

Technology Diffusion and Innovation: the regional gains from entry of large plants

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Localisation and Productivity
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- Can the local economy benefit from the interaction with a new source of knowledge?
- Relevant for policy makers. Possible reason to attract FDI: improvement of local technology.

Reserach Question

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- **knowledge production**

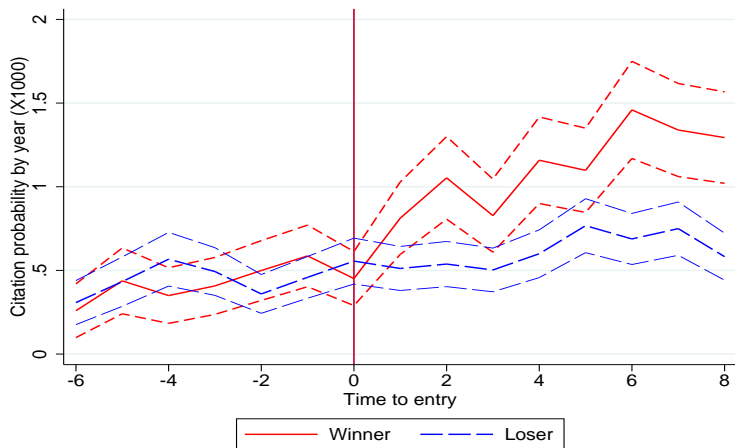
What We Do

- Set of large corporations entering US counties and building plants (MDP).
- Information on location decision of firm entry:
 - Chosen county (“Winning”)
 - Shortlisted but not chosen counties (“Losing”)
 - “Winning” / “Losing” considered a Case
 - Greenstone and Moretti (2004), Greenstone, Hornbeck and Moretti (2010)
- Compare **citations** to MDP patents from patents in the *winning* and *losing* counties.
- Compare **patenting** from inventors in *winning* and *losing* counties.

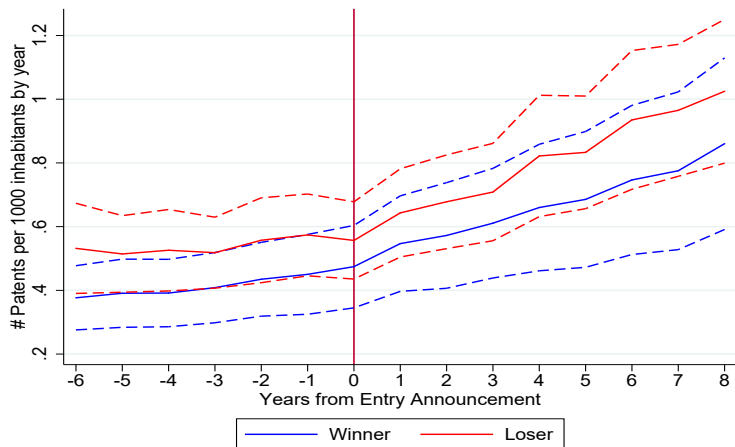
Relevant Literature

- **Proximity, innovation, citations:** *Jaffe (1993); Branstetter (2006); Agrawal et al. (2008); Fons Rosen (2010); Helmers and Overman (2017)*
- **FDI and Innovation:** *Branstetter (2006); Crespo et al. (2007); Arnold et al. (2009); Keller (2009)*
- **Agglomeration Economies:** *Ellison et al. (1997); Greenstone, Hornbeck and Moretti (2004, 2010)*

Results (1): Entry and Citation



Results (2): Entry and Innovation



- 1 Identification Strategy
- 2 Data
- 3 Empirical Specification
- 4 Results
 - Patent Citation
 - Patent Production

Identification Strategy

Endogeneity Concern: MDP *Endogenously* decide to enter into a location

Revealed preferences and ranking of locations:

- **Identification Strategy:**

- Treatment group: Winning county
- Control group: Losing county

- **Identifying Assumption:** losing bidders form a valid counterfactual to winning bidders \implies overcome endogeneity problem.

Balancing Test

Variable	From 6 to 1 year before entry			Year before entry		
	Average Winner	Average Losing	T-stat	Average Winner	Average Losing	T-stat
Inventor Level						
Experience	5.37	5.27	0.23	5.84	5.8	0.08
Patents Produced	0.58	0.62	-1.77	0.6	0.61	-0.28
Patents Produced (Quality Weight)	0.67	0.74	-1.31	0.69	0.74	-0.8
Patents Produced Cumulated	3.72	3.91	-0.56	3.84	4.11	-0.82
Patents Produced Cumulated (Quality Weight)	4.39	4.93	-1.23	4.58	5.27	-1.48
Patents in Main Tech Class	0.16	0.17	-0.93	0.17	0.15	0.28
Patents not in Main Tech Class	0.07	0.07	-0.56	0.07	0.07	-0.11
County Level						
Share Inventors (%)	0.1	0.11	-1.3	0.11	0.12	-0.68
Total Active Population '000	163.51	197.79	-0.68	172.12	206.16	0.14
log Patents Per Capita	-10.19	-10.28	0.7	-10.18	-10.22	0.28

Data: Locations

- Cases from "The Million Dollar Plant" articles (Site Selection Journal)
- Cases in years 1982-1993.
- Out of 82 cases available, we identify 49 usable cases.
- Restriction criteria:
 - Restrict to Manufacturing and Services firms.
 - Entering firm must have produced at least one patent before entry decision.
 - Opening of the plant confirmed.
 - In 14 cases opening did not take place or unconfirmed. Used as Placebo.
- Final sample includes 50 winning and 80 losing locations

Data: Patent and Inventors

- U.S. Patent and Trademark Office data (USPTO)
- Patents
 - Data: application year, class, citations, name & location of inventors (zip), **assignee name**, etc.
 - Patents assigned to counties based on location of inventors.
 - Classified in 8 main technology classes [list](#).
- Inventors
 - Homonymy, misspelling, etc. → Disambiguation by Li et al. (2014).
 - Classification based on location before entry announcement of MDP. (*endogeneity concern*)
- Patent Citation: advantages and disadvantages. **Lower bound** of knowledge flows.

Empirical Specification

Treatment group: Winning counties; Control group: Losing counties

$$C_{pct} = \alpha + \beta_1 Post_{ct} + \beta_2 Winner_{cf} + \beta_3 Winner_{cf} X Post_{ct} + \\ + \delta X_{pct} + \gamma Z_{fct} + \eta_c + \theta_f + \lambda_t + \mu_{pfc} + \varepsilon_{icft}$$

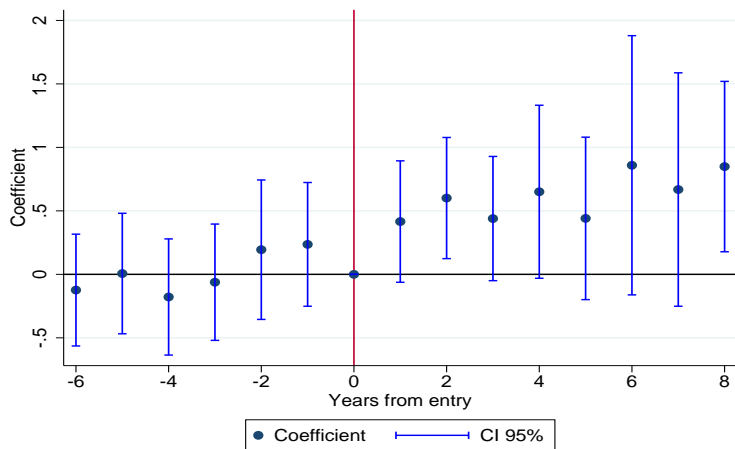
- C_{pct} : number of application for patents by inventor i in case c , county f and in year t .
- $Winner_{cl} X Post_{tc}$: classic diff-in-diff term.
- Standard errors clustered at county-case level.
- Time span: -6;+8 .

Does Geographic Proximity Promote Knowledge Diffusion?

Result - Citations

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
Winner	0.000 (0.193)	0.001 (0.220)	-0.341*** (0.103)	-0.388*** (0.116)	
Post Announcement	0.171 (0.109)	0.177 (0.310)	-0.258** (0.115)		-0.218* (0.110)
WinnerXPost Announcement	0.444*** (0.143)	0.532*** (0.157)	0.505*** (0.157)	0.565*** (0.180)	0.426*** (0.138)
log(ActivePopulation)		0.597*** (0.167)	0.500 (0.540)	0.750 (0.901)	0.584 (0.559)
Other citations		0.624*** (0.152)	0.620*** (0.153)	0.618*** (0.153)	0.472*** (0.118)
Observations	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374
R-squared	0.000	0.003	0.006	0.008	0.129
Year FE	N	Y	Y	Y	Y
Year since Patent	N	Y	Y	Y	Y
County FE	N	N	Y	Y	Y
Case FE	N	N	Y	Y	Y
YearXCase FE	N	N	N	Y	N
PatentXCountyXCase FE	N	N	N	N	Y

Timing



Robustness

Robustness:

- Number of citations: Linear and Poisson [Table](#)
- Citations to MDP: patents and citations [Table](#)
- Opening [Table](#)
- Placebo [Table](#)
- Number of losing counties [Table](#)
- Exclusion of single cases [Table](#)

Heterogeneity

Heterogeneity

- Patent:
 - More recent patents [Table](#)
 - Top decile in terms of citations [Table](#)
 - Citations mostly from the same tech class [Table](#)
 - Driven by patents never cited before in the winning county [Table](#)
- Firm and County:
 - Effect stronger for more innovative MDP. [Table](#)
 - Stronger for Services (Telecommunication). [Table](#)
 - More innovative winning counties benefit more. [Table](#)

Channel:

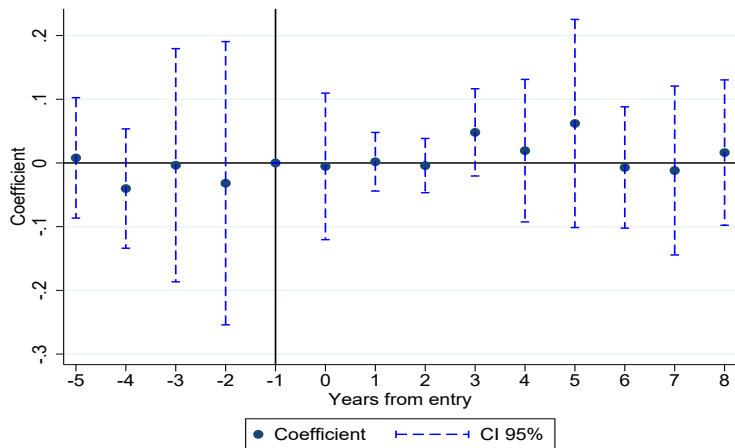
- Mobility of Inventors explains part of the effect [Table](#)

Does Geographic Proximity Promote Knowledge Production?

Result - Patents at County Level Other

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6) Log
Winner	-0.128* (0.074)	-0.133* (0.074)	-0.132 (0.095)	0.135*** (0.033)		
Post	0.259*** (0.040)	-0.069 (0.082)	-0.022 (0.022)			
WinnerXPost Announcement	-0.009 (0.051)	-0.011 (0.047)	-0.012 (0.047)	0.003 (0.055)	0.003 (0.055)	-0.007 (0.049)
Observations	1,950	1,950	1,950	1,950	1,950	1,950
Year FE	NO	YES	YES	YES	YES	YES
Case FE	NO	NO	YES	YES	YES	YES
Fips FE	NO	NO	NO	YES	YES	YES
Case-Year FE	NO	NO	NO	YES	YES	YES
Case-Fips FE	NO	NO	NO	NO	YES	YES

Result - Inventors: Stayers



Conclusions

- Winner-Runner up identification strategy for knowledge diffusion.
- We find strong effects of firm entry on patent citation (+70% probability).
- No effects on aggregate patenting and on patenting by stayers.
- *For the future.* Look more closely at inventors: compositional effects

Technology Classes:

- Biotechnology
- Chemicals
- Communications
- Software
- Mechanical Engineering
- Semiconductors
- Transportation

main

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) Not Cited Before
Winner	0.001 (0.199)	0.002 (0.248)	-0.762*** (0.144)	-0.830*** (0.148)	-0.762*** (0.144)	
Post Announcement	0.260* (0.140)	0.186 (0.362)	-0.371** (0.160)		-0.371** (0.160)	-0.312 (0.211)
WinnerXPost Announcement	0.626*** (0.211)	0.732*** (0.225)	0.709*** (0.234)	0.807*** (0.237)	0.709*** (0.234)	0.558*** (0.213)
log(ActivePopulation)		0.702*** (0.190)	0.507 (0.860)	0.664 (1.891)	0.507 (0.860)	0.822 (0.823)
Other citations		1.051*** (0.324)	1.052*** (0.329)	1.050*** (0.362)	1.052*** (0.329)	0.760*** (0.209)
Observations	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374
Year FE	N	Y	Y	Y	Y	Y
Year since Patent	N	Y	Y	Y	Y	Y
County FE	N	N	Y	Y	Y	Y
Case FE	N	N	Y	Y	Y	Y
YearXCase FE	N	N	N	Y	N	N
PatentXCountyXCase FE	N	N	N	N	Y	Y

Count: Poisson Main

	(1)	(2)	(3)	(4)	(5)
Winner	0.12393 (0.48343)	0.19279 (0.32628)	-4.99295** (2.11066)	-0.76943 (0.87415)	-5.51540** (2.67200)
Post	0.41991* (0.25422)	0.38338 (0.49148)	-0.23389 (0.25085)	0.59897 (0.47584)	-0.20987 (0.25184)
WinnerXPost Announcement	0.57199* (0.31475)	0.28121 (0.26350)	0.35967** (0.14054)	0.41355** (0.17468)	0.32233** (0.15909)
log(ActivePopulation)		1.09417*** (0.18343)	2.74892** (1.09391)	0.43063 (0.93048)	2.52122** (1.20151)
Other citations		0.10843*** (0.01026)	0.09966*** (0.00739)	0.09854*** (0.00891)	0.08389*** (0.02774)
Year FE	N	Y	Y	Y	Y
Year since Patent	N	Y	Y	Y	Y
County FE	N	N	Y	Y	Y
Case FE	N	N	Y	Y	Y
Tech FE	N	N	Y	Y	Y
YearXCase FE	N	N	N	Y	N
PatentXFipsXCase FE	N	N	N	N	Y
Observations	2,505,649	2,491,939	1,856,024	1,310,870	14,407

Patents and Citations Main

VARIABLES	(1)	(2)	(3)	(4) Dummies - coarse	(5) Dummies	(6) Dummies - citations
Post Announcement	-0.218 (0.158)	-0.216 (0.155)	-0.144 (0.141)	-0.221 (0.158)	-0.104 (0.103)	-0.252 (0.205)
WinnerXPost Announcement	0.426*** (0.156)	0.422*** (0.152)	0.329** (0.153)	0.426*** (0.155)	0.208** (0.091)	0.358* (0.206)
log(ActivePopulation)	0.584 (0.572)	0.275 (0.574)	0.645 (0.533)	0.588 (0.574)	0.298 (0.401)	0.815** (0.377)
Other citations	0.472*** (0.119)	0.472*** (0.118)	0.473*** (0.119)	0.472*** (0.119)	0.469*** (0.117)	0.467*** (0.117)
Log Total Patents (no MDP)		0.205*** (0.058)				
Total Patents (no MDP)			0.002*** (0.001)			
Observations	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374
Year FE	Y	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y	Y

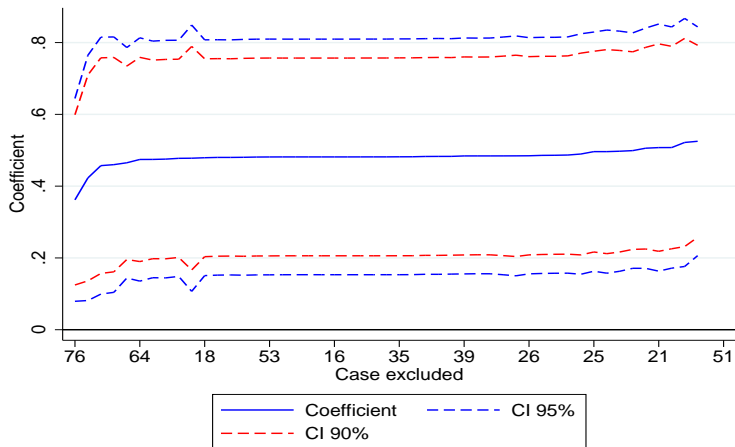
Number of Losing Main

VARIABLES	(1) Overall	(2) Only 1 losing	(3) 2 or more losing
Post Announcement	-0.218* (0.110)	-0.254 (0.227)	-0.345** (0.155)
WinnerXPost Announcement	0.426*** (0.138)	0.496* (0.276)	0.466** (0.185)
log(ActivePopulation)	0.584 (0.559)	0.158 (0.603)	0.626 (0.877)
Other citations	0.472*** (0.118)	0.443** (0.179)	0.483*** (0.149)
Observations	2,468,374	1,096,588	1,371,786
Rescaled Coefficient	.698	1.462	.613
Year FE	Y	Y	Y
Year since Patent	Y	Y	Y
County FE	Y	Y	Y
Case FE	Y	Y	Y
PatentXCountyXCase FE	Y	Y	Y
Number of cases	49	32	17

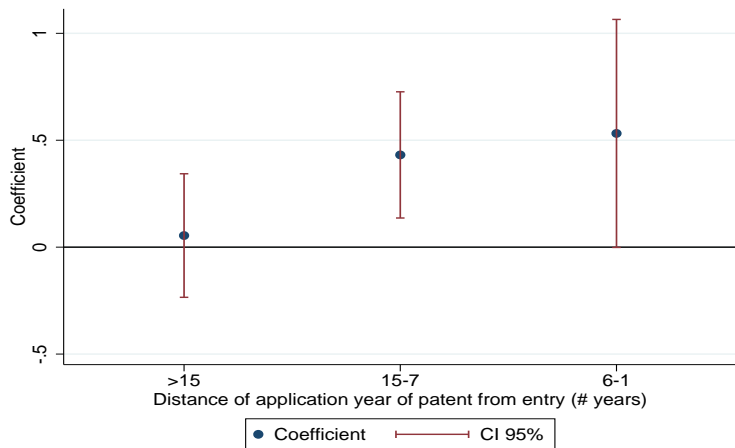
VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
Winner	0.000 (0.193)	0.001 (0.220)	-0.345*** (0.107)	-0.389*** (0.128)	
Post Announcement	-0.046 (0.167)	0.171 (0.245)	-0.157 (0.113)		-0.119 (0.114)
WinnerXPost Announcement	0.286 (0.220)	0.159 (0.179)	0.244 (0.180)	0.230 (64.664)	0.172 (0.185)
Post opening	0.295 (0.181)	0.056 (0.154)	-0.178** (0.079)		-0.178** (0.080)
WinnerXPost opening	0.195 (0.264)	0.481* (0.255)	0.352* (0.203)	0.450* (0.246)	0.343 (0.209)
log(ActivePopulation)		0.597*** (0.165)	0.393 (0.528)	0.485 (0.848)	0.475 (0.542)
Other citations		0.625*** (0.152)	0.620*** (0.153)	0.618*** (0.153)	0.472*** (0.118)
Observations	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374
Year FE	N	Y	Y	Y	Y
Year since Patent	N	Y	Y	Y	Y
County FE	N	N	Y	Y	Y
Case FE	N	N	Y	Y	Y
YearXCase FE	N	N	N	Y	N
PatentXCountyXCase FE	N	N	N	N	Y

VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
Winner	2.178 (1.991)	3.956** (1.799)			
Post Announcement	0.079 (0.196)	-0.522 (0.727)	-0.257 (0.269)		
WinnerXPost Announcement	0.206 (0.305)	0.101 (0.333)	-0.007 (0.295)	-0.035 (0.258)	-0.018 (0.252)
log(ActivePopulation)		1.642** (0.570)	2.228 (2.317)	1.082 (1.534)	0.905 (1.258)
Other citations		2.286 (1.906)	2.204 (1.908)	2.196 (1.907)	1.721 (1.458)
Observations	321,809	321,809	321,809	321,809	321,809
R-squared	0.001	0.009	0.013	0.014	0.137
Year FE	N	Y	Y	Y	Y
Year since Patent	N	Y	Y	Y	Y
County FE	N	N	Y	Y	Y
Case FE	N	N	Y	Y	Y
YearXCase FE	N	N	N	Y	N
PatentXCountyXCase FE	N	N	N	N	Y

Exclusion Single Cases Main



Age of Patent Main



VARIABLES	(1) OLS	(2) OLS	(3) OLS	(4) At least 4 years	(5) At least 4 years	(6) At least 4 years
Post Announcement	-0.187 (0.123)	-0.176* (0.103)	-0.187 (0.122)	-0.197 (0.137)	-0.170* (0.093)	-0.197 (330.723)
WinnerXPost Announcement	0.369*** (0.063)	0.314** (0.132)	0.369*** (0.071)	0.388*** (0.134)	0.266*** (0.084)	0.388 (49.219)
Top 50pctXPostXWinner	0.118 (0.213)		-0.126 (0.205)	0.006 (0.245)		-0.287 (0.243)
Top 90pctXpostXWinner		1.119* (0.596)	1.191* (0.614)		1.230* (0.626)	1.395** (0.648)
log(ActivePopulation)	0.583 (0.559)	0.582 (0.558)	0.583 (0.557)	0.648 (0.480)	0.645 (0.479)	0.647 (0.478)
Other citations	0.472*** (0.118)	0.472*** (0.118)	0.472*** (0.121)	0.475*** (0.121)	0.475*** (0.121)	0.475*** (0.121)
Observations	2,468,374	2,468,374	2,468,374	1,958,935	1,958,935	1,958,935
R-squared	0.129	0.129	0.129	0.113	0.113	0.113
Year FE	Y	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y	Y

Generality and Originality Main

VARIABLES	(1) Generality	(2) Generality	(3) Generality	(4) Originality	(5) Originality	(6) Originality
Post Announcement	-0.306** (0.147)	-0.296** (0.142)	-0.231* (0.124)	-0.265** (0.119)	-0.275** (0.122)	-0.237** (0.116)
WinnerXPost Announcement	0.421*** (0.057)	0.410** (0.172)	0.445*** (0.038)	0.507*** (0.158)	0.502*** (0.087)	0.466*** (0.149)
generalityXwinnerXpost	0.021 (0.433)					
originalityXwinnerXpost				-0.935 (0.646)		
log(ActivePopulation)	0.529 (0.551)	0.578 (0.559)	0.582 (0.558)	0.550 (0.559)	0.544 (0.554)	0.589 (0.559)
Other citations	0.471*** (0.118)	0.471*** (0.118)	0.472*** (0.118)	0.472*** (0.118)	0.471*** (0.118)	0.472*** (0.118)
top50XwinnerXpost		0.033 (0.156)			-0.377 (0.287)	
top90XwinnerXpost			-0.200 (0.199)			-0.549 (0.393)
Observations	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374	2,468,374
R-squared	0.129	0.129	0.129	0.129	0.129	0.129
Year FE	Y	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y	Y

VARIABLES	(1) OLS	(2) Bottom Half	(3) Top Half	(4) Top 10pct	(5) Interaction
Post Announcement	-0.218 (0.158)	-0.226 (1.224)	-0.213 (0.159)	0.048 (0.171)	-0.218 (0.158)
WinnerXPost Announcement	0.426*** (0.156)	-0.590 (0.782)	0.436*** (0.158)	0.539* (0.247)	0.334 (0.370)
WinnerXPostXTop Half					0.094 (0.366)
log(ActivePopulation)	0.584 (0.572)	-1.469 (6.486)	0.621 (0.580)	1.675 (1.075)	0.583 (0.573)
Other citations	0.472*** (0.119)	1.107** (0.527)	0.462*** (0.120)	0.287* (0.141)	0.472*** (0.119)
Observations	2,468,374	36,001	2,432,373	882,133	2,468,374
R-squared	0.129	0.151	0.128	0.154	0.129
Year FE	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y

VARIABLES	(1) Overall	(2) Manufacturing	(3) Not manufacturing
Post Announcement	-0.119 (0.114)	-0.193 (0.131)	-0.193 (0.177)
WinnerXPost Announcement	0.172 (0.185)	0.325** (0.156)	0.761*** (0.164)
Post opening	-0.178** (0.080)		
WinnerXPost opening	0.343 (0.209)		
log(ActivePopulation)	0.475 (0.542)	0.338 (0.489)	0.223 (1.422)
Other citations	0.472*** (0.118)	0.553** (0.213)	0.397*** (0.084)
Observations	2,468,374	1,875,310	593,064
Rescaled coefficient	.282	.542	1.183
Year FE	Y	Y	Y
Year since Patent	Y	Y	Y
County FE	Y	Y	Y
Case FE	Y	Y	Y
PatentXCountyXCase FE	Y	Y	Y

VARIABLES	(1) OLS	(2) Bottom Half Innovation	(3) Top Half Innovation	(4) Top Decile Innovation	(5) Btm Half Inn. - pc	(6) Top Half Inn. - pc	(7) Top Decile Inn. - pc
Post Announcement	-0.218 (0.158)	-0.047 (0.175)	-0.391 (0.281)	-1.498 (1.297)	-0.089 (0.171)	-0.307 (0.240)	-0.950 (0.909)
WinnerXPost Announcement	0.426*** (0.156)	0.029 (0.170)	0.750*** (0.200)	1.726** (0.654)	0.067 (0.153)	0.617*** (0.179)	1.098* (0.589)
log(ActivePopulation)	0.584 (0.572)	0.845 (0.838)	0.577 (0.599)	0.302 (1.066)	1.067 (0.968)	0.351 (0.531)	4.544** (1.779)
Other citations	0.472*** (0.119)	0.329*** (0.116)	0.508*** (0.151)	1.298** (0.426)	0.300** (0.131)	0.504*** (0.143)	1.509*** (0.363)
Observations	2,468,374	1,057,204	1,411,170	314,824	863,897	1,604,477	378,011
R-squared	0.129	0.121	0.131	0.128	0.119	0.131	0.132
Year FE	Y	Y	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y	Y	Y

VARIABLES	(1) Overall	(2) Same tech	(3) Different tech
Post Announcement	-0.030*** (0.011)	-0.189** (0.074)	-0.007 (0.005)
WinnerXPost Announcement	0.055*** (0.018)	0.329*** (0.121)	0.016* (0.008)
lpop	0.067 (0.071)	0.463 (0.349)	0.008 (0.032)
Other citations	0.522*** (0.155)	0.468*** (0.143)	0.631*** (0.205)
Observations	19,746,992	2,468,374	17,278,618
R-squared	0.116	0.118	0.113
Rescaled Coefficient	.702	.808	.504
Year FE	Y	Y	Y
Year since Patent	Y	Y	Y
County FE	Y	Y	Y
Tech FE	Y	Y	Y
Case FE	Y	Y	Y
PatentXCountyXCaseXTech FE	Y	Y	Y

Citations and Mobility Main

VARIABLES	(1) Baseline	(2) Entry	(3) Entry - before firm	(4) Entry - after firm	(5) Entry and Exit
Post Announcement	-0.220* (0.113)	-0.212* (0.109)	-0.198* (0.103)	-0.198* (0.110)	-0.210* (0.111)
WinnerXPost Announcement	0.424*** (0.143)	0.388*** (0.136)	0.399*** (0.131)	0.328** (0.141)	0.384*** (0.130)
WinnerXEntry Inventor		20.347** (9.054)	0.183 (5.926)	21.615* (10.933)	19.504* (10.666)
WinnerXExit Inventor					2.226 (3.695)
log(ActivePopulation)	0.637 (0.532)	0.622 (0.533)	0.602 (0.547)	0.864 (0.585)	0.619 (0.543)
Other citations	0.472*** (0.119)	0.472*** (0.118)	0.462*** (0.112)	0.475*** (0.120)	0.472*** (0.121)
Observations	2,468,374	2,468,374	2,462,219	2,434,537	2,468,374
R-squared	0.129	0.129	0.128	0.129	0.129
Year FE	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y

Citations and Past Citations Main

VARIABLES	(1) Baseline	(2) Cited Before	(3) Not Cited Before	(4) (#) Cited Before	(5) (#) Not Cited Before	(6) Not same county	(7) Same county
Post Announcement	-0.218* (0.110)	-23.255*** (7.666)	-0.145 (0.096)	-8.849 (12.011)	-0.253* (0.143)	-0.118 (0.103)	-3.521*** (1.154)
WinnerXPost Announcement	0.426*** (0.138)	-155.240*** (9.905)	0.805*** (0.241)	-150.237*** (14.064)	0.926*** (0.290)	0.222* (0.119)	5.015** (2.060)
log(ActivePopulation)	0.584 (0.559)	-17.216 (11.646)	0.463 (0.643)	-18.428 (11.744)	0.710 (0.945)	0.889 (0.570)	-2.786 (4.162)
Other citations	0.472*** (0.118)	3.420*** (1.049)	0.440*** (0.103)	5.234** (2.325)	0.713*** (0.189)	0.444*** (0.104)	1.719 (1.041)
Observations	2,468,374	6,344	2,462,030	6,344	2,462,030	2,386,822	81,552
R-squared	0.129	0.183	0.128	0.312	0.143	0.129	0.128
Year FE	Y	Y	Y	Y	Y	Y	Y
Year since Patent	Y	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y	Y
Case FE	Y	Y	Y	Y	Y	Y	Y
YearXCase FE	N	N	N	N	N	N	N
PatentXCountyXCase FE	Y	Y	Y	Y	Y	Y	Y

Other Measure of Patents Main

VARIABLES	(1) Log	(2) Log+inv	(3) Log+main	(4) Log+quality	(5) Log with MDP	(6) Log citations
winnerXpost	-0.007 (0.049)	-0.029 (0.056)	0.022 (0.047)	-0.013 (0.067)	0.014 (0.048)	0.061 (0.080)
Observations	1,950	1,950	1,950	1,950	1,950	1,950
R-squared	0.966	0.966	0.952	0.948	0.968	0.945
Year FE	YES	YES	YES	YES	YES	YES
Case FE	YES	YES	YES	YES	YES	YES
Fips FE	YES	YES	YES	YES	YES	YES
Case-Year FE	YES	YES	YES	YES	YES	YES
Case-Fips FE	YES	YES	YES	YES	YES	YES