799 | 0.2054\* | 0.0045\* |
| 0.5 | 0.4, 0.7 | 0.5 | 0.1, 0.8 | 0.4985 | -0.3036\* | 1.8747 | 0.4823 | 1.8309 | 0.4265 | 1.2818 | 0.7785 | 0.2474\* | -0.6565 |
| Average (absolute bias) | | | | 0.2137 | 0.1343\* | 0.6521 | 0.3971 | 0.6364 | 0.1553 | 0.5002 | 0.2309 | 0.1387\* | 0.2138 |
|  | | | | 0.1740\* | | 0.5246 | | 0.3958 | | 0.3656 | | 0.1763 | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Appendix B. Different Combinations of Autocorrelation

Table B1. Bias of Direct Impacts for Different Strengths of Autocorrelation. , , , .

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | OLS | | SLX | | SAR | | SEM | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.3 | 0.3 | -0.0004 | 0.0022\* | -0.0001\* | 0.0031 | -0.0004 | -0.0518 | -0.0271 | -0.1503 | 0.0050 | -0.0142 | 0.0004 | 0.0068 | -0.0017 | -0.0055 |
| 0.5 | 0.3 | -0.0002 | 0.0021\* | 0.0003 | 0.0030 | -0.0000\* | -0.0741 | -0.0441 | -0.2219 | 0.0055 | -0.0464 | 0.0017 | 0.0119 | -0.0065 | -0.0300 |
| 0.7 | 0.3 | -0.0000\* | 0.0014\* | 0.0007 | 0.0024 | 0.0009 | -0.1104 | -0.0711 | -0.3317 | 0.0012 | -0.1109 | 0.0048 | 0.0245 | -0.0217 | -0.0996 |
| 0.9 | 0.3 | -0.0006\* | -0.0037 | 0.0009 | -0.0027\* | -0.0080 | -0.2325 | -0.1360 | -0.5993 | -0.0270 | -0.3120 | 0.0116 | 0.0494 | -0.0761 | -0.3347 |
| 0.3 | 0.5 | 0.0000\* | 0.0027\* | 0.0003 | 0.0036 | 0.0061 | -0.0465 | -0.0301 | -0.1686 | 0.0088 | -0.0334 | 0.0019 | 0.0152 | -0.0026 | -0.0111 |
| 0.5 | 0.5 | 0.0003\* | 0.0027\* | 0.0007 | 0.0036 | 0.0092 | -0.0617 | -0.0464 | -0.2344 | 0.0075 | -0.0718 | 0.0049 | 0.0280 | -0.0086 | -0.0410 |
| 0.7 | 0.5 | 0.0007 | 0.0024\* | 0.0013 | 0.0034 | 0.0142 | -0.0871 | -0.0725 | -0.3389 | -0.0005\* | -0.1470 | 0.0119 | 0.0578 | -0.0245 | -0.1127 |
| 0.9 | 0.5 | 0.0005\* | -0.0016 | 0.0018 | -0.0006\* | 0.0039 | -0.2090 | -0.1364 | -0.6015 | -0.0356 | -0.3655 | 0.0235 | 0.0998 | -0.0773 | -0.3407 |
| 0.3 | 0.7 | 0.0007\* | 0.0037\* | 0.0009 | 0.0045 | 0.0203 | -0.0256 | -0.0327 | -0.1844 | 0.0166 | -0.0452 | 0.0061 | 0.0381 | -0.0037 | -0.0174 |
| 0.5 | 0.7 | 0.0011\* | 0.0040\* | 0.0015 | 0.0049 | 0.0279 | -0.0290 | -0.0484 | -0.2453 | 0.0129 | -0.0899 | 0.0130 | 0.0680 | -0.0106 | -0.0510 |
| 0.7 | 0.7 | 0.0018 | 0.0043\* | 0.0023 | 0.0054 | 0.0363 | -0.0438 | -0.0737 | -0.3452 | 0.0005\* | -0.1747 | 0.0263 | 0.1230 | -0.0265 | -0.1226 |
| 0.9 | 0.7 | 0.0022\* | 0.0027\* | 0.0033 | 0.0037 | 0.0157 | -0.1861 | -0.1367 | -0.6032 | -0.0422 | -0.4083 | 0.0360 | 0.1528 | -0.0778 | -0.3445 |
| 0.3 | 0.9 | 0.0021\* | 0.0069\* | 0.0021 | 0.0077 | 0.0599 | 0.0492 | -0.0348 | -0.1975 | 0.0430 | -0.0172 | 0.0201 | 0.1160 | -0.0047 | -0.0232 |
| 0.5 | 0.9 | 0.0029\* | 0.0083\* | 0.0030 | 0.0092 | 0.0681 | 0.0507 | -0.0499 | -0.2540 | 0.0346 | -0.0723 | 0.0328 | 0.1660 | -0.0119 | -0.0583 |
| 0.7 | 0.9 | 0.0042\* | 0.0110\* | 0.0044 | 0.0120 | 0.0654 | 0.0152 | -0.0744 | -0.3495 | 0.0148 | -0.1717 | 0.0465 | 0.2142 | -0.0274 | -0.1284 |
| 0.9 | 0.9 | 0.0059\* | 0.0183\* | 0.0065 | 0.0191 | 0.0224 | -0.1736 | -0.1366 | -0.6039 | -0.0409 | -0.4287 | 0.0449 | 0.1814 | -0.0775 | -0.3454 |
| Average (absolute bias) | | 0.0015\* | 0.0049\* | 0.0019 | 0.0056 | 0.0224 | 0.0904 | 0.0719 | 0.3393 | 0.0185 | 0.1568 | 0.0179 | 0.0845 | 0.0287 | 0.1291 |
|  | | 0.0032\* | | 0.0037 | | 0.0564 | | 0.2056 | | 0.0877 | | 0.0512 | | 0.0789 | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Table B2. Bias of Indirect Impacts for Different Strengths of Autocorrelation. , , , .

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | SLX | | SAR | | SAC | | SDM | | SDEM | |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 0.3 | 0.3 | -0.0260\* | -0.1971 | 0.0890 | -0.5762 | 0.2900 | -0.0351\* | 0.0686 | 0.3528 | -0.0420 | -0.2831 |
| 0.5 | 0.3 | -0.0978\* | -0.5567 | 0.1863 | -0.6482 | 0.3776 | -0.1366\* | 0.1374 | 0.6562 | -0.1525 | -0.8284 |
| 0.7 | 0.3 | -0.3245\* | -1.6044 | 0.4664 | -0.6929 | 0.4893 | -0.6352\* | 0.3418 | 1.5363 | -0.4851 | -2.3461 |
| 0.9 | 0.3 | -1.8563 | -8.3520 | 0.7387 | -3.6504\* | -0.1147\* | -6.0352 | 0.9216 | 3.9014 | -2.3812 | -10.6470 |
| 0.3 | 0.5 | -0.0245\* | -0.1936 | 0.2670 | -0.1768 | 0.3690 | 0.0839\* | 0.1520 | 0.8308 | -0.0477 | -0.3147 |
| 0.5 | 0.5 | -0.0958\* | -0.5523 | 0.5008 | 0.0649\* | 0.4480 | -0.0739 | 0.3238 | 1.6066 | -0.1637 | -0.8841 |
| 0.7 | 0.5 | -0.3219\* | -1.5977 | 1.0849 | 0.7313\* | 0.4992 | -0.7792 | 0.8223 | 3.7944 | -0.4983 | -2.4074 |
| 0.9 | 0.5 | -1.8524 | -8.3378 | 1.4847 | -1.9049\* | -0.3411\* | -6.8599 | 1.9225 | 8.3204 | -2.3870 | -10.6740 |
| 0.3 | 0.7 | -0.0219\* | -0.1870\* | 0.7086 | 0.8009 | 0.5559 | 0.4223 | 0.3612 | 2.0194 | -0.0536 | -0.3465 |
| 0.5 | 0.7 | -0.0925\* | -0.5435 | 1.2625 | 1.7761 | 0.6306 | 0.2161\* | 0.7878 | 3.9738 | -0.1731 | -0.9316 |
| 0.7 | 0.7 | -0.3174\* | -1.5845 | 2.2593 | 3.4158 | 0.6228 | -0.6721\* | 1.7894 | 8.3603 | -0.5078 | -2.4529 |
| 0.9 | 0.7 | -1.8458 | -8.3083 | 2.2187 | -0.2088\* | -0.4630\* | -7.3746 | 2.9508 | 12.8685 | -2.3900 | -10.6909 |
| 0.3 | 0.9 | -0.0166\* | -0.1651\* | 2.4503 | 4.6096 | 1.4205 | 2.1489 | 1.1525 | 6.6166 | -0.0586 | -0.3737 |
| 0.5 | 0.9 | -0.0860\* | -0.5139\* | 3.3502 | 6.4141 | 1.4331 | 1.7591 | 2.0378 | 10.4425 | -0.1795 | -0.9651 |
| 0.7 | 0.9 | -0.3087\* | -1.5387 | 3.9543 | 7.2462 | 1.2674 | 0.4890\* | 3.1944 | 15.0044 | -0.5123 | -2.4786 |
| 0.9 | 0.9 | -1.8342 | -8.2010 | 2.6037 | 0.6582\* | -0.2434\* | -7.1352 | 3.5207 | 15.1102 | -2.3891 | -10.6950 |
| Average (absolute bias) | | 0.5701\* | 2.6521 | 1.4766 | 2.0984\* | 0.5979 | 2.1785 | 1.2803 | 5.9622 | 0.7763 | 3.5824 |
|  | | 1.6111 | | 1.7875 | | 1.3882\* | | 3.6212 | | 2.1794 | |

\* Lowest bias for  within the parameter combination. Number of observations=900, repetitions=1000.  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Appendix C. Lagrange Multiplier Tests

Table C1. Rejection Rates of  (Lagrange multiplier test). , .

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
| 0.0 | 0, 0 | 0.0 | 0, 0 | 0.0410 | 0.0440 | 0.0520 | 0.0500 | 0.0580 |
| 0.4 | 0, 0 | 0.0 | 0, 0 | 1.0000 | 1.0000 | 0.0920 | 0.7750 | 1.0000 |
| 0.8 | 0, 0 | 0.0 | 0, 0 | 1.0000 | 1.0000 | 0.3880 | 0.9990 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.0 | 0, 0 | 0.0440 | 0.0520 | 0.0550 | 0.0590 | 0.0550 |
| 0.4 | 0.4, 0.7 | 0.0 | 0, 0 | 1.0000 | 1.0000 | 0.1340 | 0.9900 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.0 | 0, 0 | 1.0000 | 1.0000 | 0.9950 | 1.0000 | 1.0000 |
| 0.0 | 0, 0 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 0.7190 | 0.1140 | 1.0000 |
| 0.4 | 0, 0 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 0.8560 | 0.6830 | 1.0000 |
| 0.8 | 0, 0 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 0.8380 | 0.9780 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 0.9430 | 0.1100 | 1.0000 |
| 0.4 | 0.4, 0.7 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 0.9970 | 0.9560 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.4 | 0, 0 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.0 | 0, 0 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 0.9990 | 0.2860 | 1.0000 |
| 0.4 | 0, 0 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 0.9960 | 0.5190 | 1.0000 |
| 0.8 | 0, 0 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 0.7450 | 0.7410 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 1.0000 | 0.3000 | 1.0000 |
| 0.4 | 0.4, 0.7 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 1.0000 | 0.7280 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.8 | 0, 0 | 1.0000 | 1.0000 | 1.0000 | 0.9410 | 1.0000 |
| 0.0 | 0, 0 | 0.0 | 0.1, 0.8 | 0.4240 | 0.9910 | 1.0000 | 1.0000 | 1.0000 |
| 0.4 | 0, 0 | 0.0 | 0.1, 0.8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.8 | 0, 0 | 0.0 | 0.1, 0.8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 0.8320 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.4 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9960 | 1.0000 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.0 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.4970 | 1.0000 | 1.0000 |
| 0.0 | 0, 0 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9900 | 1.0000 | 1.0000 |
| 0.4 | 0, 0 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9530 | 1.0000 | 1.0000 |
| 0.8 | 0, 0 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.8520 | 1.0000 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9560 | 1.0000 | 1.0000 |
| 0.4 | 0.4, 0.7 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.0930 | 1.0000 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.4 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9600 | 1.0000 | 1.0000 |
| 0.0 | 0, 0 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.2590 | 0.9930 | 1.0000 |
| 0.4 | 0, 0 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.2370 | 0.9940 | 1.0000 |
| 0.8 | 0, 0 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.1530 | 0.9940 | 1.0000 |
| 0.0 | 0.4, 0.7 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 0.9880 | 1.0000 | 1.0000 |
| 0.4 | 0.4, 0.7 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 0.8 | 0.4, 0.7 | 0.8 | 0.1, 0.8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

Number of observations=900, repetitions=1000.  Lagrange multiplier test,  Robust Lagrange multiplier test, each for : , : , : .  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Appendix D. Different specifications of 

Figure D1.  10-nearest neighbours, inverse distance weighted, row-normalized. Bias of impacts and 95% confidence interval of empirical standard deviation without omv: , .  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.

Figure D2.  inverse distance weighted neighbours (cut-off: 100 neighbours), maximum eigenvalue-normalized. Bias of impacts and 95% confidence interval of empirical standard deviation without omv: , .  autocorrelation in the dependent variable ();  autocorrelation in the covariates ();  autocorrelation in the disturbances ();  spatial spillover effects of covariates ();  strength of omv.