Agglomeration and Firm-level Productivity: A Bayesian Spatial Approach – Online Appendix –

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Appendix A: k-nearest neighbors spatial weighting matrix

We provide the estimation results of the model in Hashiguchi and Tanaka (2014) using several *knn* (*k*-nearest neighbors) spatial weighting matrices. The elements of *knn* weight matrix is specified as $w_{cj} = d_{cj} / \sum_j^{N_c} d_{cj}$, and $d_{cj} = 1$ if county j is county c's k-nearest neighbors. k is the number of nearest neighbors for county c, given by econometrician. In this appendix, we use $k = 3, 4, 5, 6, 7, 8, 9, 10$ for robustness check. Tables 1 and 2 show the estimation results. These estimates are basically unchanged from the original results based on the queen-type contiguity weight matrix.

[Tables 1 and 2]

Appendix B: Spatial Durbin model

Hashiguchi and Tanaka (2014)'s model can be extended to the spatial Durbin model by adding $\mathbf{W} \log U_c$ into Equation (5) of the original paper. In this appendix, to check the robustness of the paper's results, we show the estimation results of the extended model. As Table 3 reports, coefficient estimates of both $\log U_c$ and $\mathbf{W} \log U_c$ have large variance and are insignificant. These results may be caused by the collinearity among $\log U_c$ and $\mathbf{W} \log U_c$. However, the other estimates are basically unchanged from the original results in Hashiguchi and Tanaka (2014).

[Table 3]

Appendix C: List of county names

[Tables 4, 5 and 6]

Table 1: Estimation results based on a *knn* weighting matrix
(Bayesian IV model, $\log A_f = \log FD_f$)

			$k = 3$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0228	0.0052	0.0126	0.0228	0.0330
β_h	0.1490	0.0032	0.1427	0.1490	0.1553
β_{EX}	0.0258	0.0064	0.0132	0.0258	0.0384
β_K	0.2101	0.0021	0.2060	0.2101	0.2143
β_L	0.5944	0.0037	0.5871	0.5944	0.6015
μ_0	1.5679	0.2411	1.1035	1.5654	2.0526
μ_U	0.0048	0.0171	-0.0289	0.0047	0.0384
ρ	0.4075	0.0825	0.2394	0.4079	0.5665

			$k = 4$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0225	0.0052	0.0122	0.0225	0.0327
β_h	0.1488	0.0032	0.1424	0.1488	0.1552
β_{EX}	0.0259	0.0064	0.0134	0.0259	0.0386
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5942	0.0037	0.5870	0.5943	0.6014
μ_0	1.5097	0.2568	1.0192	1.5057	2.0328
μ_U	0.0044	0.0173	-0.0295	0.0044	0.0383
ρ	0.4289	0.0888	0.2463	0.4302	0.5976

			$k = 5$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0220	0.0052	0.0118	0.0220	0.0323
β_h	0.1487	0.0032	0.1423	0.1487	0.1550
β_{EX}	0.0261	0.0064	0.0135	0.0260	0.0387
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5941	0.0037	0.5869	0.5941	0.6013
μ_0	1.3415	0.2574	0.8528	1.3360	1.8693
μ_U	0.0037	0.0170	-0.0296	0.0037	0.0371
ρ	0.4930	0.0898	0.3069	0.4949	0.6622

			$k = 6$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0220	0.0052	0.0117	0.0220	0.0323
β_h	0.1487	0.0032	0.1424	0.1487	0.1551
β_{EX}	0.0260	0.0064	0.0134	0.0260	0.0386
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5942	0.0037	0.5870	0.5942	0.6013
μ_0	1.3146	0.2676	0.8099	1.3076	1.8668
μ_U	0.0021	0.0171	-0.0315	0.0020	0.0357
ρ	0.5061	0.0944	0.3092	0.5084	0.6828

Table 2: Estimation results based on a *knn* weighting matrix (continued)

			$k = 7$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0220	0.0052	0.0117	0.0220	0.0323
β_h	0.1487	0.0032	0.1424	0.1487	0.1551
β_{EX}	0.0260	0.0064	0.0134	0.0260	0.0386
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5942	0.0037	0.5870	0.5942	0.6013
μ_0	1.2962	0.2763	0.7750	1.2887	1.8661
μ_U	0.0012	0.0172	-0.0325	0.0012	0.0350
ρ	0.5149	0.0981	0.3100	0.5172	0.6987

			$k = 8$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0221	0.0052	0.0119	0.0221	0.0324
β_h	0.1487	0.0032	0.1424	0.1487	0.1551
β_{EX}	0.0260	0.0064	0.0134	0.0260	0.0387
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5942	0.0037	0.5870	0.5942	0.6013
μ_0	1.2811	0.2841	0.7448	1.2741	1.8650
μ_U	0.0001	0.0172	-0.0337	0.0001	0.0340
ρ	0.5229	0.1016	0.3113	0.5250	0.7129

			$k = 9$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0224	0.0052	0.0122	0.0224	0.0326
β_h	0.1489	0.0032	0.1425	0.1489	0.1552
β_{EX}	0.0259	0.0064	0.0134	0.0259	0.0386
β_K	0.2102	0.0021	0.2060	0.2102	0.2143
β_L	0.5943	0.0037	0.5870	0.5943	0.6014
μ_0	1.2662	0.2953	0.7125	1.2570	1.8768
μ_U	0.0010	0.0173	-0.0329	0.0009	0.0350
ρ	0.5265	0.1058	0.3049	0.5296	0.7233

			$k = 10$		
	Mean	Stdev	95%L	Median	95%U
β_A	0.0224	0.0052	0.0121	0.0224	0.0326
β_h	0.1489	0.0032	0.1425	0.1489	0.1552
β_{EX}	0.0259	0.0064	0.0134	0.0259	0.0386
β_K	0.2101	0.0021	0.2060	0.2102	0.2143
β_L	0.5943	0.0037	0.5871	0.5943	0.6014
μ_0	1.2846	0.3060	0.7153	1.2729	1.9186
μ_U	0.0005	0.0174	-0.0337	0.0005	0.0348
ρ	0.5209	0.1105	0.2889	0.5256	0.7244

Table 3: Model with $\mathbf{W} \log U_c$

	Mean	Stdev	95%CI	
$\log A_f = \log FD_f$				
β_A	0.0223	(0.0052)	[0.012,	0.033]
β_h	0.1486	(0.0032)	[0.142,	0.155]
β_{EX}	0.0260	(0.0064)	[0.013,	0.039]
β_K	0.2102	(0.0021)	[0.206,	0.214]
β_L	0.5941	(0.0037)	[0.587,	0.601]
μ_0	1.2468	(0.2386)	[0.802,	1.746]
μ_U	-0.0239	(0.0290)	[-0.081,	0.033]
$\tilde{\mu}_U$	0.0353	(0.0362)	[-0.036,	0.106]
ρ	0.5121	(0.0819)	[0.335,	0.665]
$\log A_f = \log LD_f$				
β_A	0.0105	(0.0066)	[-0.002,	0.023]
β_h	0.1527	(0.0028)	[0.147,	0.158]
β_{EX}	0.0258	(0.0065)	[0.013,	0.039]
β_K	0.2103	(0.0021)	[0.206,	0.215]
β_L	0.5953	(0.0035)	[0.588,	0.602]
μ_0	0.9824	(0.2204)	[0.574,	1.448]
μ_U	0.0155	(0.0326)	[-0.048,	0.080]
$\tilde{\mu}_U$	0.0179	(0.0378)	[-0.056,	0.092]
ρ	0.5415	(0.0815)	[0.365,	0.692]
$\log A_f = \log FN_f$				
β_A	0.0332	(0.0058)	[0.022,	0.044]
β_h	0.1555	(0.0027)	[0.150,	0.161]
β_{EX}	0.0229	(0.0064)	[0.010,	0.036]
β_K	0.2099	(0.0021)	[0.206,	0.214]
β_L	0.5976	(0.0035)	[0.591,	0.604]
μ_0	1.0348	(0.2205)	[0.621,	1.494]
μ_U	-0.0002	(0.0309)	[-0.061,	0.061]
$\tilde{\mu}_U$	0.0243	(0.0363)	[-0.047,	0.096]
ρ	0.5186	(0.0834)	[0.340,	0.675]
Sample size: 97947				

Note: $\tilde{\mu}_U$ is the coefficient of $\mathbf{W} \log U_c$.

Table 4: List of county names

id	Prefecture-level	County-level	id	Prefecture-level	County-level
1	Shanghai	Huangpu*	41	Lianyungang	Lianyungang Dist.
2	Shanghai	Minxing	42	Lianyungang	Ganyu
3	Shanghai	Baoshan	43	Lianyungang	Donghai
4	Shanghai	Jiading	44	Lianyungang	Guanyun
5	Shanghai	Pudongxin	45	Lianyungang	Guannan
6	Shanghai	Jinshan	46	Huaiyin	Huaiyin Dist.
7	Shanghai	Songjiang	47	Huaiyin	Lianshui
8	Shanghai	Qingpu	48	Huaiyin	Hongze
9	Shanghai	Nanhui	49	Huaiyin	Xuyi
10	Shanghai	Fengxian	50	Huaiyin	Jinhu
11	Shanghai	Chongming	51	Yancheng	Yancheng Dist.
12	Nanjing	Nanjing Dist.	52	Yancheng	Xiangshui
13	Nanjing	Lishui	53	Yancheng	Binhai
14	Nanjing	Gaochun	54	Yancheng	Funing
15	Wuxi	Wuxi Dist.	55	Yancheng	Sheyang
16	Wuxi	Jiangyin	56	Yancheng	Jianhu
17	Wuxi	Yixing	57	Yancheng	Dongtai
18	Xuzhou	Xuzhou Dist.	58	Yancheng	Dafeng
19	Xuzhou	Fengxian	59	Yangzhou	Yangzhou Dist.
20	Xuzhou	Peixian	60	Yangzhou	Baoying
21	Xuzhou	Tongshan	61	Yangzhou	Yizheng
22	Xuzhou	Suining	62	Yangzhou	Gaoyou
23	Xuzhou	Xinyi	63	Yangzhou	Jiangdu
24	Xuzhou	Pizhou	64	Zhenjiang	Zhenjiang Dist.
25	Changzhou	Changzhou Dist.	65	Zhenjiang	Danyang
26	Changzhou	Liyang	66	Zhenjiang	Yangzhong
27	Changzhou	Jintan	67	Zhenjiang	Jurong
28	Suzhou	Suzhou Dist.	68	Taizhou	Taizhou Dist.
29	Suzhou	Changshu	69	Taizhou	Xinghua
30	Suzhou	Zhangjiagang	70	Taizhou	Jingjiang
31	Suzhou	Kunshan	71	Taizhou	Taixing
32	Suzhou	Wujiang	72	Taizhou	Jiangyan
33	Suzhou	Taicang	73	Suqian	Suqian Dist.
34	Nantong	Nantong Dist.	74	Suqian	Shuyang
35	Nantong	Haian	75	Suqian	Siyang
36	Nantong	Rudong	76	Suqian	Sihong
37	Nantong	Qidong	77	Hangzhou	Hangzhou Dist.
38	Nantong	Rugao	78	Hangzhou	Tonglu
39	Nantong	Tongzhou	79	Hangzhou	Chunan
40	Nantong	Haimen	80	Hangzhou	Jiande

Notes: * Huangpu (id = 1) includes the following nine county-level regions: Huangpu, Luwan, Xuhui, Changning, Jingan, Putuo, Zhabei, Hongkou, and Yangpu. Because the areas of these regions are quite small, we aggregate them into one composite. "Dist." is the abbreviation for "District."

Table 5: List of county names (continued)

id	Prefecture-level	County-level	id	Prefecture-level	County-level
81	Hangzhou	Fuyang	121	Jinhua	Yongkang
82	Hangzhou	Linan	122	Quzhou	Quzhou Dist.
83	Ningbo	Ningbo Dist.	123	Quzhou	Changshan
84	Ningbo	Xiangshan	124	Quzhou	Kaihua
85	Ningbo	Ninghai	125	Quzhou	Longyou
86	Ningbo	Yuyao	126	Quzhou	Jiangshan
87	Ningbo	Cixi	127	Zhoushan	Zhoushan Dist.
88	Ningbo	Fenghua	128	Zhoushan	Daishan
89	Wenzhou	Wenzhou Dist.	129	Zhoushan	Shengsi
90	Wenzhou	Dongtou	130	Taizhou	Taizhou Dist.
91	Wenzhou	Yongjia	131	Taizhou	Yuhuan
92	Wenzhou	Pingyang	132	Taizhou	Sanmen
93	Wenzhou	Cangnan	133	Taizhou	Tiantai
94	Wenzhou	Wencheng	134	Taizhou	Xianju
95	Wenzhou	Taishun	135	Taizhou	Wenling
96	Wenzhou	Ruian	136	Taizhou	Linhai
97	Wenzhou	Leqing	137	Lishui	Lishui Dist.
98	Jiaxing	Jiaxing Dist.	138	Lishui	Qingtian
99	Jiaxing	Jiashan	139	Lishui	Jinyun
100	Jiaxing	Haiyan	140	Lishui	Suichang
101	Jiaxing	Haining	141	Lishui	Songyang
102	Jiaxing	Pinghu	142	Lishui	Yunhe
103	Jiaxing	Tongxiang	143	Lishui	Qingyuan
104	Huzhou	Huzhou Dist.	144	Lishui	Jingning
105	Huzhou	Deqing	145	Lishui	Longquan
106	Huzhou	Changxing	146	Hefei	Hefei Dist.
107	Huzhou	Anji	147	Hefei	Changfeng
108	Shaoxing	Shaoxing Dist.	148	Hefei	Feidong
109	Shaoxing	Shaoxing	149	Hefei	Feixi
110	Shaoxing	Xinchang	150	Wuhu	Wuhu Dist.
111	Shaoxing	Zhuji	151	Wuhu	Wuhu
112	Shaoxing	Shangyu	152	Wuhu	Fanchang
113	Shaoxing	Shengzhou	153	Wuhu	Nanling
114	Jinhua	Jinhua Dist.	154	Bengbu	Bengbu Dist.
115	Jinhua	Wuyi	155	Bengbu	Huaiyuan
116	Jinhua	Pujiang	156	Bengbu	Wuhe
117	Jinhua	Panan	157	Bengbu	Guzhen
118	Jinhua	Lanxi	158	Huainan	Huainan Dist.
119	Jinhua	Yiwu	159	Huainan	Fengtai
120	Jinhua	Dongyang	160	Maanshan	Maanshan Dist.

Note: "Dist." is the abbreviation for "District."

Table 6: List of county names (continued)

id	Prefecture-level	County-level	id	Prefecture-level	County-level
161	Maanshan	Dangtu	201	Chaohu	Hanshan
162	Huaibei	Huaibei Dist.	202	Chaohu	Hexian
163	Huaibei	Suixi	203	Liuan	Liuan Dist.
164	Tongling	Tongling Dist.	204	Liuan	Shouxian
165	Tongling	Tongling	205	Liuan	Huoqiu
166	Anqing	Anqing Dist.	206	Liuan	Shucheng
167	Anqing	Huaining	207	Liuan	Jinzhai
168	Anqing	Zongyang	208	Liuan	Huoshan
169	Anqing	Qianshan	209	Bozhou	Bozhou Dist.
170	Anqing	Taihu	210	Bozhou	Guoyang
171	Anqing	Susong	211	Bozhou	Mengcheng
172	Anqing	Wangjiang	212	Bozhou	Lixin
173	Anqing	Yuexi	213	Chizhou	Chizhou Dist.
174	Anqing	Tongcheng	214	Chizhou	Dongzhi
175	Huangshan	Huangshan Dist.	215	Chizhou	Shitai
176	Huangshan	Shexian	216	Chizhou	Qingyang
177	Huangshan	Xiuning	217	Xuancheng	Xuancheng Dist.
178	Huangshan	Yixian	218	Xuancheng	Langxi
179	Huangshan	Qimen	219	Xuancheng	Guangde
180	Chuzhou	Chuzhou Dist.	220	Xuancheng	Jingxian
181	Chuzhou	Laian	221	Xuancheng	Jixi
182	Chuzhou	Quanjiao	222	Xuancheng	Jingde
183	Chuzhou	Dingyuan	223	Xuancheng	Ningguo
184	Chuzhou	Fengyang			
185	Chuzhou	Tianchang			
186	Chuzhou	Mingguang			
187	Fuyang	Fuyang Dist.			
188	Fuyang	Linquan			
189	Fuyang	Taihe			
190	Fuyang	Funan			
191	Fuyang	Yingshang			
192	Fuyang	Jieshou			
193	Suzhou	Suzhou Dist.			
194	Suzhou	Dangshan			
195	Suzhou	Xiaoxian			
196	Suzhou	Lingbi			
197	Suzhou	Sixian			
198	Chaohu	Chaohu Dist.			
199	Chaohu	Lujiang			
200	Chaohu	Wuwei			

Note: "Dist." is the abbreviation for "District."