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.