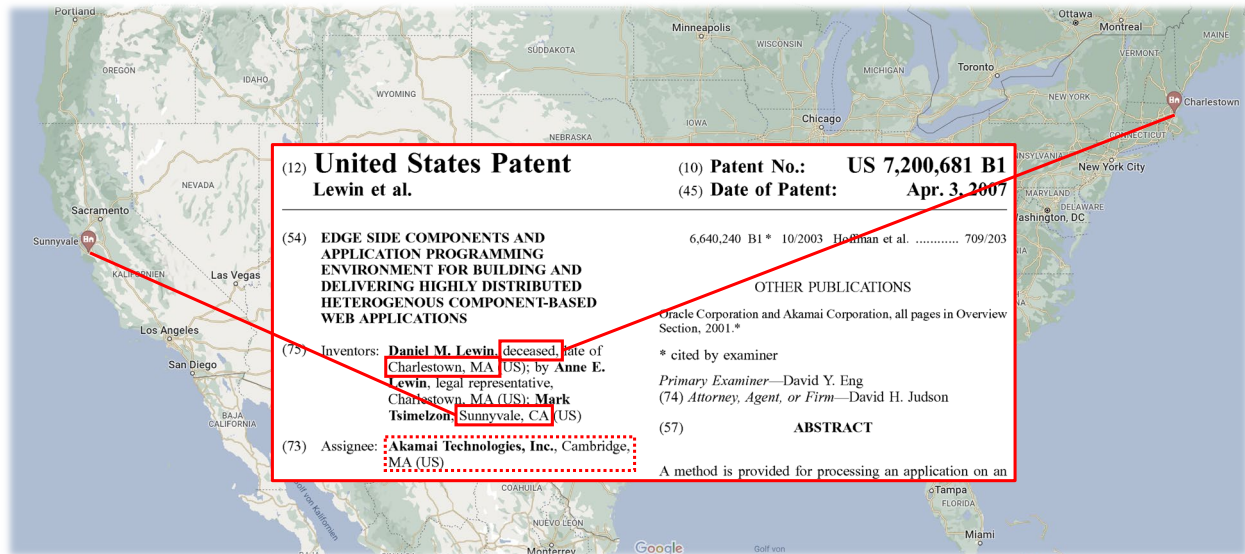


Appendices for

Micro-foundations of Absorptive Capacity as Revealed by Inventor Deaths

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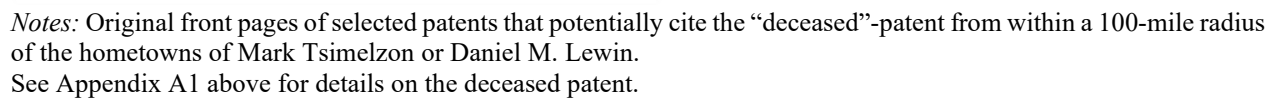
A1 - Example of primary data source that identifies deceased vs. still living co-inventors



Notes: Original patent front page for U.S. patent 7,200,681, indicating that Daniel M. Lewin, of Charlestown, MA, died after the application for the patent but before the patent's grant. Sadly he was a victim of the 9/11 terrorist attacks. His still-living co-inventor, Mark Tsimelzon resided in Sunnyvale, Ca.

100-mile radius around co-inventor

100-mile radius around deceased inventor



A3 - Example of data frame and structure

United States Patent Xiques et al. (10) Patent No.: **US 9,215,065 B2**
(45) Date of Patent: **Dec. 15, 2015**

(54) MEDIA PLAYER SECURITY FOR FULL LENGTH EPISODES

(75) Inventors: **Christopher Peter Xiques**, Oakland, CA (US); **Agnes Yashwant D. Pruv**, Monmouth Junction, NJ (US); **Shalitha Anusha Senanayake**, Hidden Valley Lake, CA (US); **James Kong Hsu**, Redwood City, CA (US)

(73) Assignee: **CBS Interactive Inc.**, San Francisco, CA (US)

(56) References Cited
U.S. PATENT DOCUMENTS

7,200,681 B1 *	4/2007	Lewin	H04L 67/2842
7,756,388 B2	7/2010	Plastina	G11B 27/105
2011/0231660 A1 *	9/2011	Kanungo	H04N 7/165
2011/0252111 A1 *	10/2011	Pantos	G06F 17/30053
2012/0170341 A1 *	7/2012	Chen	H04L 63/0428
2012/0014804 A1 *	11/2012	Lindquist	H04L 63/0428

787 patents, 2,708,456 patents, 1,279,469 inventors

	cited	citing	citing_inventor_id	dist100_alive	cite_nsc_all	same_firm
1	7200681	9215065	fl:ja_ln:hsu-17	1	1	0
2	7200681	9215065	fl:ch_ln:xiques-1	1	1	0
3	7200681	9817916	fl:ma_ln:flack-4	0	1	1
4	7200681	7734814	fl:er_ln:swildens-1	1	0	1

United States Patent Lewin et al. (10) Patent No.: **US 7,200,681 B1**
(45) Date of Patent: **Apr. 3, 2007**

(54) EDGE SIDE COMPONENTS AND APPLICATION PROGRAMMING ENVIRONMENT FOR BUILDING AND DELIVERING HIGHLY DISTRIBUTED HETEROGENOUS COMPONENT-BASED WEB APPLICATIONS

(75) Inventors: **Daniel M. Lewin**, deceased, late of Charlestown, MA (US); by **Anne E. Lewin**, legal representative, Charlestown, MA (US); **Mark Tsimelzon**, Sunnyvale, CA (US)

(73) Assignee: **Akamai Technologies, Inc.**, Cambridge, MA (US)

145,519,852 observations within a 100-mile radius

Notes: Actual excerpt from dataset. Total number of observations is 145,519,852 within 100-mile radius. The dataset includes 787 deceased patents, 2,708,456 potentially citing patents, and 1,279,469 potentially citing inventors. The variable dist100_alive is coded as 1 if the potentially citing inventor is located within 100 miles of the living inventor, 0 if within 100 miles of the deceased inventor, and missing if within 100 miles of both.

A4 - Summary statistics for within firm sample

Radii	Obs.	Obs. near deceased	Obs. near living	No. of cited patents	No. of citing patents	No. of citing inventors	No. of cites	No. of cites to deceased	No. of cites to living	Fraction exp.
10	215,856	42,674	173,182	82	77,232	34,158	504	48	456	0.4410
20	318,019	94,373	223,646	90	88,659	42,808	683	75	608	0.4072
30	355,051	102,230	252,821	89	92,040	45,748	696	70	626	0.3884
40	361,527	104,407	257,120	90	87,114	46,215	760	78	682	0.3870
50	372,658	103,444	269,214	84	87,185	46,856	810	76	734	0.3844
60	378,606	104,386	274,220	80	88,012	47,681	813	74	739	0.3820
70	382,627	105,697	276,930	81	88,645	48,464	816	74	742	0.3809
80	382,637	106,084	276,553	80	88,501	48,681	816	74	742	0.3797
90	379,639	107,169	272,470	80	88,412	49,067	818	74	744	0.3691
100	396,624	109,387	287,237	79	87,942	49,057	815	74	741	0.3575

Note: This table presents descriptive statistics of the analysis sample of the within firm citations. Each observation refers to a potentially citing inventor from future US patents (within a 10-year citation window as a baseline) that reside within a certain radius around each inventor of a deceased patent, i.e., deceased and alive co-inventors from different commuting zones, and works at the same firm as indicated by the same assignee on the cited and citing patent. The number of observations near the living inventor is greater than observations near the deceased inventor because most deceased inventors had more than one co-inventor. Citation and assignee data come from the USPTO Patentsview database. Geographic distances were calculated based on longitude/latitude information from Patentsview. Inventors at risk of citation are restricted to those with different assignees as compared to the deceased patent and not living in overlapping regions of circles drawn around the deceased and still living co-inventors of the same patent. Frac exp. is the fraction of inventors with at least one prior patent in the same CPC subsection as the deceased patent up to ten years prior to the grant date of the potentially citing patent.

A5 - Robustness check: Probit model

These tables illustrate how the results are robust to estimating equations 1 and 2 in the paper with a Probit instead of an LPM.

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.9485858*** (0.0670827)	0.8212624*** (0.0544784)	0.5672536*** (0.0420004)	0.4169840*** (0.0429044)	0.3747535*** (0.0396906)	0.3430000*** (0.0348993)	0.3568098*** (0.0319542)	0.2896653*** (0.0327493)	0.2651543*** (0.0304455)	0.2517139*** (0.0290063)
<i>Pseudo R²</i>	0.1520	0.1603	0.1465	0.1303	0.1173	0.1115	0.1075	0.1014	0.0982	0.0937
<i>N</i>	8,284,597	13,314,014	17,630,113	21,507,130	23,745,303	27,298,018	29,962,932	32,175,879	34,319,660	36,502,055
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents results of probit models, where the dependent variable is a dummy variable indicating a potential cite that occur within a radius r of the location of inventor i for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. $Alive = 1$ indicates that the potential citing inventor lives within radius r of at least one living inventor of the deceased inventor's patent. Standard errors clustered at the cited-potentially citing inventor pair reported in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.8751147*** (0.1054011)	0.8426650*** (0.0635661)	0.5070239*** (0.0551570)	0.3349484*** (0.0529272)	0.3068357*** (0.0488697)	0.2805880*** (0.0428840)	0.2637988*** (0.0400069)	0.2364347*** (0.0424034)	0.2057381*** (0.0404094)	0.1823954*** (0.0391764)
<i>Experience</i>	0.6870545*** (0.1078424)	0.7815390*** (0.0669614)	0.8303218*** (0.0589723)	0.8429122*** (0.0537074)	0.8576215*** (0.0529482)	0.8669661*** (0.0500560)	0.8333857*** (0.0482666)	0.8884196*** (0.0505359)	0.8649746*** (0.0476732)	0.8444277*** (0.0458738)
<i>Alive*Experience</i>	0.1209729 (0.1148950)	-0.0699661 (0.0754995)	0.0631444 (0.0642728)	0.0973768 (0.0614193)	0.0775609 (0.0601261)	0.0565315 (0.0567218)	0.1248167** (0.0545076)	0.0602819 (0.0558117)	0.0860560 (0.0536920)	0.1137807** (0.0523698)
<i>Pseudo R²</i>	0.2286	0.2207	0.2308	0.2185	0.2062	0.1996	0.1993	0.1940	0.1906	0.1870
<i>N</i>	8,284,597	13,314,014	17,630,113	21,507,130	23,745,303	27,298,018	29,962,932	32,175,879	34,319,660	36,502,055
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	10	20	30	40	50	60	70	80	90	100
<i>Difference in experience effect for inventors near alive vs. near deceased</i>	0.0018137*** (0.0002266)	0.0010835*** (0.0001413)	0.0009473*** (0.0001164)	0.0006953*** (0.0000972)	0.0005939*** (0.0000863)	0.0004786*** (0.0000733)	0.0005414*** (0.0000700)	0.0004399*** (0.0000688)	0.0004278*** (0.0000656)	0.0004299*** (0.0000637)
<i>N</i>	8,284,597	13,314,014	17,630,113	21,507,130	23,745,303	27,298,018	29,962,932	32,175,879	34,319,660	36,502,055
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents coefficient estimates of Probit models specified in equation (2), where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. $Alive = 1$ indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. $Experience = 1$ indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC subsection) of the cited patent p . *Difference in experience effect for inventors near alive vs. near deceased* is the estimated difference in the marginal effect sizes of having experience around an alive versus the deceased inventor. Standard errors for the difference in marginal effects come from a two-sided t-test of margins experience(deceased) – experience(alive) = 0. Standard errors of the Probit estimation clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A6 - Robustness check: premature death sample

This table provides results of a re-estimation of our baseline model with a restricted sample, where the deceased inventor died before or at the age of 60 years, indicating that death was likely unexpected (Jaravel et al., 2018). Data on inventors' age comes from Kaltenberg et al. (2021).

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.02032*** (0.00389)	0.02084*** (0.00351)	0.02263*** (0.00343)	0.01938*** (0.00321)	0.01461*** (0.00248)	0.00963*** (0.00175)	0.00814*** (0.00137)	0.00626*** (0.00114)	0.00397*** (0.00085)	0.00347*** (0.00079)
<i>R</i> ²	0.0019	0.0023	0.0015	0.0010	0.0006	0.0004	0.0002	0.0001	0.0001	0.0001
<i>N</i>	2,448,949	4,184,898	4,987,591	6,070,298	6,991,868	8,056,292	8,487,702	8,885,304	9,695,058	10,083,378
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents coefficient estimates of the LPM model specified in equation (1), where the dependent variable is a dummy variable indicating a potential cite that occur within a radius r of the location of inventor i for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. *Alive* = 1 indicates that the potential citing inventor lives within radius r of at least one living inventor of the deceased inventor's patent. Estimates are measured in percentage points. Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.01349*** (0.00354)	0.01523*** (0.00324)	0.01812*** (0.00307)	0.01550*** (0.00288)	0.01120*** (0.00217)	0.00660*** (0.00146)	0.00482*** (0.00111)	0.00304*** (0.00093)	0.00119* (0.00069)	0.00086 (0.00063)
<i>Experience</i>	0.01229*** (0.00295)	0.01013*** (0.00216)	0.01301*** (0.00263)	0.01128*** (0.00231)	0.01017*** (0.00226)	0.00909*** (0.00203)	0.00760*** (0.00175)	0.00828*** (0.00193)	0.00856*** (0.00191)	0.00879*** (0.00197)
<i>Alive*Experience</i>	0.03014*** (0.00707)	0.03565*** (0.00587)	0.03866*** (0.00635)	0.03687*** (0.00586)	0.03505*** (0.00557)	0.03151*** (0.00505)	0.03410*** (0.00482)	0.03332*** (0.00468)	0.03267*** (0.00454)	0.03069*** (0.00442)
<i>R</i> ²	0.0021	0.0025	0.0017	0.0012	0.0008	0.0006	0.0004	0.0003	0.0003	0.0003
<i>N</i>	2,448,949	4,184,898	4,987,591	6,070,298	6,991,868	8,056,292	8,487,702	8,885,304	9,695,058	10,083,378
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents coefficient estimates of the LPM model specified in equation (2), where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Since we estimate the likelihood of a rare event (the unconditional baseline incidence rate for 20 miles is 0.0149), *R*² values are low and small coefficients can imply economically meaningful relative changes. Estimates are measured in percentage points. *Alive* = 1 indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. *Experience* = 1 indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC subsection) of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A7 - Robustness check: citing assignee fixed effects

We add citing assignee fixed effects to our baseline model of *across firm spillovers*. Note this is not testing self-citations within the same firm. We provide this in response to concerns that the localization of citations might result from supplier relationships (Fadeev, 2023). This changes the quasi-experimental setup towards testing if potentially citing inventors within the *same citing firm* are more likely to cite the deceased patent when being close to the still living co-inventor as compared to being close to the deceased inventor of the same patent p . Holding the citing firm constant rules out that our results are driven by unobserved citing firm characteristics, e.g. supplier of goods and services or partners. Note that the cited patent fixed effects already absorb all unobserved differences in cited firm characteristics.

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.03841*** 0.00464	0.03624*** 0.00382	0.01911*** 0.00209	0.01044*** 0.00133	0.00937*** 0.00109	0.00717*** 0.00087	0.00612*** 0.00072	0.00417*** 0.00068	0.00325*** 0.00058	0.00319*** 0.00052
R^2	0.0900	0.0623	0.0314	0.0283	0.0255	0.0231	0.0237	0.0221	0.0213	0.0196
N	8,270,843	13,298,805	17,614,864	21,492,602	23,731,231	27,283,901	29,949,619	32,163,325	34,307,701	36,490,260
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Assignee FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents results of Linear-Probability models, where the dependent variable is a dummy variable indicating a potential cite that occur within a radius r of the location of inventor i for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, ‘deceased patent inventor’ and ‘at risk of citing deceased patent inventor,’ where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Alive = 1 indicates that the potential citing inventor lives within radius r of at least one living inventor of the deceased inventor’s patent. Estimates are measured in percentage points. Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.02254*** 0.00441	0.02496*** 0.00338	0.01060*** 0.00186	0.00500*** 0.00131	0.00439*** 0.00105	0.00267*** 0.00087	0.00141** 0.00072	-0.00017 0.00073	-0.00080 0.00066	-0.00064 0.00060
<i>Experience</i>	0.00775*** 0.00217	0.01124*** 0.00202	0.01420*** 0.00176	0.01235*** 0.00159	0.01220*** 0.00148	0.01127*** 0.00124	0.00959*** 0.00105	0.01044*** 0.00124	0.01011*** 0.00120	0.01004*** 0.00118
<i>Alive*Experience</i>	0.07235*** 0.01018	0.05461*** 0.00693	0.04367*** 0.00563	0.03072*** 0.00462	0.02939*** 0.00432	0.02560*** 0.00381	0.02772*** 0.00364	0.02595*** 0.00362	0.02537*** 0.00352	0.02496*** 0.00344
<i>R²</i>	0.0902	0.0625	0.0316	0.0284	0.0257	0.0233	0.0239	0.0222	0.0215	0.0198
<i>N</i>	8,270,843	13,298,805	17,614,864	21,492,602	23,731,231	27,283,901	29,949,619	32,163,325	34,307,701	36,490,260
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Assignee FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents coefficient estimates of the LPM model specified in equation (2), where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, ‘deceased patent inventor’ and ‘at risk of citing deceased patent inventor,’ where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Since we estimate the likelihood of a rare event (the unconditional baseline incidence rate for 20 miles is 0.0149), R^2 values are low and small coefficients can imply economically meaningful relative changes. Estimates are measured in percentage points. $Alive = 1$ indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. $Experience = 1$ indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC subsection) of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A8 - Robustness check: alternative definition of inventor experience based on CPC section

We check that the results remain insensitive to the granularity of technology classification (default is subsection).

	10	20	30	40	50	60	70	80	90	100
<i>Alive</i>	0.03964*** (0.00586)	0.02751*** (0.00339)	0.00897*** (0.00161)	0.00431*** (0.00120)	0.00262*** (0.00097)	0.00141* (0.00076)	0.00093 (0.00066)	0.00020 (0.00062)	-0.00045 (0.00057)	-0.00056 (0.00053)
<i>Experience</i>	0.00638*** (0.00219)	0.00737*** (0.00132)	0.00716*** (0.00091)	0.00664*** (0.00078)	0.00632*** (0.00073)	0.00556*** (0.00061)	0.00465*** (0.00051)	0.00512*** (0.00065)	0.00466*** (0.00061)	0.00448*** (0.00060)
<i>Alive*Experience</i>	0.03354*** (0.00507)	0.02058*** (0.00347)	0.02186*** (0.00285)	0.01616*** (0.00235)	0.01530*** (0.00218)	0.01380*** (0.00193)	0.01441*** (0.00181)	0.01340*** (0.00177)	0.01322*** (0.00169)	0.01264*** (0.00161)
<i>R²</i>	0.0010	0.0012	0.0022	0.0017	0.0011	0.0009	0.0008	0.0007	0.0006	0.0005
<i>N</i>	8,284,597	13,314,014	17,630,113	21,507,130	23,745,303	27,298,018	29,962,932	32,175,879	34,319,660	36,502,055
Patent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents coefficient estimates of the LPM model specified in equation (2), where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, ‘deceased patent inventor’ and ‘at risk of citing deceased patent inventor,’ where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Since we estimate the likelihood of a rare event (the unconditional baseline incidence rate for 20 miles is 0.0149), R^2 values are low and small coefficients can imply economically meaningful relative changes. Estimates are measured in percentage points. $Alive = 1$ indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. $Experience = 1$ indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC section) of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A9 - Robustness check: regional technology class patent controls

Patent controls are defined as the count of patents originating from a particular city in a given CPC subsection within a five-year window.

	20 miles
<i>Alive</i>	0.03521*** (0.00359)
<i>Patent controls</i>	-0.00000104*** (0.000000252)
Patent FE	Yes
	20 miles
<i>Alive</i>	0.02343*** (0.0031)
<i>Experience</i>	0.01152*** (0.00173)
<i>Alive*Experience</i>	0.06354*** (0.00758)
<i>Patent controls</i>	-0.00000133*** 0.000000261
Patent FE	Yes

Note: This table presents coefficient estimates of the LPM model specified in equations (1) and (2), respectively, where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Since we estimate the likelihood of a rare event (the unconditional baseline incidence rate for 20 miles is 0.0149), R^2 values are low and small coefficients can imply economically meaningful relative changes. Estimates are measured in percentage points. Alive = 1 indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. Experience = 1 indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC subsection) of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A10 - Robustness check: regional technology class inventor controls

Inventor controls are defined as the count of inventors living in a given city who have filed at least one patent in a given CPC subsection within a five-year window.

	20 miles
<i>Alive</i>	0.03522*** (0.00359)
<i>Inventor controls</i>	-0.00000207*** (0.000000471)
Patent FE	Yes
	20 miles
<i>Alive</i>	0.02347*** (0.0031)
<i>Experience</i>	0.01148*** (0.00173)
<i>Alive*Experience</i>	0.06352*** (0.00758)
<i>Inventor controls</i>	-0.00000249*** 0.000000484
Patent FE	Yes

Note: This table presents coefficient estimates of the LPM model specified in equations (1) and (2), respectively, where the dependent variable indicates a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Since we estimate the likelihood of a rare event (the unconditional baseline incidence rate for 20 miles is 0.0149), R^2 values are low and small coefficients can imply economically meaningful relative changes. Estimates are measured in percentage points. *Alive* = 1 indicates that the potentially citing inventor lives within radius r of a living co-inventor of a deceased inventor. *Experience* = 1 indicates that the potentially citing inventor has experience from prior patenting in the technology class (CPC subsection) of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level.

A11 - Estimations for recency of experience and multiple technologies (H2,3,4) and as illustrated Figures 5, 6, and 7

Recency of experience

	abs <= 5yr	5yr<abs<=10yr
<i>Alive</i>	0.02430*** (0.00314)	0.03543*** (0.00363)
<i>Experience</i>	0.01199*** (0.00184)	0.00357 (0.00286)
<i>Alive*Experience</i>	0.06729*** (0.00815)	0.00482 (0.00581)
R^2	0.0014	0.0011
N	13,314,014	13,314,014
Patent FE	Yes	Yes

Note: This table shows the estimated marginal benefit of having absorptive capacity and being within 20 miles to an alive inventor measured in increases of the citation propensities in % estimated from the LPM model specified in equation (2). Separate estimates for potentially citing inventors (a) with more recent experience, defined as having applied for at least one prior patent with the same CPC subsection as the deceased patent within less than or equal to 5 years since the grant date of the potentially citing patent (excluding the potentially citing patent itself) and (b) inventors with the most recent experience in the same CPC subsection as the deceased patent gained 5 to 10 years since the grant date of the potentially citing patent. The dependent variable is a dummy variable indicating a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Potentially citing inventor has experience from prior patenting in the first mentioned CPC subsection of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level. Graphs show 95% confidence bands.

Multiple technologies

	single cpc	2+ cpc
<i>Alive</i>	0.0177*** (0.00347)	0.03379*** (0.00579)
<i>Experience</i>	0.015*** (0.00269)	0.00886*** (0.00159)
<i>Alive*Experience</i>	0.03194*** (0.00629)	0.11011*** (0.01655)
R^2	0.0015	0.0015
N	7,688,765	5,625,249
Patent FE	Yes	Yes

Note: This table shows the estimated marginal benefit of having absorptive capacity and being within 20 miles to an alive inventor measured in increases of the citation propensities in % estimated from the LPM model specified in equation (2). Separate estimates for deceased patents (a) where the patented technology comes from one specific field (CPC sections, 54%) and (b) those that span more than one technological field (2+ CPC sections, 39% cover two fields, 5% three, and 2% more). The dependent variable is a dummy variable indicating a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Potentially citing inventor has experience from prior patenting in the first mentioned CPC subsection of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level. Graphs show 95% confidence bands.

Multiple technologies & recency of experience

	single cpc & abs <= 5yr	single cpc & 5yr<abs<=10yr	2+ cpc & abs <= 5yr	2+ cpc & 5yr<abs<=10yr
<i>Alive</i>	0.01788*** (0.00347)	0.02488*** (0.00434)	0.03446*** (0.00578)	0.05066*** (0.00629)
<i>Experience</i>	0.01529*** (0.00291)	0.00707 (0.00444)	0.00941*** (0.0016)	-0.00186 (0.00129)
<i>Alive*Experience</i>	0.03423*** (0.00684)	-0.00355 (0.00597)	0.11820*** (0.01805)	0.01769 (0.01117)
<i>R</i> ²	0.0016	0.0013	0.0015	0.0010
<i>N</i>	7,688,765	7,688,765	5,625,249	5,625,249
Patent FE	Yes	Yes	Yes	Yes

Note: This table shows the estimated marginal benefit of having absorptive capacity and being within 20 miles to an alive inventor measured in increases of the citation propensities in % estimated from the LPM model specified in equation (2). Separate estimates for four combinations of recency of experience and complexity of deceased patent. Recent experience is defined as having applied for at least one prior patent with the same CPC subsection as the deceased patent within less than 5 years since the grant date of the potentially citing patent (excluding the potentially citing patent itself). Inventors with the most recent experience in the same CPC subsection as the deceased patent gained 5 to 10 years since the grant date of the potentially citing patent form the comparison group. Simple patented technologies are those that stay within one specific field (CPC section) and complex are those that span more than one technological field (2+ CPC sections). The dependent variable is a dummy variable indicating a cite that occurs within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. Potentially citing inventor has experience from prior patenting in the first mentioned CPC subsection of the cited patent p . Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level. Graphs show 95% confidence bands.

A12 - Estimations for within firm knowledge flows (H5) as illustrated in Figure 8

	10	20	30	40	50	60	70	80	90	100
<i>Dist alive</i>	0.18857*** (0.06620)	0.13367*** (0.03847)	0.09510*** (0.02945)	0.08658*** (0.03107)	0.10742*** (0.03431)	0.10652*** (0.03329)	0.10403*** (0.03221)	0.10177*** (0.03168)	0.09671*** (0.03003)	0.07327*** (0.02314)
<i>R</i> ²	0.0677	0.0717	0.0667	0.0636	0.0662	0.0659	0.0656	0.0651	0.0649	0.0647
<i>N</i>	215,856	318,019	355,050	361,523	372,653	378,605	382,626	382,636	379,638	396,623
<i>Patent FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table shows the marginal increase in citation propensities around still living versus deceased co-inventors from the LPM models specified in equation (1), where the dependent variable indicates a cite that occurs within a given firm and within a radius r of the location of inventor j for the same multi-author patent p within 10 years since grant of p . Unit of observation is a pair of inventors, 'deceased patent inventor' and 'at risk of citing deceased patent inventor,' where the deceased patent inventor is dead or alive, depending on the region of the citing inventor. The graph plots the coefficient of $Alive_{ijp}$ in equation (1). Standard errors clustered at the cited-potentially citing inventor pair in parentheses. Significant at the * 10% level; ** 5% level; *** 1% level. Graphs show 95% confidence bands.

Appendix references

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