

Supplementary Material Table S1

Two-stage least-squares regression.

Variables	Phase I		Phase II
	sprawl (1)	sprawl ² (2)	(3)
Updste2	−0.0001*** (0.0000)	−0.0001*** (0.0000)	
Sloalu2	−0.0005* (0.0002)	−0.0010*** (0.0003)	
L.sprawl	0.7651*** (0.0547)	0.1603** (0.0661)	
L.sprawl ²	0.0056 (0.0639)	0.5956*** (0.0815)	
sprawl			3.5425*** (0.7668)
sprawl ²			−3.8829*** (0.7872)
Control variables	YES	YES	YES
Province-fixed effect	YES	YES	YES
Industry-fixed effect	YES	YES	YES
Year-fixed effect	YES	YES	YES
Cragg–Donald Wald F statistic			2551.496
Kleibergen–Paap rk Wald F statistic			161.569
Hansen J statistic			3.012
p-value corresponding to the J statistic			0.2218
N	18321	18321	18321
R ²			0.2972

***, **, and * indicate significance at the statistical levels of 1%, 5%, and 10%, respectively.

Supplementary Material Table S2

Regression by year.

Variables	2010 (1)	2011 (2)	2012 (3)	2013 (4)	2014 (5)	2015 (6)	2016 (7)	2017 (8)	2018 (9)	2019 (10)	2020 (11)
sprawl	2.635 8* (1.385 0)	2.890 0*** (0.621 0)	2.200 7*** (0.54 35)	1.970 9 (2.05 49)	4.121 3** (1.639 4)	4.559 5*** (1.060 1)	2.429 3** (1.04 20)	1.247 9 (1.185 0)	1.772 6** (0.828 9)	1.867 4* (0.988 6)	2.096 7*** (0.453 9)
sprawl ²	−3.11 39**	−2.43 80***	−2.76 52***	−2.85 98	−4.51 87**	−4.59 17***	−2.54 38** *	−1.02 88	−1.93 42**	−2.12 78**	−2.01 75***

	(1.142 0)	(0.585 2)	(0.48 72)	(2.07 69)	(1.581 0)	(0.786 7)	(0.83 01)	(1.138 4)	(0.706 0)	(0.877 8)	(0.452 0)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	760	963	1199	1240	1329	1485	1649	1962	2073	2179	2445
R ²	0.313 7	0.301 7	0.306 1	0.334 0	0.338 6	0.333 5	0.380 8	0.387 0	0.403 5	0.395 6	0.411 0

***, **, and * indicate significance at the statistical levels of 1%, 5%, and 10%, respectively.

Supplementary Material Table S3

Substituting variables tests.

Variables	Substitution of variables	Patent types		
	(1)	Inventions (2)	Utility models (3)	Designs (4)
sprawl	1.9688*** (0.5832)	1.6506*** (0.4114)	2.4896*** (0.4749)	1.1038** (0.4160)
sprawl ²	−2.3049*** (0.5104)	−1.7642*** (0.3759)	−2.5644*** (0.4441)	−1.2672*** (0.3944)
Control variables	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES
N	17255	21882	21882	21882
R ²	0.4321	0.3940	0.3628	0.1767

*** and ** indicate significance at the statistical levels of 1% and 5%, respectively.

Supplementary Material Table S4

Other robustness tests.

Variables	Excluding special samples	Cross-multiplication fixed effect	Explanatory variables lagged one period	Explanatory variables lagged two periods
	(1)	(2)	(3)	(4)
sprawl	2.2127***	2.5733***	1.9750***	1.5500**

	(0.4661)	(0.6123)	(0.5974)	(0.6486)
sprawl ²	−2.4412***	−2.7692***	−2.2330***	−1.8202***
	(0.4124)	(0.5222)	(0.5237)	(0.5244)
Control variables	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES
Industry × year fixed effect	NO	YES	NO	NO
Province × year fixed effect	NO	YES	NO	NO
N	17287	17284	18321	15441
R ²	0.3776	0.3948	0.3955	0.3769

*** and ** indicate significance at the statistical levels of 1% and 5%, respectively.

Supplementary Material Table S5

Regional heterogeneity.

Variables	East (3)	Central (4)	West (5)	North-east (6)
sprawl	2.6028*** (0.5317)	1.1965* (0.5873)	1.5199** (0.5393)	3.7468* (1.9859)
sprawl ²	−3.0926*** (0.4825)	−1.2621* (0.7095)	−1.1294** (0.4255)	−3.4162** (1.5219)
Control variables	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES
N	10822	3135	2369	958
R ²	0.3545	0.4424	0.4742	0.3472

***, **, and * indicate significance at the statistical levels of 1%, 5%, and 10%, respectively.

Supplementary Material Table S6

Heterogeneity of city size and industry type.

Variables	City size			Industry type	
	Large city	Medium-sized city	Small city	Manufacturing industry	Non-manufacturing industry
	(1)	(2)	(3)	(4)	(5)
sprawl	2.4104 (3.4239)	−0.1364 (0.5570)	2.7801*** (0.3670)	1.7268*** (0.4304)	2.2963** (1.0384)

sprawl ²	−1.9681 (4.9040)	−0.2696 (0.8821)	−2.8392*** (0.2877)	−1.9792*** (0.4282)	−2.4552** (1.1467)
Control variables	YES	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES	YES
N	3897	5462	7927	12742	4545
R ²	0.4356	0.3856	0.3754	0.3849	0.2774

*** and ** indicate significance at the statistical levels of 1% and 5%, respectively.

Supplementary Material Table S7

Heterogeneity of enterprise and industry characteristics.

Variable	Size of enterprises		Age of enterprises		Nature of enterprises	
	Below average	Above average	Below average	Above average	State enterprise	Non-state enterprise
	(1)	(2)	(3)	(4)	(5)	(6)
sprawl	1.3976*** (0.4443)	2.9104** (1.1293)	2.0942*** (0.5859)	2.4778*** (0.7277)	1.5237 (0.8868)	2.4687*** (0.4073)
sprawl ²	−1.7347*** (0.3052)	−3.0413*** (0.9722)	−2.2393*** (0.5145)	−2.8086*** (0.6265)	−1.9043** (0.6554)	−2.6311*** (0.3357)
Control variables	YES	YES	YES	YES	YES	YES
Province-fixed effect	YES	YES	YES	YES	YES	YES
Industry-fixed effect	YES	YES	YES	YES	YES	YES
Year-fixed effect	YES	YES	YES	YES	YES	YES
N	8810	8477	8691	8595	5072	12214
R ²	0.2827	0.4025	0.3898	0.3939	0.4665	0.3494

*** and ** indicate significance at the statistical levels of 1% and 5%, respectively.