

Patent Boxes and the Success Rate of Applications

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Introduction

- ▶ Patent boxes reduce the tax on qualifying income by 50%
 - ▶ Income attributed to a granted patent
- ▶ These are arguably to spur innovation
 - ▶ **Granted patents:** *Schwab & Totenhaupt (2019, WP)*, *Bradley, et al. (2015, NTJ)*, *Böhm, et al. (2015, WP)*
 - ▶ **“Quality” of Granted Patents:** *Ernst, et al. (2014, ITAX)*
 - ▶ **EPO registrations:** *Alstadsaeter, et al. (2018, EconPol)*
 - ▶ **Patent location:** *Ciaramella (2017, WP)*, *Griffith, et al. (2014, JPubE)*; *Karkinsky & Riedel (2012, JIE)*
 - ▶ **Profit location:** *Chen, et al. (2019, WP)*; *Koethenbuerger, et al. (2019, WP)*
- ▶ \$100 billion in profits shifted to 3 box users annually: IE, LUX, and NL
- ▶ 16% of EU corporate income taxes are lost (Tørslov, et al (2020, WP))

Introduction

- ▶ Focus to date is on granted patents
 - ▶ Only 54% of applications granted
 - ▶ Application costs are not cheap (over €100K)
 - ▶ Mixed patent box effects on number of applications
 - ▶ Gaessler, et al. (2019, NBER): Negative
 - ▶ Bradley, et al. (2015, NTJ): Zero
 - ▶ Bösenberg & Egger (2017, EconPol): Positive
- ▶ So how does a patent box affect application behaviour?

Introduction

- ▶ 3 potential effects on probability an application is granted
 - ▶ Submit marginal innovations (OECD (2016); Bradley, et al. (2015))
 - ▶ Selection effect **lowers chance of success**
 - ▶ Spend more on patent prosecution
 - ▶ Representative upgrading **increases chance of success**
 - ▶ Increase research effort to develop novel innovations
 - ▶ Effort effect **increases chance of success with a lag**

Our Contributions

- ▶ A simple model of application decisions
- ▶ We estimate patent box effect on success rates using data from the EPO from 1978-2019
 - ▶ Estimation window: 2000-2012
- ▶ Estimate the probability of an application being granted
 - ▶ We find that patent boxes increase the success by 6.9 pp (12%)
 - ▶ Effect only for top 5% of innovators (19+ applications; 74% of applications)
 - ▶ Results come after two year lag
 - ▶ Corp. tax and b-index do not have an effect
- ▶ This suggests the increase in research effort leading to better applications and thus more granted patents even if no change in number of applications
- ▶ But only from the cabal of major innovators

Our Contributions

- ▶ Adds to literature on success rates
 - ▶ *Lei & Wright (2017, JPubE); de Rassenfosse, et al. (2016, NBER); Webster, et al. (2014, RAND); Lemley & Sampat (2012, REStat); Bacchiocchi & Montobbio (2010, ScanJE)*
- ▶ Home bias a major focus
- ▶ No consideration of tax policy

Simple Model of Patenting

- ▶ Decisions: how many research projects, how much effort per project, which to apply for, how much to work on each application.
- ▶ Firm develops M research projects at cost $d(M) + \alpha(s)M$
 - ▶ Cost is decreasing in size s
 - ▶ Access to credit/reserves (Egger & Keuschnigg (2015, AEJ:Pol))
- ▶ Each innovation has a novelty n drawn from $F(n, e_i)$ where effort is at cost $\beta(s)e$.
 - ▶ $F_e(n, e) < 0$ and $F_{ee}(n, e) > 0$; $\beta'(s) < 0$.

Simple Model of Patenting

- ▶ If no granted patent, probability $1 - q$ someone steals your idea and you get nothing.
- ▶ If apply for a patent, put c_i into application:
 - ▶ Probability of success: $p(n_i, c_i)$; $p_n, p_c > 0$, $p_{nn}, p_{ee}, p_{ne} < 0$
 - ▶ de Rassenfosse, et al. (2018, BC)
- ▶ The patent gets you protection and lower taxes in the box

Simple Model of Patenting

- ▶ If don't apply, expected profit is (where t is the CIT):

$$q(1-t)r \quad (1)$$

- ▶ If apply, expected profit is (where $\phi = \frac{1-bt}{1-t} - q$):

$$(1-t)(p(n,e)\phi r + qr - c) \quad (2)$$

- ▶ Only get the lower tax b if you get the patent
- ▶ Apply whenever expected profits from doing so are at least as high, implying a threshold novelty $\bar{n}(\phi)$.

Model Predictions

- ▶ Introducing a patent box lowers the effective tax and:
 - ▶ Increases application effort (representative upgrading; success rises immediately)
 - ▶ Reduces the threshold novelty (selection effect; success falls immediately)
 - ▶ Increases research effort (success rises with a lag)
 - ▶ Big firms have more research effort and higher success
- ▶ CIT and b-index (tax rate on R&D costs) have no impact on submission decisions
- ▶ b-index lowers research effort
- ▶ Effective taxes and b-index reduce innovation effort and number of innovation projects

Data

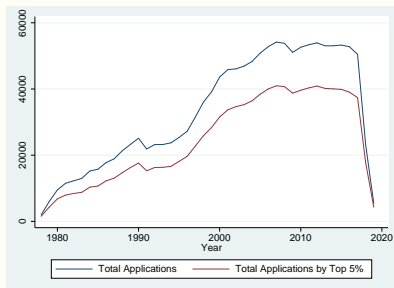
- ▶ EPO applications (1978-2019): 3.3 million; 46.3% success
- ▶ Restrict to single-country applications: 3.2 million
- ▶ Restrict to EPO members, companies: 1.4 million; 54.5% success
 - ▶ Evidence of Home Bias
- ▶ Restrict to company applicants (no individuals, govt's, unis, etc.)
 - ▶ This is about *corporate* tax policy
- ▶ Summary Stats [here](#)

Countries in Data

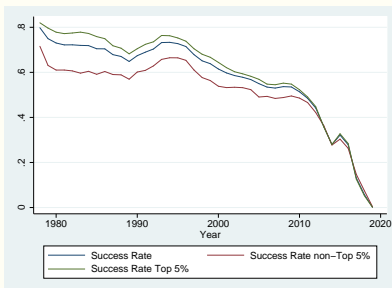
Country	Number of Applications	Success Rate	Patent Box Years
Austria	12,961	60.6	
Belgium	13,789	49.5	2007-†
Bulgaria	66	51.5	
Croatia	130	48.5	
Cyprus	414	47.8	2012-*
Czech Republic	781	48.3	
Denmark	13,072	49.8	
Finland	20,039	42.6	
France	83,094	55.6	1971-*
Germany	254,973	59.3	
Greece	337	46.9	
Hungary	661	51.6	2003-*
Ireland	4,126	47	1973-2010; 2016-*,†
Italy	41,305	58.2	2017-
Lithuania	63	55.6	2018-
Luxembourg	3,630	51.6	2008-
Malta	277	62.8	
Netherlands	46,107	42.6	2007-†
Norway	4,531	49.9	
Poland	830	46.5	2019-
Portugal	522	46.9	
Romania	60	46.7	
Slovak Republic	141	49.6	2018-
Slovenia	762	51.8	
Spain	9,046	43.8	2008-*,†
Sweden	36,774	53.2	
Switzerland	53,241	53.5	2011-*
Turkey	1,877	59.9	2015-
United Kingdom	44,989	46.3	2013-*

Truncation Issues

(a) Applications by Year

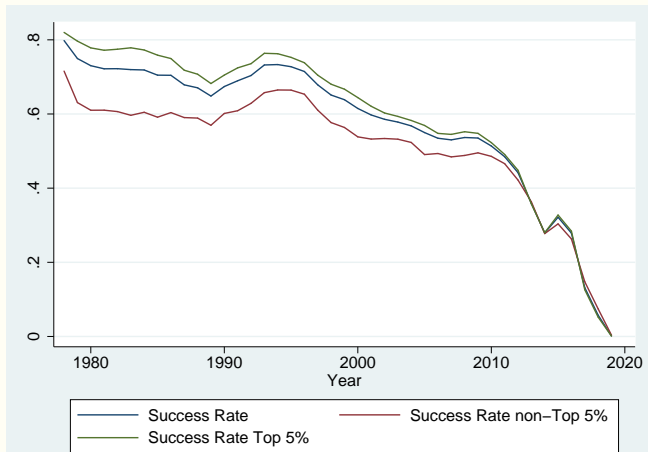


(b) Success Rate by Year





Success Rates by Year

- ▶ Fall off in success rates in 2013
- ▶ Average time to granting is 1897.5 days (5.3 years)
- ▶ Box insignificantly lowers the avg. time by 8 days
- ▶ Important for changes in resubmission activities



Patent Information

(19)  **Europäisches Patentamt**
European Patent Office
Office européen des brevets

(11)  **EP 2 912 656 B1**

(12) EUROPEAN PATENT SPECIFICATION

Grant Date → (45) Date of publication and mention of the grant of the patent:
27.02.2019 Bulletin 2019/09

Filing Date → (22) Date of filing: **17.09.2013**

(21) Application number: **13848556.0**

(51) Int. Cl.: **G10D 3/14 (2006.01)** **G10D 1/08 (2006.01)** → **Tech Codes**

(86) International application number: **PCT/SE2013/051081** → **Family ID**

(87) International publication number: **WO 2014/065740 (01.05.2014 Gazette 2014/18)**

(54) **FASTENING DEVICE FOR AN ELECTRIC GUITAR**
BEFESTIGUNGSVORRICHTUNG FÜR EINE ELEKTRISCHE GITARRE
DISPOSITIF D'ATTACHE POUR GUITARE ÉLECTRIQUE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(72) Inventor: **THIDELL, Anders**
S-151 55 Södertälje (SE) → **Inventor(s)**

(74) Representative: **Noréns Patentbyrå AB**
Box 10198
100 55 Stockholm (SE)

(30) Priority: **24.10.2012 SE 1251200**

(43) Date of publication of application:
02.09.2015 Bulletin 2015/36

Applicant(s) → (73) Proprietor: **Truetremolo Scandinavia AB**
117 61 Stockholm (SE)

(56) References cited:
WO-A1-2007/081273 **WO-A1-2007/081273**
FR-A1- 2 780 542 **FR-A1- 2 780 542**
US-A- 5 359 144 **US-A1- 2009 183 619**
US-B1- 7 479 592 **US-B1- 7 479 592**
US-B1- 7 718 873

Applicants

The 1.4 million applications come from 149K applicants. For these, we have:

- ▶ Country (use applicant *at time of initial submission*)
- ▶ Total number of applications 1978-2019
 - ▶ 1 single application (52% of applicants; 5% of applications, 42% success)
 - ▶ 2-10 applications (38%; 15%; 50%)
 - ▶ 19+ applications (5%; 74%; 54.5% success)
- ▶ Prior Success Rate over rolling 3 year window for:
 - ▶ Applicant
 - ▶ Inventor team (mean)
 - ▶ Legal representative (mean)
 - ▶ Also tried 5 and 10 year windows
 - ▶ For teams also tried max

Other Data

We also have:

- ▶ Application: Family size, number of CPC codes, number of claims (total and independent), inventor team size, int'l composition of team, forward & backward citations
- ▶ Country:
 - ▶ Patent box dummy (or tax reduction): Alstadsaeter, et al. (2018), expanded
 - ▶ Corporate Income Tax: same
 - ▶ b-index: Bösenberg & Egger (2017)
 - ▶ GDP, GDP per capita, R&D relative to GDP
- ▶ 3 digit CPC, country/applicant, and year dummies

Regression Specification

- ▶ Estimation sample is 646K applications during 2000-2012. We estimate a linear probability model:

$$Success_{aictp} = \beta_1 Box_{ct} + \beta_2 X_{aictp} + \alpha_i + \alpha_t + \alpha_{c/i} + \varepsilon_{aictk}$$

where errors are two-way clustered at the country and year levels.

- ▶ Also consider a dynamic diff-in-diff (event study) approach.
- ▶ Probit used in robustness checks. [here](#)

Baseline Results

Sample:	(1) All	(2) All	(3) All	(4) Bottom 95%	(5) Top 5%	(6) All	(7) Bottom 95%	(8) Top 5%
Patent Box	0.0382*** (0.0102)	0.0363*** (0.0114)	0.0386*** (0.0116)	0.0141 (0.0130)	0.0447** (0.0158)	0.0658*** (0.0175)	0.0179 (0.0175)	0.0693*** (0.0175)
CIT	-0.0364 (0.104)	0.00522 (0.0828)	-0.0719 (0.0875)	-0.134 (0.118)	0.0826 (0.0879)	-0.0890 (0.121)	-0.129 (0.125)	-0.0425 (0.122)
b-index	-0.0517 (0.0431)	-0.0357 (0.0420)	-0.0513 (0.0458)	-0.0924 (0.0540)	-0.0255 (0.0409)	-0.0156 (0.0514)	-0.169** (0.0559)	0.00228 (0.0468)
Family Size	0.0320*** (0.00365)	0.0318*** (0.00425)	0.0307*** (0.00443)	0.0534*** (0.00557)	0.0263*** (0.00307)	0.0405*** (0.00381)	0.0510*** (0.00449)	0.0382*** (0.00386)
Codes	-0.00215*** (0.000478)	-0.00199*** (0.000500)	-0.00211*** (0.000526)	-0.00196** (0.000810)	-0.00187*** (0.000441)	-0.00194*** (0.000373)	-0.00126* (0.000675)	-0.00202*** (0.000405)
Claims	-6.67e-05 (7.25e-05)	-7.89e-05 (6.82e-05)	-9.61e-05 (8.20e-05)	-0.000174 (0.000243)	-7.60e-05 (5.77e-05)	-3.47e-05 (5.90e-05)	0.000648** (0.000250)	-6.66e-05 (6.88e-05)
Ind. Claims	-0.00386*** (0.00114)	-0.00331*** (0.000902)	-0.00347*** (0.00111)	-0.00364* (0.00168)	-0.00286*** (0.000749)	-0.00134* (0.000733)	-0.000297 (0.00130)	-0.00166** (0.000758)
Num. Inventors	-0.00181 (0.00144)	-0.000283 (0.000957)	-0.000143 (0.000974)	0.000448 (0.00187)	0.000685 (0.000857)	0.00264*** (0.000712)	0.00189 (0.00172)	0.00259*** (0.000711)
Intl Team	-0.00138 (0.00467)	-0.00436 (0.00453)	-0.00360 (0.00494)	-0.0130* (0.00668)	-0.00186 (0.00511)	0.000420 (0.00392)	-0.00187 (0.00707)	0.000940 (0.00425)
Intl App-Inv	-0.0113 (0.0107)	-0.0107 (0.0105)	-0.0130 (0.0121)	0.0125 (0.0116)	-0.00862 (0.0105)	-0.00324 (0.00797)	0.00224 (0.0139)	-0.00258 (0.00818)
Forward Cites	0.00290*** (0.000587)	0.00297*** (0.000681)	0.00300*** (0.000673)	0.00457*** (0.000639)	0.00256*** (0.000698)	0.00240*** (0.000519)	0.00260*** (0.000466)	0.00235*** (0.000559)
Backward Cites	-0.000153 (0.000179)	-8.98e-05 (0.000183)	-0.000133 (0.000194)	0.000330 (0.000458)	-3.99e-05 (0.000199)	-4.84e-05 (0.000208)	-0.000423 (0.000391)	-1.34e-05 (0.000218)
Total Apps.	-2.78e-06*** (6.61e-07)	-3.03e-06** (1.03e-06)	-2.96e-06* (1.46e-06)	0.00328*** (0.000600)	-1.62e-06* (7.52e-07)			
App. Success	0.241*** (0.0132)	0.210*** (0.0120)	0.230*** (0.0127)	0.0675*** (0.00757)	0.398*** (0.0241)	-0.103*** (0.0235)	-0.221*** (0.0114)	0.0493 (0.0290)
Inv. Success	0.0670*** (0.00610)	0.0579*** (0.00692)	0.0625*** (0.00737)	0.0440*** (0.00713)	0.0722*** (0.00829)	0.0566*** (0.00640)	0.0130 (0.00732)	0.0699*** (0.00821)
Rep. Success		0.275*** (0.0255)		0.200*** (0.0214)	0.251*** (0.0322)	0.190*** (0.0311)	0.192*** (0.0269)	0.192*** (0.0391)
GDP	-0.446*** (0.138)	-0.302** (0.127)	-0.373** (0.142)	-0.583*** (0.134)	-0.123 (0.192)	-0.429 (0.342)	-1.005*** (0.349)	-0.244 (0.349)
GDP per capita	-0.0347 (0.143)	-0.274* (0.146)	-0.251 (0.159)	0.0153 (0.131)	-0.364* (0.182)	-0.145 (0.291)	0.245** (0.111)	-0.270 (0.301)
R&D	-0.00705 (0.0213)	-0.0193 (0.0222)	-0.0186 (0.0226)	-0.000141 (0.0203)	-0.0147 (0.0241)	-0.0430 (0.0326)	0.00810 (0.0195)	-0.0399 (0.0316)
Constant	13.30*** (3.074)	11.66*** (2.660)	13.58*** (2.928)	16.52*** (3.111)	7.479* (3.962)	14.08* (6.973)	26.13*** (5.158)	10.11 (6.893)
Obs.	646,022	551,810	551,810	158,733	393,077	510,595	117,689	392,906
Adj. R-sq.	0.095	0.105	0.099	0.073	0.130	0.192	0.270	0.178

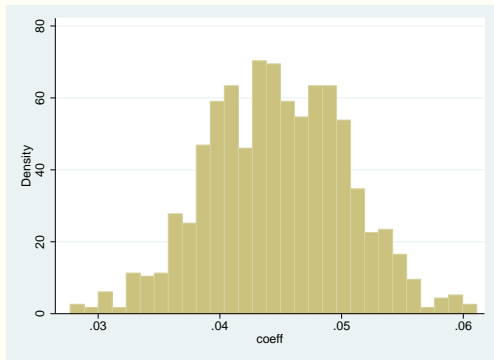


Baseline Results

Sample:	(1) All	(2) All	(3) All	(4) Bottom 95%	(5) Top 5%	(6) All	(7) Bottom 95%	(8) Top 5%
		Add Rep				App FE	App FE	App FE
Patent Box	0.0382*** (0.0102)	0.0363*** (0.0114)	0.0386*** (0.0116)	0.0141 (0.0130)	0.0447** (0.0158)	0.0658*** (0.0157)	0.0179 (0.0175)	0.0693*** (0.0175)
CIT	-0.0364 (0.104)	0.00522 (0.0828)	-0.0719 (0.0875)	-0.134 (0.118)	0.0826 (0.0879)	-0.0890 (0.121)	-0.129 (0.125)	-0.0425 (0.122)
b-index	-0.0517 (0.0431)	-0.0357 (0.0420)	-0.0513 (0.0458)	-0.0924 (0.0540)	-0.0255 (0.0409)	-0.0156 (0.0514)	-0.169** (0.0559)	0.00228 (0.0468)
Obs.	646,022	551,810	551,810	158,733	393,077	510,595	117,689	392,906

► Also tried 90/10; 99/1 splits [here](#)

Random Subsets of top 5%



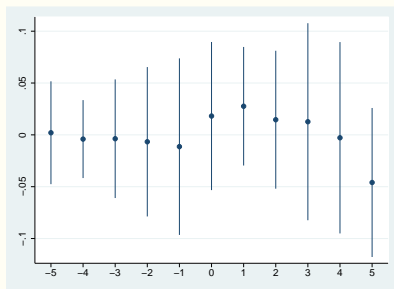
Out of 1000 random subsamples, patent box coefficient is significant at:

- ▶ 1%: 227
- ▶ 5%: 641
- ▶ 10%: 116
- ▶ Insignificant: 16

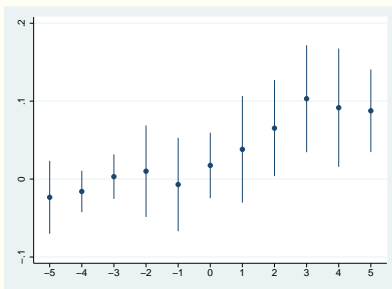
Dynamic Diff-in-Diff

Figure: Event Study

(a) Bottom 95%



(b) Top 5%



Note: 95% confidence intervals illustrated.

Robustness Checks

- ▶ Probit estimator: [here](#)
- ▶ Ending the estimation window earlier: [here](#)
- ▶ Omitting Ireland or small countries: [here](#)
- ▶ By technology class: [here](#)
- ▶ Omitting forward citations: [here](#)
- ▶ Alternatives to the 95/5 sample split: [here](#)
- ▶ Heterogenous effects by family size: [here](#)
 - ▶ Did find a positive effect for bottom 95% for pentadic applications

- ▶ In each case, positive effect for most frequent inventors.

Box Conditions

- ▶ Boxes differ in their characteristics
- ▶ Tax rate reduction: usually 50% of standard CIT rate
- ▶ Broad/narrow: Does the box cover pre-existing and acquired patents?
- ▶ Nexus requirements: a threshold of local R&D content needed to qualify
- ▶ These raise multinational considerations
 - ▶ What income qualifies?
 - ▶ As bad as transfer pricing

Box Conditions [here](#)

	(1) Tax Rate Reduction	(2) Covers Existing Patents?	(3) Nexus Requirement?
Tax Reduction	0.327*** (0.0900)		
Patent Box		0.0676*** (0.0182)	-0.0597 (0.0544)
Broad Box		0.0360* (0.0173)	
Nexus Req.			0.135** (0.0556)
CIT	-0.0516 (0.129)	-0.0230 (0.109)	-0.0368 (0.123)
b-index	-0.00212 (0.0463)	-0.00906 (0.0485)	0.00672 (0.0462)

Other Considerations

- ▶ If boxes encourage submission of marginal innovations, expect an increase in number of applications
 - ▶ We find no such effect at country or applicant level [here](#)
 - ▶ If anything, slight negative effect (Gaessler, et al. (2019, NBER))
 - ▶ Caution over sample of countries and applicants
- ▶ Boxes may encourage more revise and resubmits (fight longer for patent)
 - ▶ For eventually granted patents, 1897 days to process (just over 5 years)
 - ▶ Box lowers days to granting by an insignificant 8 days [here](#)

Conclusion

- ▶ Patent boxes are linked to an increase in the probability of an application being granted by 6.9 percentage points (12% increase)
- ▶ Effect found only in top 5% of innovating firms (who make up 75% of applications)
- ▶ Effect found only after two years
- ▶ Results argue for increased research effort as main force
 - ▶ Slight representative upgrading
 - ▶ No evidence of flooding system with mediocre applications
 - ▶ No evidence of longer fights over application

Conclusion

- ▶ Thus, patent boxes do seem to improve innovation but:
 - ▶ More granted patents may not come from more applications
 - ▶ Applications spread knowledge
 - ▶ Only for big players (cost-based incentives more help to SMEs)
 - ▶ At a significant tax revenue cost

Thank you!

Join the Society for International Trade Theory

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	(1)	(2)
Patent Box	0.128*** (0.0448)	0.208*** (0.0496)
CIT	0.258 (0.241)	-0.0813 (0.365)
b-index	-0.0684 (0.0769)	0.0273 (0.107)
Family Size	0.0752*** (0.00603)	0.115*** (0.00825)
Codes	-0.00535*** (0.000742)	-0.00600*** (0.000808)
Claims	-0.000610 (0.000609)	-0.000712 (0.000674)
Ind. Claims	-0.00728*** (0.00248)	-0.00403* (0.00233)
Num. Inventors	0.00188 (0.00175)	0.00768*** (0.00150)
Intl Team	-0.00620 (0.0114)	0.00251 (0.00761)
Intl App-Inv	-0.0237 (0.0258)	-0.00583 (0.0205)
Forward Cites	0.00780*** (0.00243)	0.00774*** (0.00219)
Backward Cites	-7.67e-05 (0.000473)	4.89e-05 (0.000525)
App. Success	-4.47e-06*** (1.72e-06)	
Inv. Success	1.084*** (0.0662)	0.116** (0.0566)
Rep. Success	0.207*** (0.0185)	0.212*** (0.0200)
GDP	-0.256 (0.608)	-0.393 (1.115)
GDP per capita	-1.084** (0.528)	-1.009 (0.971)
R&D	-0.0472 (0.0645)	-0.147* (0.0756)
Constant	16.15 (12.43)	20.60 (22.18)
Obs.	393,077	389,443

	(1)	(2)
Patent Box	0.128*** (0.0448)	0.208*** (0.0496)
CIT	0.258 (0.241)	-0.0813 (0.365)
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Obs.	393,077	389,443

Summary Statistics [Back](#)

Variable	Obs	Mean	Std. Dev.	Min	Max
Granted	646,022	0.5450325	0.4979683	0	1
Filing Date	646,022	2006.206	3.689671	2000	2012
Patent Box	646,022	0.1848466	0.3881734	0	1
CIT	646,022	0.3227945	0.0662948	0.1	0.5161155
b-index	646,022	0.9631331	0.1070114	0.5058044	1.042012
Tax Reduction	646,022	.0366621	.0777964	0	.27192
Nexus	646,022	.0529951	.2240239	0	1
Broad	646,022	.1552997	.3621904	0	1
Offices	646,022	2.593006	1.370755	0	5
Codes	646,022	5.356819	5.227992	1	329
Claims	646,022	15.05554	21.34444	1	10677
Ind. Claims	646,022	2.164754	2.405841	1	196
Num. of Inv.	646,022	2.451788	1.722909	1	99
Intl Team	646,022	0.0906625	0.2871289	0	1
Intl App-Inv	646,022	0.1282247	0.3343401	0	1
For. Cites	646,022	1.913029	5.973979	0	596
Back Cites	646,022	5.748228	8.951659	0	1013
Total Apps	646,022	4202.49	9751.625	1	43047
Prior Success (3 yrs)	646,022	0.52206	0.326566	0	1
Mean Inv Success (3 yrs)	646,022	0.2782722	0.3370434	0	1
Mean Rep Success (3 yrs)	551,810	0.5299358	0.1615784	0	1
GDP	646,022	28.07134	0.9383021	22.69007	28.8964
GDP per capita	646,022	10.68314	0.2349141	8.282806	11.62597
R&D	646,022	2.300556	0.6159442	0.2269	3.90785
Triadic	646,022	0.4766448	0.4994546	0	1
Pentadic	646,022	0.129573	0.3358333	0	1

By Technology Class [Back](#)

CPC code	All Applicants		Top 5% Only	
	Obs.	Success Rate	Obs.	Success Rate
A: Human Necessities	110,349	54.7	71,442	56.8
B: Operations and Transport	149,172	63	99,239	66.4
C: Chemistry and Metallurgy	14,531	62.5	68,676	53.7
D: Textiles	91,151	52.3	10,502	65.1
E: Fixed Constructions	33,018	56.3	17,011	62.3
F: Mechanical Engineering	79,348	60.7	55,294	64.3
G: Physics	109,706	44.1	80,037	45.5
H: Electricity	125,191	48.6	103,634	49.5
Y: Emerging Cross-Sectional Technologies	80,098	59.2	57,926	61.3

By Technology Class Back

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Contains CPC:	(A) Human Necessities	(B) Operations & Transport	(C) Chemistry & Metal	(D) Textiles	(E) Fixed Construction	(F) Mechanical Engineering	(G) Physics	(H) Electricity	(Y) Emerging Tech
Patent Box	0.0484** (0.0197)	0.00255 (0.0239)	-0.000223 (0.0161)	-0.0163 (0.0373)	0.0123 (0.0396)	0.114*** (0.0353)	0.0784*** (0.0196)	0.119*** (0.0223)	0.0664** (0.0225)
CIT	-0.00512 (0.147)	-0.163 (0.166)	0.0983 (0.199)	-0.560 (0.338)	-0.367 (0.252)	0.179 (0.204)	-0.00915 (0.143)	0.191 (0.246)	0.0824 (0.202)
b-index	-0.0338 (0.0619)	-0.133* (0.0638)	0.0219 (0.0811)	-0.341 (0.202)	-0.243 (0.140)	-0.124* (0.0657)	0.0268 (0.0653)	0.0978 (0.0719)	-0.0442 (0.0772)
Family Size	0.0406*** (0.00392)	0.0337*** (0.00451)	0.0498*** (0.00499)	0.0381*** (0.00504)	0.0347*** (0.00673)	0.0344*** (0.00390)	0.0358*** (0.00373)	0.0375*** (0.00723)	0.0287*** (0.00278)
Codes	-6.04e-05 (0.000713)	-0.00273*** (0.000402)	-0.00200*** (0.000372)	-0.00320** (0.00120)	-0.00440** (0.00178)	-0.00199*** (0.000506)	-0.00115* (0.000578)	-0.00273*** (0.000757)	-0.00125** (0.000521)
Claims	-3.06e-05 (2.47e-05)	-0.000240 (0.000282)	-8.13e-05 (0.000167)	-0.000276 (0.000561)	0.000153 (0.000586)	-0.000721 (0.000491)	-0.000170 (0.000224)	-7.69e-05 (0.000362)	-0.000188 (0.000280)
Ind. Claims	-0.000328 (0.000955)	-0.000597 (0.00162)	-0.00121 (0.000917)	0.00159 (0.00285)	0.00278 (0.00226)	0.000194 (0.00185)	-0.000269 (0.000949)	-0.00296** (0.00125)	0.000129 (0.00161)
Num. Inventors	0.00122 (0.00167)	0.00503*** (0.00106)	0.00241 (0.00175)	0.00358 (0.00448)	0.00392 (0.00427)	0.000290 (0.00148)	-0.00162 (0.00168)	0.00311 (0.00250)	0.000891 (0.00200)
Intl Team	-0.0111 (0.00769)	-0.00254 (0.0106)	0.00642 (0.00693)	0.0194 (0.0300)	0.00770 (0.0209)	0.0115 (0.0125)	0.00258 (0.0114)	0.00779 (0.00920)	0.000409 (0.00900)
Intl App-Inv	0.000266 (0.0111)	0.0102 (0.0105)	-0.00804 (0.00856)	-0.0425* (0.0199)	0.000141 (0.0225)	0.00170 (0.0142)	-0.000121 (0.0122)	-0.00434 (0.0117)	0.00188 (0.0120)
Forward Cites	0.00127* (0.000653)	0.00362*** (0.000928)	0.00166** (0.000708)	0.00322*** (0.000955)	0.00516*** (0.000883)	0.00419*** (0.000714)	0.00221*** (0.000581)	0.00231*** (0.000554)	0.00282*** (0.000463)
Backward Cites	-9.27e-06 (0.000298)	-0.000675 (0.000501)	0.000101 (0.000194)	-0.00105 (0.00125)	0.000529 (0.00212)	-0.000735 (0.00117)	-0.000117 (0.000683)	-0.00209 (0.00161)	-0.000272 (0.000499)
App. Success	0.00739 (0.0293)	0.0232 (0.0229)	0.0614 (0.0483)	0.122 (0.0756)	-0.0558 (0.0316)	-0.00478 (0.0277)	0.0593 (0.0455)	0.147** (0.0571)	0.0676** (0.0266)
Inv. Success	0.0607*** (0.0114)	0.0301*** (0.00722)	0.0872*** (0.0138)	0.0184 (0.0229)	0.0300* (0.0165)	0.0355*** (0.00974)	0.0763*** (0.0158)	0.0962*** (0.0108)	0.0421*** (0.0129)
Rep. Success	0.164*** (0.0333)	0.185*** (0.0344)	0.211*** (0.0457)	0.247*** (0.0493)	0.108** (0.0431)	0.200*** (0.0511)	0.179*** (0.0583)	0.178** (0.0678)	0.180*** (0.0444)
GDP	-0.0825 (0.312)	-0.158 (0.237)	0.144 (0.429)	0.616 (0.734)	-0.0894 (0.433)	-0.664*** (0.214)	-0.253 (0.405)	-0.506 (0.597)	-0.0973 (0.370)
GDP per capita	-0.507 (0.306)	-0.436** (0.196)	-0.201 (0.370)	-0.580 (0.623)	-0.486 (0.329)	0.0372 (0.297)	-0.166 (0.366)	-0.0747 (0.516)	-0.433 (0.419)
R&D	-0.0648* (0.0320)	0.0175 (0.0241)	-0.00510 (0.0305)	-0.222** (0.0943)	0.101** (0.0423)	0.000464 (0.0245)	-0.00481 (0.0335)	-0.0548 (0.0562)	-0.0117 (0.0176)
Constant	8.288 (5.734)	9.692* (5.250)	-1.736 (8.673)	-9.607 (15.00)	8.302 (9.762)	18.79*** (3.942)	9.018 (7.916)	15.04 (11.85)	7.750 (6.788)
Obs.	70,849	98,468	68,081	10,220	16,484	54,494	79,173	102,965	56,880
Adj. R-sq.	0.159	0.165	0.156	0.194	0.151	0.170	0.190	0.155	0.180



Earlier Ending Dates [Back](#)

	(1)	(2)	(3)
Ending in:	2011	2010	2009
Patent Box	0.0605*** (0.0165)	0.0542*** (0.0161)	0.0395** (0.0128)
CIT	-0.0480 (0.123)	-0.0134 (0.110)	0.0334 (0.0927)
b-index	0.0400 (0.0419)	0.0322 (0.0395)	0.0444 (0.0479)
Family Size	0.0394*** (0.00378)	0.0395*** (0.00403)	0.0412*** (0.00369)
Codes	-0.00187*** (0.000406)	-0.00174*** (0.000420)	-0.00175*** (0.000463)
Claims	-5.70e-05 (6.16e-05)	-4.80e-05 (5.65e-05)	-3.57e-05 (4.72e-05)
Ind. Claims	-0.00143* (0.000755)	-0.00163* (0.000760)	-0.00170* (0.000805)
Num. Inventors	0.00251** (0.000828)	0.00256** (0.000836)	0.00274*** (0.000833)
Intl Team	0.00155 (0.00464)	0.00216 (0.00520)	0.00205 (0.00599)
Intl App-Inv	0.000398 (0.00871)	0.000541 (0.00889)	-6.89e-05 (0.00914)
Forward Cites	0.00236*** (0.000592)	0.00240*** (0.000568)	0.00240*** (0.000540)
Backward Cites	-5.95e-05 (0.000186)	-6.34e-05 (0.000247)	-5.56e-05 (0.000313)
App. Success	0.0357 (0.0320)	0.0216 (0.0358)	-0.000244 (0.0390)
Inv. Success	0.0691*** (0.00822)	0.0686*** (0.00823)	0.0677*** (0.00816)
Rep. Success	0.183*** (0.0407)	0.168*** (0.0385)	0.201*** (0.0476)
GDP	-0.348 (0.349)	-0.516 (0.422)	-1.057*** (0.246)
GDP per capita	-0.258 (0.317)	-0.0665 (0.500)	0.663* (0.322)
R&D	-0.0755** (0.0268)	-0.0755** (0.0332)	-0.0447 (0.0286)
Constant	12.96* (6.751)	15.64* (7.041)	22.88*** (4.838)
Obs.	360,561	326,846	291,125
Adj. R-sq.	0.179	0.183	0.190

Omitting Countries

Back

	(1)	(2)
Sample excludes:	Ireland	Countries with <1000 obs.
Patent Box	0.0659*** (0.0185)	0.0695*** (0.0175)
CIT	-0.0598 (0.123)	-0.0473 (0.126)
b-index	0.00501 (0.0479)	0.00642 (0.0460)
Family Size	0.0382*** (0.00391)	0.0382*** (0.00390)
Codes	-0.00201*** (0.000410)	-0.00202*** (0.000406)
Claims	-7.04e-05 (7.29e-05)	-6.61e-05 (6.82e-05)
Ind. Claims	-0.00177** (0.000778)	-0.00160* (0.000769)
Num. Inventors	0.00265*** (0.000724)	0.00262*** (0.000718)
Intl Team	0.00126 (0.00443)	0.00117 (0.00432)
Intl App-Inv	-0.00258 (0.00836)	-0.00265 (0.00822)
Forward Cites	0.00234*** (0.000566)	0.00235*** (0.000570)
Backward Cites	-1.32e-05 (0.000220)	-1.24e-05 (0.000217)
App. Success	0.0501 (0.0295)	0.0496 (0.0292)
Inv. Success	0.0699*** (0.00830)	0.0699*** (0.00829)
Rep. Success	0.193*** (0.0389)	0.192*** (0.0395)
GDP	-0.152 (0.324)	-0.257 (0.358)
GDP per capita	-0.357 (0.279)	-0.276 (0.309)
R&D	-0.0366 (0.0305)	-0.0426 (0.0322)
Constant	8.463 (6.444)	10.55 (7.027)
Obs.	390,797	391,312
Adj. R-sq.	0.178	0.178

Omitting Countries

Back

	(1)	(2)
Sample excludes:	Ireland	Countries with <1000 obs.
Patent Box	0.0659*** (0.0185)	0.0695*** (0.0175)
CIT	-0.0598 (0.123)	-0.0473 (0.126)
b-index	0.00501 (0.0479)	0.00642 (0.0460)
Family Size	0.0382*** (0.00391)	0.0382*** (0.00390)
Codes	-0.00201*** (0.000410)	-0.00202*** (0.000406)
Claims	-7.04e-05 (7.29e-05)	-6.61e-05 (6.82e-05)
Ind. Claims	-0.00177** (0.000778)	-0.00160* (0.000769)
Num. Inventors	0.00265*** (0.000724)	0.00262*** (0.000718)
Intl Team	0.00126 (0.00443)	0.00117 (0.00432)
Intl App-Inv	-0.00258 (0.00836)	-0.00265 (0.00822)
Forward Cites	0.00234*** (0.000566)	0.00235*** (0.000570)
Backward Cites	-1.32e-05 (0.000220)	-1.24e-05 (0.000217)
App. Success	0.0501 (0.0295)	0.0496 (0.0292)
Inv. Success	0.0699*** (0.00830)	0.0699*** (0.00829)
Rep. Success	0.193*** (0.0389)	0.192*** (0.0395)
GDP	-0.152 (0.324)	-0.257 (0.358)
GDP per capita	-0.357 (0.279)	-0.276 (0.309)
R&D	-0.0366 (0.0305)	-0.0426 (0.0322)
Constant	8.463 (6.444)	10.55 (7.027)
Obs.	390,797	391,312
Adj. R-sq.	0.178	0.178



Family Size Back

Sample:	(1) Triadic Only	(2) Pentadic Only	(3) All
Patent Box	0.0903*** (0.0189)	0.107*** (0.0327)	0.0675* (0.0358)
Box*Family Size			0.000540 (0.0107)
CIT	-0.113 (0.180)	-0.287* (0.156)	-0.0422 (0.123)
b-index	0.0558 (0.0575)	0.107 (0.0868)	0.00238 (0.0475)
Family Size	0.0200*** (0.00379)	0 (1.19e-05)	0.0380*** (0.00429)
Codes	-0.00182*** (0.000414)	-0.00194*** (0.000584)	-0.00202*** (0.000403)
Claims	-6.69e-05 (7.24e-05)	-0.000249 (0.000430)	-6.66e-05 (6.93e-05)
Ind. Claims	-0.00195** (0.000799)	-0.00110 (0.00138)	-0.00166* (0.000791)
Num. Inventors	0.00191* (0.00104)	0.00348* (0.00171)	0.00259*** (0.000717)
Intl Team	0.00322 (0.00519)	0.000871 (0.00780)	0.000941 (0.00435)
Intl App-Inv	-0.00376 (0.0107)	4.49e-05 (0.0124)	-0.00259 (0.00829)
Forward Cites	0.00257*** (0.000691)	0.00243** (0.000944)	0.00235*** (0.000555)
Backward Cites	-0.000272 (0.000166)	-0.000397* (0.000203)	-1.31e-05 (0.000204)
App. Success	0.0684* (0.0361)	0.0327 (0.0285)	0.0493 (0.0291)
Inv. Success	0.0764*** (0.00996)	0.0975*** (0.0144)	0.0698*** (0.00815)
Rep. Success	0.184*** (0.0425)	0.170*** (0.0505)	0.192*** (0.0391)
GDP	-0.0482 (0.446)	-0.0139 (0.612)	-0.244 (0.349)
GDP per capita	-0.416 (0.311)	-0.323 (0.434)	-0.270 (0.301)
R&D	-0.0552 (0.0399)	-0.0701 (0.0551)	-0.0399 (0.0311)
Constant	6.224 (9.342)	4.386 (13.10)	10.11 (6.890)
Obs.	214,546	62,247	392,906
Adj. R-sq.	0.178	0.181	0.178



Box Conditions back

	(1) Tax Rate Reduction	(2) Covers Existing Patents?	(3) Nexus Requirement?
Tax Reduction	0.327*** (0.0900)		
Patent Box		0.0676*** (0.0182)	-0.0597 (0.0544)
Broad Box		0.0360* (0.0173)	
Nexus Req.			0.135** (0.0556)
CIT	-0.0516 (0.129)	-0.0230 (0.109)	-0.0368 (0.123)
b-index	-0.00212 (0.0463)	-0.00906 (0.0485)	0.00672 (0.0462)
Family Size	0.0381*** (0.00379)	0.0381*** (0.00390)	0.0382*** (0.00388)
Codes	-0.00201*** (0.000406)	-0.00202*** (0.000406)	-0.00203*** (0.000400)
Claims	-6.67e-05 (6.93e-05)	-6.65e-05 (6.99e-05)	-6.66e-05 (6.88e-05)
Ind. Claims	-0.00166* (0.000761)	-0.00168** (0.000745)	-0.00166** (0.000762)
Num. Inventors	0.00259*** (0.000699)	0.00261*** (0.000728)	0.00258*** (0.000700)
Intl Team	0.000931 (0.00425)	0.000948 (0.00420)	0.00107 (0.00464)
Intl App-Inv	-0.00262 (0.00812)	-0.00256 (0.00815)	-0.00255 (0.00835)
Forward Cites	0.00235*** (0.000562)	0.00235*** (0.000565)	0.00235*** (0.000586)
Backward Cites	-1.41e-05 (0.000216)	-2.01e-05 (0.000223)	-1.47e-05 (0.000217)
App. Success	0.0490 (0.0290)	0.0491 (0.0289)	0.0499 (0.0290)
Inv. Success	0.0697*** (0.00814)	0.0698*** (0.00816)	0.0696*** (0.00827)
Rep. Success	0.192*** (0.0389)	0.192*** (0.0389)	0.193*** (0.0387)
GDP	-0.230 (0.341)	-0.401 (0.271)	-0.201 (0.354)
GDP per capita	-0.284 (0.293)	-0.126 (0.240)	-0.311 (0.306)
R&D	-0.0412 (0.0318)	-0.0499* (0.0262)	-0.0394 (0.0307)
Constant	9.893 (6.753)	12.98** (5.400)	9.353 (6.960)
Obs.	392.906	392.906	392.906
Adj. R-sq.	0.178	0.178	0.178



Number of Applications [back](#)

Following Bösenberg & Egger (2017, EconPol), use negative binomial:

Number of Apps:	(1) Country-Level		(3) Applicant-Level	
	Submitted	Granted	Submitted	Granted
Patent Box	-0.125* (0.0742)	-0.0282 (0.0572)	-0.323* (0.186)	-0.167** (0.0717)
CIT	-0.178 (0.376)	-0.482 (0.484)	-0.175 (0.614)	-0.408 (0.472)
b-index	0.0455 (0.149)	-0.134 (0.170)	-0.0578 (0.331)	-0.136 (0.268)
App. Success			0.151** (0.0616)	0.419*** (0.0523)
GDP	3.462*** (0.656)	2.490*** (0.698)	3.478*** (0.912)	2.407*** (0.928)
GDP per capita	-1.670*** (0.470)	-1.540*** (0.464)	-1.811** (0.784)	-1.341* (0.776)
R&D	0.185* (0.0992)	0.168* (0.0958)	0.132 (0.134)	0.0834 (0.115)
Obs.	371	371	50,066	49,684
Num. of Countries	29	29		
Num. of Applicants			6,346	6,215

Other Splits [Back](#)

Sample:	(1) Bottom 90%	(2) Top 10%	(3) Bottom 97.5%	(4) Top 2.5%	(5) Bottom 99%	(6) Top 1%	(7) Top 10-1%
Patent Box	0.00571 (0.0155)	0.0690*** (0.0161)	0.0101 (0.0187)	0.0743*** (0.0177)	0.00835 (0.0127)	0.0771*** (0.0192)	0.0693*** (0.0175)
CIT	-0.0926 (0.142)	-0.0584 (0.117)	-0.149 (0.102)	-0.00306 (0.130)	-0.177* (0.0948)	0.0546 (0.141)	-0.0425 (0.122)
b-index	-0.241*** (0.0548)	0.00169 (0.0471)	-0.179*** (0.0499)	0.0231 (0.0436)	-0.169*** (0.0423)	0.0476 (0.0421)	0.00228 (0.0468)
Family Size	0.0507*** (0.00442)	0.0392*** (0.00383)	0.0500*** (0.00442)	0.0369*** (0.00384)	0.0479*** (0.00383)	0.0355*** (0.00377)	0.0382*** (0.00386)
Codes	-0.00108 (0.000749)	-0.00200*** (0.000379)	-0.00186** (0.000695)	-0.00192*** (0.000411)	-0.00186*** (0.000495)	-0.00197*** (0.000461)	-0.00202*** (0.000405)
Claims	0.000562* (0.000268)	-4.98e-05 (6.25e-05)	3.98e-06 (7.70e-05)	-0.000294 (0.000244)	4.25e-06 (6.78e-05)	-0.000391 (0.000270)	-6.66e-05 (6.88e-05)
Ind. Claims	0.00131 (0.00162)	-0.00164* (0.000799)	0.000915 (0.00110)	-0.00154 (0.00102)	0.000614 (0.000793)	-0.00176 (0.00124)	-0.00166** (0.000758)
Num. Inventors	0.00365 (0.00207)	0.00257*** (0.000719)	0.00381** (0.00174)	0.00236*** (0.000671)	0.00376*** (0.00119)	0.00190** (0.000804)	0.00259*** (0.000711)
Intl Team	-0.00341 (0.0139)	0.000867 (0.00401)	0.000999 (0.00694)	0.000449 (0.00694)	0.000610 (0.00430)	0.000609 (0.00631)	0.000940 (0.00425)
Intl App-Inv	-0.00175 (0.0168)	-0.00275 (0.00815)	0.00973 (0.0114)	-0.00263 (0.00855)	0.00436 (0.0101)	-0.00133 (0.00907)	-0.00258 (0.00818)
Forward Cites	0.00228*** (0.000602)	0.00239*** (0.000572)	0.00315*** (0.000449)	0.00222*** (0.000575)	0.00214** (0.000972)	0.00250*** (0.000445)	0.00235*** (0.000559)
Backward Cites	-0.000432 (0.000431)	-2.43e-05 (0.000210)	-0.000615 (0.000530)	2.87e-05 (0.000218)	-0.000265 (0.000314)	2.62e-05 (0.000237)	-1.34e-05 (0.000218)
App. Success	-0.268*** (0.0102)	-0.0111 (0.0253)	-0.182*** (0.0132)	0.133*** (0.0327)	-0.158*** (0.0146)	0.252*** (0.0380)	0.0493 (0.0290)
Inv. Success	0.0110 (0.00677)	0.0649*** (0.00721)	0.0138* (0.00673)	0.0767*** (0.00899)	0.0162*** (0.00508)	0.0867*** (0.00988)	0.0698*** (0.00821)
Rep. Success	0.0755** (0.0325)	0.189*** (0.0360)	0.0785*** (0.0212)	0.192*** (0.0439)	0.0883*** (0.0145)	0.196*** (0.0509)	0.192*** (0.0391)
GDP	-1.184*** (0.282)	-0.306 (0.326)	-0.890*** (0.121)	-0.145 (0.349)	-0.767*** (0.132)	-0.0127 (0.352)	-0.244 (0.349)
GDP per capita	0.384* (0.194)	-0.228 (0.278)	0.147* (0.0771)	-0.360 (0.295)	0.0614 (0.0863)	-0.505 (0.300)	-0.270 (0.301)
R&D	0.0368 (0.0250)	-0.0423 (0.0306)	0.0281 (0.0192)	-0.0409 (0.0321)	0.0192 (0.0122)	-0.0314 (0.0319)	-0.0399 (0.0316)
Constant	29.60*** (6.779)	11.44 (6.552)	23.96*** (4.092)	8.207 (6.880)	21.48*** (3.670)	5.927 (6.857)	10.11 (6.893)
Obs.	78,969	431,626	164,647	345,948	223,339	287,256	392,906
Adj. R-sq.	0.298	0.180	0.251	0.177	0.236	0.175	0.178



Other Splits [Back](#)

Sample:	(1) Bottom 90%	(2) Top 10%	(3) Bottom 97.5%	(4) Top 2.5%	(5) Bottom 99%	(6) Top 1%	(7) Top 10-1%
Patent Box	0.00571 (0.0155)	0.0690*** (0.0161)	0.0101 (0.0187)	0.0743*** (0.0177)	0.00835 (0.0127)	0.0771*** (0.0192)	0.0693*** (0.0175)
CIT	-0.0926 (0.142)	-0.0584 (0.117)	-0.149 (0.102)	-0.00306 (0.130)	-0.177* (0.0948)	0.0546 (0.141)	-0.0425 (0.122)
b-index	-0.241*** (0.0548)	0.00169 (0.0471)	-0.179*** (0.0499)	0.0231 (0.0436)	-0.169*** (0.0423)	0.0476 (0.0421)	0.00228 (0.0468)
Family Size	0.0507*** (0.00442)	0.0392*** (0.00383)	0.0500*** (0.00442)	0.0369*** (0.00384)	0.0479*** (0.00383)	0.0355*** (0.00377)	0.0382*** (0.00386)
Codes	-0.00108 (0.000749)	-0.00200*** (0.000379)	-0.00186** (0.000695)	-0.00192*** (0.000411)	-0.00186*** (0.000495)	-0.00197*** (0.000461)	-0.00202*** (0.000405)
Claims	0.000562* (0.000268)	-4.98e-05 (6.25e-05)	3.98e-06 (7.70e-05)	-0.000294 (0.000244)	4.25e-06 (6.78e-05)	-0.000391 (0.000270)	-6.66e-05 (6.88e-05)
Ind. Claims	0.00131 (0.00162)	-0.00164* (0.000799)	0.000915 (0.00110)	-0.00154 (0.00102)	0.000614 (0.000793)	-0.00176 (0.00124)	-0.00166** (0.000758)
Num. Inventors	0.00365 (0.00207)	0.00257*** (0.000719)	0.00381** (0.00174)	0.00236*** (0.000671)	0.00376*** (0.00119)	0.00190** (0.000804)	0.00259*** (0.000711)
Intl Team	-0.00341 (0.0139)	0.000867 (0.00401)	0.000999 (0.00694)	0.000449 (0.00694)	0.000610 (0.00430)	0.000609 (0.00631)	0.000940 (0.00425)
Intl App-Inv	-0.00175 (0.0168)	-0.00275 (0.00815)	0.00973 (0.0114)	-0.00263 (0.00855)	0.00436 (0.0101)	-0.00133 (0.00907)	-0.00258 (0.00818)
Forward Cites	0.00228*** (0.000602)	0.00239*** (0.000572)	0.00315*** (0.000449)	0.00222*** (0.000575)	0.00214** (0.000972)	0.00250*** (0.000445)	0.00235*** (0.000559)
Backward Cites	-0.000432 (0.000431)	-2.43e-05 (0.000210)	-0.000615 (0.000530)	2.87e-05 (0.000218)	-0.000265 (0.000314)	2.62e-05 (0.000237)	-1.34e-05 (0.000218)
App. Success	-0.268*** (0.0102)	-0.0111 (0.0253)	-0.182*** (0.0132)	0.133*** (0.0327)	-0.158*** (0.0146)	0.252*** (0.0380)	0.0493 (0.0290)
Inv. Success	0.0110 (0.00677)	0.0649*** (0.00721)	0.0138* (0.00673)	0.0767*** (0.00899)	0.0162*** (0.00508)	0.0867*** (0.00988)	0.0698*** (0.00821)
Rep. Success	0.0755** (0.0325)	0.189*** (0.0360)	0.0785*** (0.0212)	0.192*** (0.0439)	0.0883*** (0.0145)	0.196*** (0.0509)	0.192*** (0.0391)
GDP	-1.184*** (0.282)	-0.306 (0.326)	-0.890*** (0.121)	-0.145 (0.349)	-0.767*** (0.132)	-0.0127 (0.352)	-0.244 (0.349)
GDP per capita	0.384* (0.194)	-0.228 (0.278)	0.147* (0.0771)	-0.360 (0.295)	0.0614 (0.0863)	-0.505 (0.300)	-0.270 (0.301)
R&D	0.0368 (0.0250)	-0.0423 (0.0306)	0.0281 (0.0192)	-0.0409 (0.0321)	0.0192 (0.0122)	-0.0314 (0.0319)	-0.0399 (0.0316)
Constant	29.60*** (6.779)	11.44 (6.552)	23.96*** (4.092)	8.207 (6.880)	21.48*** (3.670)	5.927 (6.857)	10.11 (6.893)
Obs.	78,969	431,626	164,647	345,948	223,339	287,256	392,906
Adj. R-sq.	0.298	0.180	0.251	0.177	0.236	0.175	0.178



Days to Granting back

	(1)	(2)	(3)
Sample:	All	Bottom 95%	Top 5%
Patent Box	-13.20 (49.11)	-78.88 (85.03)	-8.473 (43.46)
CIT	-17.67 (492.2)	-136.3 (360.8)	1.882 (411.1)
b-index	-152.3 (146.5)	-33.37 (138.5)	-175.7 (138.4)
Family Size	24.34* (12.37)	15.58** (6.795)	25.51** (10.36)
Codes	11.47*** (0.699)	9.109*** (1.282)	11.70*** (0.917)
Claims	2.796*** (0.763)	0.470 (0.542)	3.222*** (0.721)
Ind. Claims	4.560 (4.029)	3.260 (3.639)	4.472 (3.706)
Num. Inventors	13.77** (5.469)	13.85* (6.425)	13.81*** (4.442)
Intl Team	5.248 (14.24)	16.24 (21.50)	4.117 (11.67)
Intl App-Inv	61.50*** (17.05)	71.17* (36.88)	59.40*** (17.13)
Forward Cites	-6.063*** (1.349)	-6.284*** (1.929)	-6.027*** (1.283)
Backward Cites	4.380* (2.075)	6.503* (3.109)	4.244* (2.249)
App. Success	-35.46 (29.44)	-42.69* (22.69)	-45.61 (37.39)
Inv. Success	-11.49 (23.39)	53.89*** (14.12)	-21.72 (15.69)
Rep. Success	-216.0* (104.6)	-160.0*** (41.26)	-220.0** (75.95)
GDP	-2.565*** (708.3)	-1.447** (650.6)	-2.711*** (415.7)
GDP per capita	2.832 (1.935)	1.253* (610.1)	3.069** (1.085)
R&D	-114.0 (87.28)	74.18 (76.67)	-132.9 (76.61)
Constant	43,901*** (1,075)	28,870* (15,429)	45,541*** (78.47)
Obs.	302,510	58,800	243,710
Adj. R-sq.	0.271	0.381	0.255

Days to Granting back

	(1)	(2)	(3)
Sample:	All	Bottom 95%	Top 5%
Patent Box	-13.20 (49.11)	-78.88 (85.03)	-8.473 (43.46)
CIT	-17.67 (492.2)	-136.3 (360.8)	1.882 (411.1)
b-index	-152.3 (146.5)	-33.37 (138.5)	-175.7 (138.4)
Family Size	24.34* (12.37)	15.58** (6.795)	25.51** (10.36)
Codes	11.47*** (0.699)	9.109*** (1.282)	11.70*** (0.917)
Claims	2.796*** (0.763)	0.470 (0.542)	3.222*** (0.721)
Ind. Claims	4.560 (4.029)	3.260 (3.639)	4.472 (3.706)
Num. Inventors	13.77** (5.469)	13.85* (6.425)	13.81*** (4.442)
Intl Team	5.248 (14.24)	16.24 (21.50)	4.117 (11.67)
Intl App-Inv	61.50*** (17.05)	71.17* (36.88)	59.40*** (17.13)
Forward Cites	-6.063*** (1.349)	-6.284*** (1.929)	-6.027*** (1.283)
Backward Cites	4.380* (2.075)	6.503* (3.109)	4.244* (2.249)
App. Success	-35.46 (29.44)	-42.69* (22.69)	-45.61 (37.39)
Inv. Success	-11.49 (23.39)	53.89*** (14.12)	-21.72 (15.69)
Rep. Success	-216.0* (104.6)	-160.0*** (41.26)	-220.0** (75.95)
GDP	-2.565*** (708.3)	-1.447** (650.6)	-2.711*** (415.7)
GDP per capita	2.832 (1.935)	1.253* (610.1)	3.069** (1.085)
R&D	-114.0 (87.28)	74.18 (76.67)	-132.9 (76.61)
Constant	43,901*** (1,075)	28,870* (15,429)	45,541*** (78.47)
Obs.	302,510	58,800	243,710
Adj. R-sq.	0.271	0.381	0.255

Omitting Forward Citations [back](#)

	(1)	(2)	(3)
Sample:	All	Bottom 95%	Top 5%
Patent Box	0.0661*** (0.0158)	0.0170 (0.0175)	0.0698*** (0.0176)
CIT	-0.0902 (0.120)	-0.125 (0.124)	-0.0447 (0.120)
b-index	-0.0166 (0.0510)	-0.167** (0.0560)	0.00103 (0.0465)
Family Size	0.0398*** (0.00386)	0.0502*** (0.00445)	0.0375*** (0.00396)
Codes	-0.00183*** (0.000364)	-0.00112 (0.000671)	-0.00192*** (0.000399)
Claims	-2.56e-05 (5.64e-05)	0.000674** (0.000245)	-5.83e-05 (6.38e-05)
Ind. Claims	-0.00130 (0.000768)	-0.000286 (0.00131)	-0.00162* (0.000796)
Num. Inventors	0.00283*** (0.000713)	0.00204 (0.00172)	0.00277*** (0.000703)
Intl Team	0.000344 (0.00393)	-0.00162 (0.00704)	0.000832 (0.00423)
Intl App-Inv	-0.00337 (0.00779)	0.00194 (0.0139)	-0.00269 (0.00800)
Backward Cites	-3.52e-05 (0.000203)	-0.000405 (0.000392)	-7.20e-07 (0.000213)
App. Success	-0.104*** (0.0236)	-0.221*** (0.0114)	0.0486 (0.0291)
Inv. Success	0.0569*** (0.00651)	0.0128 (0.00725)	0.0701*** (0.00832)
Rep. Success	0.190*** (0.0311)	0.0666** (0.0268)	0.192*** (0.0390)
GDP	-0.434 (0.342)	-1.007*** (0.175)	-0.249 (0.349)
GDP per capita	-0.139 (0.290)	0.253** (0.103)	-0.264 (0.300)
R&D	-0.0444 (0.0332)	0.00539 (0.0196)	-0.0412 (0.0324)
Constant	14.16* (6.960)	26.11*** (5.024)	10.20 (6.894)
Obs.	510,595	117,689	392,906
Adj. R-sq.	0.192	0.269	0.178