Electronic Companion—"Opening Up Intellectual Property Strategy: Implications for Open Source Software Entry by Start-up Firms" by Wen Wen, Marco Ceccagnoli, and Chris Forman

APPENDIX A: Additional Details on Data Construction

Identification of Software Markets and the Matching Patent Classes

Step 1: Identify Software Markets

To measure entry with new OSS products related to different software markets in each year, a crucial step is to divide the software market into different markets that are reasonably distinct from each other. One main source of software markets is the product code classification system embedded in the PROMT database. For a portion of news articles from PROMT, there are a few product codes assigned to each new article that indicate what product category/categories are associated with that article. All these product categories are organized as a hierarchical structure by PROMT and are defined both in terms of customer markets and technologies. Table A-1 shows some examples of PROMT codes.

However, there are two drawbacks to just relying on PROMT classifications. First, a significant percentage (about 60%) of OSS product introduction news articles from PROMT is missing the product code field. Thus, we must manually assign product codes for this set of articles. Second, the PROMT classes do not include keywords, making it difficult to manually match articles to PROMT classes. Thus, we further match PROMT product code classes with CorpTech product code classes[1] to take advantage of the keywords defined for each CorpTech product code. The resulting concordance table (denoted as the PROMT-CorpTech concordance hereafter) consists of about 80 PROMT codes matched to CorpTech's six-digit or seven-digit product codes. Each product code is associated with a set of technology phrases specific to that product code. This is used as a basis for us to identify (i) the PROMT articles with missing product codes and (ii) the related patents across a variety of software markets. Table A-2 shows some examples of the PROMT-CorpTech concordance.

Step 2: Identify Patent Classes across Software Markets

Using the NBER patent data project and USPTO database, we constructed our patent dataset, which consists of all patents granted from 1976 to 2009. Our sample period is from 1999 to 2009. To identify the related patents across a range of markets from the PROMT-CorpTech concordance, we first examined specialist firms that produce in only one CorpTech six- or seven-digit code[2]. The sample of single specialists is from the CorpTech directory, over 1992 to 2004 and 2010.[3] We found 3500 patents held by about 700 specialists that have products associated with CorpTech codes from the PROMT-CorpTech concordance. The 3-digit USPTO classes to which the 3500 patents and their forward citations belong served as a starting point for us to map patent classes to each product code: for each product code,

[1] There are more than 290 software product codes (denoted as SOF) defined by CorpTech Directory. Each firm in this directory is associated with a set of self-reported product codes selected from these 290 SOF categories.
[2] Examples of CorpTech code are provided in Table A-2.
[3] Unfortunately, data from the CorpTech Directory from 2005 to 2009 was not available.

the top decile of these 3-digit US classes was used as candidates representing the core technologies for that code. While such endeavor to identify patent classes across software markets has been undertaken by prior research, in particular Cockburn and MacGarvie (2006, 2011), we constructed our own classification for several reasons. First, our sample period is more recent than theirs, so the mapping between patent technologies and product markets may have changed over time. Second, Cockburn and MacGarvie (2006, 2011) examined 28 specific CorpTech product codes that have incomplete overlap with the open source product markets that we study. Finally, we took the intersection of the patent classes from the patents in The Commons with the above mapping, which lead to 34 US patent classes and their corresponding product codes.

Step 3: Match Software Markets with Patent Class-subclass Combinations

Because most of the 3-digit US patent classes contain quite heterogeneous technologies, we then further generated a more detailed mapping between software product codes and US patent subclass levels by searching for technology phrases associated with each product code in patent class and subclass description. After identifying possible patent class-subclass, we then decided the concordance between product codes and patent class-subclass manually. This process generated the final mapping between software markets and patent class-subclass combinations. We further consolidated all product codes into 33 software markets based on whether they are supported by the same technologies (similar patent classes), as we are most interested in whether the supply of certain technologies by The Commons helps start-ups move into new technology area. The final concordance that we used in the empirical analysis consists of 33 software markets matched to 422 patent class-subclass combinations. Table A-3 shows some examples of this final concordance between software markets and US patent class-subclass combinations. To boost our confidence, we compared our concordance with the concordance by Cockburn and MacGarvie (2006, 2011). Among the 27 CorpTech codes examined by Cockburn and MacGarvie (2006, 2011), 17 of them closely relates to 12 software markets defined by us, though some of our software markets are broader. We compared the patent class-subclass combinations matched to the 17 product codes by Cockburn and MacGarvie (2006, 2011) with the patent class-subclass combinations matched to the 12 markets by us. As shown in Table A-4, overall, our concordance has good overlap with theirs. Figures A-1 and A-2 present a more concrete view on the above three steps.

Keywords used to identify OSS entry

We used the following set of keywords to search in PROMT news articles for introduction of software products that are licensed as open source. A software product is tagged as open source if it contains any of these keywords. We first implement automatic search and then manually check the results to ensure it is licensed as open source. Our choice of open source license terms is based on the

distribution of open source licenses used by OSS projects at SourceForge.net, which is the largest repository of OSS. Over 230,000 projects and over 3 million users and developers were registered before the end of year 2009 (SourceForge 2009).

Keywords related to generic terms of OSS:	open source , open-sourced, OSS, FLOSS, source code, GPL-compatible, non-copyleft, copyleft, free software license, open source license, open-source license, public domain
Keywords related to open source licenses:	GPL, General Public License , GNU, Lesser General Public License, LGPL, BSD, FreeBSD, Apache License, Apache Software License, Artistic License, MIT License, Mozilla Public License

Data and measure for *IBM matched patents*

As discussed in section 6.4, the variable *IBM matched patents* is used to measure IBM's IPR holdings that were not contributed to The Commons but yet may proxy for its support to OSS in market *j* and year *t*. To construct this variable we use the characteristics of IBM's patents in The Commons, or more specifically, their patent class/subclass and application years. The underlying logic is that if we observe that IBM pledged a patent that belongs to a certain class/subclass of The Commons, other patents in the same class/subclass and that were applied for around the same time would similarly capture IBM's support for OSS. The variable *IBM matched patents* is constructed in several steps. First, we select IBM patents that were not pledged but (1) belong to the same primary USPTO classification at the subclass level and (2) that were applied for in the same year as patents in The Commons.[4] Second, we match these patents to our 33 software markets according to our concordance between software markets and patent class/subclass. Last, to be consistent with how we measure *The Commons*, we measure *IBM matched patents* using the log of the claims-weighted count of these patents related to market *j* in year *t* from step 2.

It is worth noting that while *IBM matched patents* is constructed based on the patent class/subclass and application year of IBM's patents in The Commons, the two variables—*IBM matched patents* and *The Commons*—differ both in their intensity across markets and in their variation over time. For example, the mean and standard deviation of *The Commons* across the 33 markets in year 2005 are 5.293 and 1.917, whereas the mean and standard deviation of *IBM matched patents* in year 2005 are 4.977 and 2.673. We further note that although the patents used to construct *IBM matched patents* were all applied for before December 1999 due to the matching on application year with patents in The Commons (which were all applied for before December 1999), they were granted gradually and so *IBM matched*

[4] This approach is similar to the one used by Thompson and Fox-Kean (2005) and used for Tables 2 and 3 in the paper, with the difference that in Tables 2 (3) we pair each patent in The Commons (each IBM's patent in The Commons) with only one randomly selected control patent from the market (from IBM's proprietary patents).

patents varies over time during our sample period. On the other hand, the value of *The Commons* is equal to 0 before 2005. The detailed summary statistics for *IBM matched patents* are provided in the below table.

Variable name	Obs.	Mean	Std. Dev.	Min	Max
IBM matched patents	363	4.779	2.634	0	9.504

While *IBM matched patents* could be a useful proxy for IBM's overall IP support throughout the sample period, as we discuss in details in the paper, we are in particular interested in IBM's support following the SCO case. Therefore, we interact *IBM matched patents* with a year 2004 dummy (denoted as *IBM matched patents X Year 04*) to capture its support in 2004 and with a year 2003 dummy (denoted as *IBM matched patents X Year 03*) for its support in 2003.

Table A-1: Examples of PROMT Codes

7372502	Operating systems
7372503	Operating system enhancements
7372504	Graphical user interface software
7372505	Portable document software
7372510	Software development tools
7372511	CASE software
7372512	Programming utilities
7372513	Application development software
7372514	Debugging & testing software
7372520	Peripheral support software
7372521	Device driver software
7372522	Data acquisition software
7372523	Printer support software
7372530	Disk/file management software

Table A-2: Examples of the PROMT-CorpTech Concordance

CorpTech Code	PROMT Product Code
SOF-CS-F	7372650 Fax software
SOF-DM-M	7372421 DBMS
SOF-HL-M	7372466 Medical practice software
SOF-ME-S	7372544 Sound/audio software
SOF-OA-MB	7372662 BBS software
SOF-OA-MC	7372674 Videoconferencing software
SOF-OA-ME	7372605 Electronic mail software
SOF-OA-MG	7372630 Workgroup software
SOF-OA-P	7372441 DTP software
SOF-TS-EC	7372433 Civil engineering software
SOF-TS-EE	7372434 Electrical engineering software
SOF-TS-ER	7372423 Geographic information systems
SOF-UT-H	7372521 Device driver software
SOF-UT-O	7372561 Data center management software
SOF-UT-Q	7372513 Application development software
SOF-UT-X	7372691 Data encryption software

Table A-3: Examples of the Concordance between Software Markets and US Patent Class-subclass Combinations

Software Market	US class	Subclass Level 0	Subclass Level 1
Artificial Intelligence Software	706	Fuzzy Logic Hardware	Fuzzy Neural Network
Artificial Intelligence Software	706	Knowledge Processing System	Creation Or Modification
Artificial Intelligence Software	706	Knowledge Processing System	Knowledge Representation And Reasoning Technique
Artificial Intelligence Software	706	Neural Network	Learning Method
Artificial Intelligence Software	706	Neural Network	Learning Task
Artificial Intelligence Software	706	Neural Network	Neural Simulation Environment
Artificial Intelligence Software	706	Neural Network	Structure
Artificial Intelligence Software	706	Plural Processing Systems	
Data Encryption Software	380	Communication System Using Cryptography	Having Compression
Data Encryption Software	380	Communication System Using Cryptography	Time Market Interchange
Data Encryption Software	380	Facsimile Cryptography	Including Generation Of An Associated Coded Record
Data Encryption Software	380	Key Management	Having Particular Key Generator
Data Encryption Software	380	Key Management	Key Distribution
Data Encryption Software	380	Particular Algorithmic Function Encoding	NBS/DES Algorithm
Data Encryption Software	380	Particular Algorithmic Function Encoding	Public Key
Data Encryption Software	380	Video Cryptography	Copy Protection Or Prevention
Data Encryption Software	726	Access Control Or Authentication	Network
Data Encryption Software	726	Access Control Or Authentication	Stand-Alone
Data Encryption Software	726	Monitoring Or Scanning Of Software Or Data Including Attack Prevention	Intrusion Detection
Data Encryption Software	726	Protection Of Hardware	Theft Prevention

Note: 1) US patent class 706 is described as “Data processing: artificial intelligence”; US patent class 380 is described as “Cryptography”; US patent class 726 is described as “Information security”. 2) All subclasses within each US patent class are structured hierarchically. “Subclass level 0” means the subclass is on the highest level and “Subclass level 1” means the subclass is on the second highest level. Our mapping is based on subclass level 1.

Table A-4: Validation of market-patent concordance with Cockburn and MacGarvie (2006, 2011)

	Concordance by Cockburn and MacGarvie (2006, 2011)				Our concordance		
#	CorpTech SOF code	CorpTech definition	Most commonly cited USPTO class	Subclasses and other class/subclass combinations used in mapping	Software market	Patent class	Patent subclass
1	DM-MH	Hierarchical DBMS software	707	1-10 and 100-104.1	Database software	707	1-10;100-102;104.1;200-206
2	DM-MR	Relational DBMS software	707	1-10 and 100-104.1			
3	DM-Q	Database query language software	707	1-10 esp. 002-006 and 100-104.1			
4	OA-ME	Electronic message systems software	709	206	Electronic mail software	709	206
5	TS-ER	Geographic information systems software	701	2XXX; 702/005	Geographic information systems	701	117-223;300
6	UT-H	Peripheral device drivers	710	classes 1-74 esp. sub 008-019	Peripheral device drivers	710	8-19
						719	321;324;328
7	AC-B	Invoicing/Billing software	705	34, 40, 64-69	Accounting, financial and business practice software	705	16-45;51-59;64-80
8	AC-T	Tax preparation and reporting software	705	019, 031			
9	AI-A	Voice technology software	704	all subclasses up to 278	Voice communications software	704	200-256;256.1-256.8;257-278
10	AI-L	Natural language software	704	subclasses 8 and 9; class 382	Foreign language translation software	704	1-10
11	AI-N	Neural network software	706	15-45	Artificial intelligence software	706	2;10;12;14-62
12	SV-AR	Artificial intelligence R&D	706	15-62			
13	DM-F	File management software	707	sub 1-10 and 200-206	Disk/file management software	711	100-173
						707	1-10;200-206
14	MA-Q	Quality control software	700	108-115	Manufacturing and business process software	700	28-55;95-244;266-274
15	WD-I	Inventory management software	705	esp. 28 and 10		705	7-11;28;29
16	OA-GD	Three dimensional representation software	345	418-427 and 700/98; 115-212	Graphics software	345	418-428;440-443;467-475;502-506;519;520;536-689
17	OA-P	Desktop publishing software	715	500-542	Personal productivity	715	5XX

Figure A-1: Identification of Software Markets

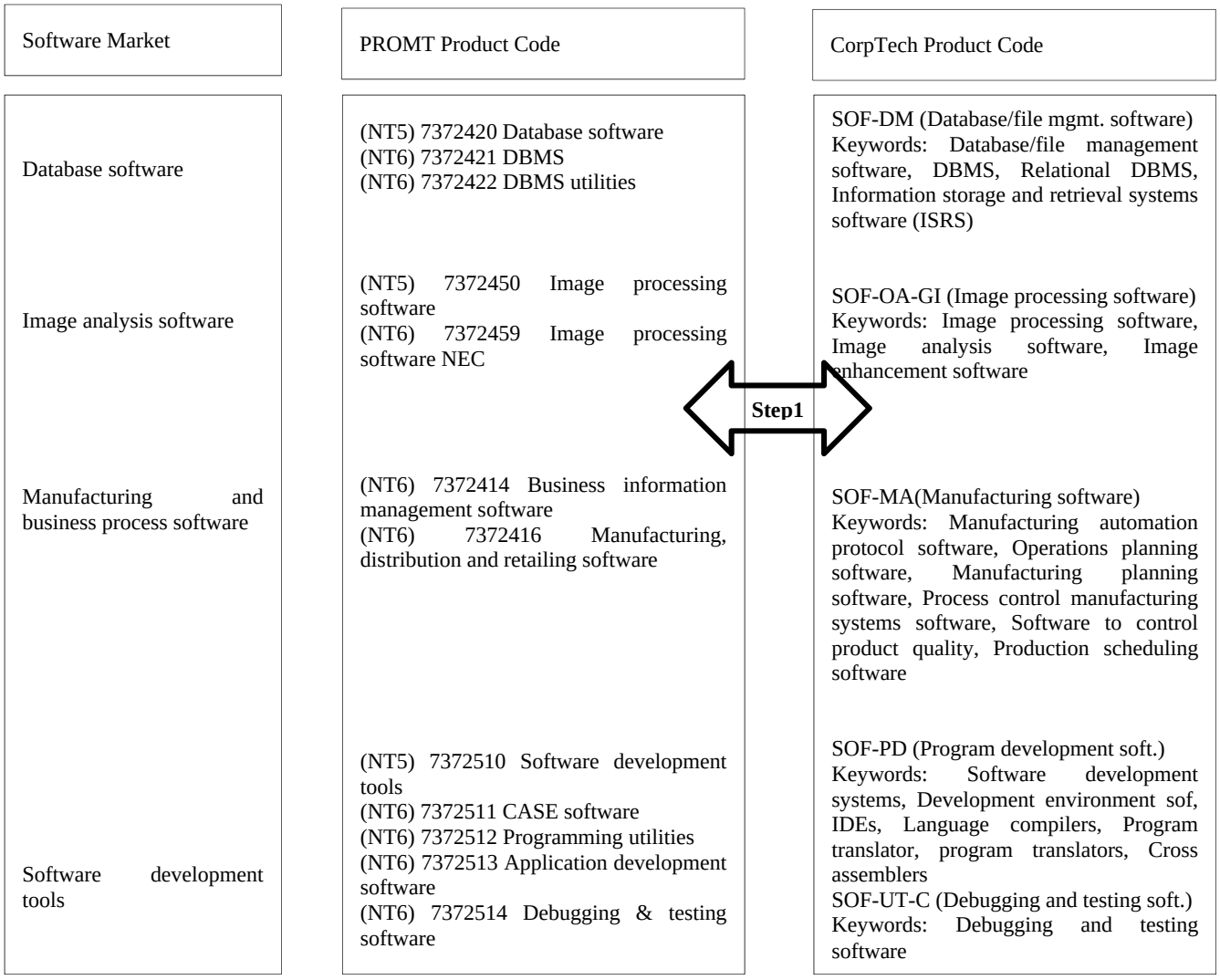
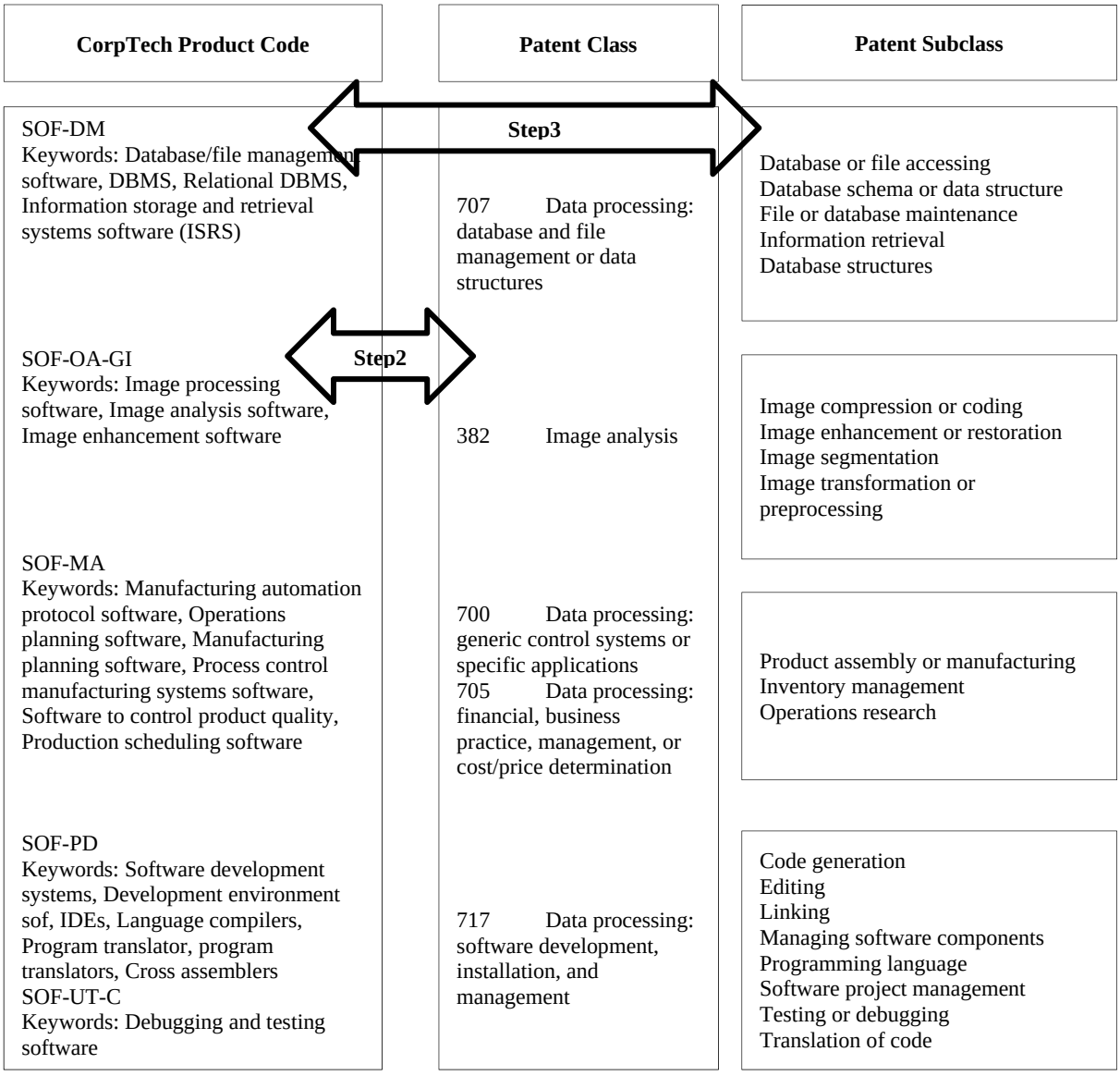


Figure A-2: Mapping Software Markets to Patent Subclasses



APPENDIX B: Supporting Empirical Results

Table B-1: Additional robustness test using market-specific time trends, conditional fixed-effect Poisson regression

Dependent variable: OSS entry	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.110*** (.039)	-.027 (.078)	-.185* (.097)	-.060 (.165)	.095*** (.033)	.042 (.068)	.077 (.151)	.032 (.167)
The Commons * Cumulativeness		.316*** (.112)		.216** (.107)		.120 (.110)		.120 (.110)
The Commons * Concentration			.948*** (.359)	.170 (.595)			.066 (.502)	.035 (.545)
Cumulativeness		-1.047 (1.064)		-1.990 (1.392)	1.408 (2.257)	1.640 (2.254)	1.445 (2.255)	1.659 (2.232)
Concentration			12.551** (6.026)	20.338*** (7.719)	21.468*** (6.266)	19.873*** (6.327)	20.946*** (6.131)	19.601*** (6.031)
Sales growth					-.862 (.777)	-.869 (.783)	-.862 (.779)	-.869 (.785)
Total patents					1.664 (2.041)	1.800 (2.029)	1.656 (2.050)	1.795 (2.047)
Patent quality					2.221 (2.916)	1.671 (3.030)	2.169 (3.143)	1.646 (3.255)
Patent age					-.292 (.445)	-.291 (.452)	-.287 (.440)	-.289 (.446)
OIN patents					-.044 (.069)	-.038 (.068)	-.044 (.069)	-.038 (.069)
SSO patents					.147* (.088)	.142 (.088)	.147* (.087)	.142 (.088)
OSS demand					.437** (.175)	.418** (.179)	.437** (.175)	.418** (.181)
Log pseudolikelihood	-223.557	-220.170	-219.409	-216.858	-210.557	-210.267	-210.553	-210.266
Marginal effects								
The Commons (average)	.110*** (.039)	.207*** (.033)	.026 (.043)	.138*** (.049)	.095*** (.033)	.131*** (.037)	.091* (.048)	.129** (.053)
The Commons (cumulativeness=10%)		.032 (.059)		.018 (.060)		.065 (.050)		.063 (.060)
The Commons (cumulativeness=90%)		.439*** (.098)		.296*** (.108)		.219** (.106)		.216* (.115)
Test of the difference between high and low cumulativeness, p-value		.004		.044		.275		.279
The Commons (concentration =10%)			-.059 (.058)	.123 (.095)			.085 (.087)	.126 (.095)
The Commons (concentration =90%)			.122** (.052)	.156*** (.041)			.098*** (.036)	.133*** (.040)
Test of the difference between high and low concentration, p-value			.008	.776			.894	.948

Notes: 1) All regressions include market-specific time trends and market fixed effects. Number of observations=286. 2) Robust standard errors, clustered by market, are in parentheses. 3) "Market-specific time trend" is measured by a linear time trend times 33 market dummies. 4) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-2: Robustness test using linear fixed-effects regression

Dependent variable: OSS entry	Specification testing direct impact of The Commons only		Add interaction with cumulativeness of innovation		Add interaction with concentration of patent ownership		Add interaction with cumulativeness of innovation and with concentration of patent ownership	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.116 (.072)	.139 (.086)	.082 (.080)	.105 (.092)	-.141 (.087)	-.122* (.069)	-.158 (.097)	-.139* (.081)
The Commons * Cumulativeness			.101 (.061)	.097 (.061)			.080 (.061)	.077 (.060)
The Commons * Concentration					.930** (.422)	.934** (.390)	.894** (.421)	.900* (.392)
Cumulativeness	.085 (.658)	.296 (.727)	.928 (.740)	1.091 (.757)	.182 (.593)	.353 (.612)	.848 (.684)	.978 (.683)
Concentration	-.019 (3.861)	-.309 (3.722)	.545 (3.792)	.246 (3.712)	1.373 (3.705)	1.077 (3.744)	1.767 (3.604)	1.465 (3.669)
Sales growth	-.469 (.313)	-.450 (.335)	-.504 (.316)	-.482 (.334)	-.553 (.350)	-.518 (.364)	-.577 (.347)	-.542 (.359)
Total patents	-.515 (.796)	-.458 (.880)	.025 (.870)	.052 (.911)	-.471 (.742)	-.470 (.769)	-.043 (.726)	-.067 (.739)
Patent quality	-.337 (1.139)	-.563 (1.255)	-.415 (1.162)	-.629 (1.272)	-.102 (1.179)	-.385 (1.260)	-.173 (1.208)	-.443 (1.286)
Patent age	-.152 (.106)	-.134 (.109)	-.116 (.103)	-.101 (.105)	-.295*** (.097)	-.268** (.113)	-.261*** (.093)	-.236** (.111)
OIN patents		-.014 (.036)		-.012 (.036)		-.011 (.032)		-.009 (.032)
SSO patents		-.043 (.077)		-.040 (.074)		-.032 (.062)		-.030 (.060)
OSS demand		.061 (.046)		.059 (.045)		.078* (.046)		.076 (.046)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	363	363	363	363	363	363	363	363
R-squared	.589	.590	.591	.593	.600	.602	.602	.604
Marginal effects								
The Commons (average)	.115 (.072)	139* (.086)	.164** (.081)	.184** (.093)	.070 (.049)	.090* (.054)	.110** (.045)	.127** (.052)
The Commons (cumulativeness=10%)			.104 (.077)	.126 (.090)			.062 (.054)	.081 (.060)
The Commons (cumulativeness=90%)			.243** (.107)	.260** (.117)			.172** (.068)	.187** (.074)
Test of the difference between high and low cumulativeness, p-value			.098	.111			.184	.201
The Commons (concentration =10%)					-.020 (.048)	-.001 (.042)	.023 (.048)	.040 (.047)
The Commons (concentration =90%)					.170** (.080)	.190** (.087)	.206*** (.074)	.223*** (.082)
Test of the difference between high and low concentration, p-value					.028	.017	.033	.022

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%. 3) R-squared includes fixed effects in R-squared computation.

Table B-3: Robustness test using raw number of patents, conditional fixed-effect Poisson regression

Dependent variable: OSS entry	Specification testing direct impact of The Commons only		Add interaction with cumulativeness of innovation		Add interaction with concentration of patent ownership		Add interaction with cumulativeness of innovation and with concentration of patent ownership	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.134 (.150)	.169 (.154)	-.025 (.171)	.022 (.172)	-.373 (.260)	-.380 (.293)	-.199 (.249)	-.161 (.341)
The Commons * Cumulativeness			.692*** (.157)	.646*** (.164)			.624*** (.183)	.572** (.223)
The Commons * Concentration					1.524** (.624)	1.613** (.717)	.556 (.669)	.577 (.972)
Cumulativeness	.616 (1.162)	.581 (1.172)	2.657** (1.103)	2.565** (1.164)	.754 (1.035)	.667 (.995)	2.524** (1.133)	2.369* (1.238)
Concentration	-5.494 (6.101)	-6.758 (7.630)	-10.908* (5.726)	-12.078 (7.775)	-12.264 (7.993)	-11.481 (8.191)	-12.802* (6.621)	-13.148* (7.511)
Sales growth	-.398 (.324)	-.305 (.343)	-.598 (.380)	-.508 (.395)	-.450 (.341)	-.388 (.356)	-.598 (.377)	-.511 (.392)
Total patents	-.431 (1.324)	-.802 (1.432)	.646 (1.341)	.424 (1.435)	-.777 (1.292)	-1.122 (1.404)	.434 (1.414)	.178 (1.613)
Patent quality	-.358 (2.409)	-1.122 (2.371)	-.424 (2.287)	-.894 (2.236)	-.074 (2.404)	-.793 (2.262)	-.316 (2.256)	-.796 (2.163)
Patent age	-.274 (.177)	-.189 (.178)	-.320* (.173)	-.252 (.171)	-.385** (.183)	-.267* (.161)	-.353* (.189)	-.271 (.173)
OIN patents		-.062 (.074)		-.068 (.067)		-.062 (.074)		-.067 (.068)
SSO patents		-.004 (.083)		-.012 (.067)		.045 (.090)		.007 (.089)
OSS demand		.311** (.156)		.229 (.147)		.305** (.152)		.237 (.151)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	286	286	286	286	286	286	286	286
Log pseudolikelihood	-227.874	-225.796	-222.780	-221.522	-225.977	-223.968	-222.580	-221.348
Marginal effects								
The Commons (average)	.134 (.150)	.169 (.154)	.489*** (.166)	.501*** (.172)	-.035 (.163)	-.023 (.174)	.387** (.186)	.392 (.253)
The Commons (cumulativeness=10%)			.106 (.162)	.144 (.164)			.042 (.163)	.075 (.192)
The Commons (cumulativeness=90%)			.995*** (.229)	.974*** (.243)			.844*** (.277)	.810** (.383)
Test of the difference between high and low cumulativeness, p-value			.001	.001			.001	.010
The Commons (concentration =10%)					-.171 (.196)	-.167 (.216)	.338 (.225)	.340 (.324)
The Commons (concentration =90%)					.120 (.143)	.141 (.147)	.444*** (.157)	.450** (.188)
Test of the difference between high and low concentration, p-value					.015	.025	.406	.553

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%. 3) The number of observations is lower than 363 because of the use of conditional fixed effects Poisson models, which drops markets without OSS entry over the entire sample period.

Table B-4: Robustness test using raw number of patents, linear fixed-effects regression

Dependent variable: OSS entry	Specification testing direct impact of The Commons only		Add interaction with cumulativeness of innovation		Add interaction with concentration of patent ownership		Add interaction with cumulativeness of innovation and with concentration of patent ownership	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.168 (.124)	.206 (.148)	.061 (.129)	.100 (.143)	-.362** (.167)	-.331** (.134)	-.379** (.177)	-.343** (.146)
The Commons * Cumulativeness			.328* (.174)	.334* (.180)			.222 (.172)	.227 (.177)
The Commons * Concentration					1.952** (.820)	1.939** (.743)	1.749** (.829)	1.722** (.760)
Cumulativeness	-.100 (.679)	.064 (.695)	1.146 (.810)	1.346 (.835)	.197 (.578)	.288 (.568)	1.010 (.782)	1.133 (.776)
Concentration	.094 (3.999)	-.170 (3.878)	1.349 (3.962)	1.100 (3.924)	.908 (3.534)	.649 (3.641)	1.672 (3.377)	1.419 (3.539)
Sales growth	-.478 (.321)	-.459 (.346)	-.539 (.333)	-.525 (.355)	-.558 (.354)	-.521 (.368)	-.591* (.353)	-.558 (.365)
Total patents	-.640 (.691)	-.620 (.757)	.147 (.877)	.194 (.904)	-.448 (.659)	-.506 (.682)	.065 (.737)	.034 (.747)
Patent quality	-.240 (1.134)	-.462 (1.243)	-.416 (1.148)	-.631 (1.248)	.110 (1.199)	-.160 (1.266)	-.046 (1.213)	-.309 (1.277)
Patent age	-.185* (.093)	-.174 (.107)	-.138 (.099)	-.130 (.107)	-.311*** (.088)	-.287** (.109)	-.266*** (.095)	-.245** (.113)
OIN patents		-.015 (.038)		-.016 (.036)		-.006 (.034)		-.008 (.033)
SSO patents		-.044 (.079)		-.049 (.075)		-.025 (.061)		-.031 (.060)
OSS demand		.063 (.045)		.061 (.043)		.077* (.045)		.074 (.045)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	363	363	363	363	363	363	363	363
R-squared	.588	.590	.594	.597	.602	.604	.605	.607
Marginal effects								
The Commons (average)	.168 (.124)	.206 (.148)	.326** (.149)	.370** (.175)	.081 (.093)	.108 (.106)	.197** (.083)	.231** (.103)
The Commons (cumulativeness=10%)			.132 (.119)	.173 (.138)			.066 (.097)	.097 (.105)
The Commons (cumulativeness=90%)			.582** (.255)	.631** (.284)			.371** (.188)	.408** (.208)
Test of the difference between high and low cumulativeness, p-value			.059	.064			.195	.199
The Commons (concentration =10%)					-.107 (.091)	-.078 (.085)	.029 (.096)	.065 (.102)
The Commons (concentration =90%)					.291 (.155)	.317* (.167)	.386*** (.139)	.416*** (.154)
Test of the difference between high and low concentration, p-value					.017	.009	.035	.023

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%. 3) R-squared includes fixed effects in R-squared computation.

Table B-5: Robustness using citation-weighted count of patents, conditional fixed-effect Poisson regression

Dependent variable: OSS entry	Use the citations without adjustment for truncation				Use the citations with adjustment for truncation				Use the citations received in three-year post grant window			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
The Commons	.079 (.079)	-.029 (.105)	-.255* (.144)	-.265* (.142)	.090 (.072)	-.001 (.101)	-.221 (.135)	-.226* (.127)	.089 (.089)	-.032 (.117)	-.310* (.178)	-.293* (.164)
The Commons * Cumulativeness		.312*** (.111)		.252** (.124)		.288*** (.103)		.235** (.113)		.402*** (.125)		.328** (.144)
The Commons * Concentration			1.062** (.414)	.811* (.451)			.961** (.383)	.734* (.407)			1.232** (.490)	.860 (.532)
Cumulativeness	.820 (1.085)	2.838*** (1.069)	.587 (.989)	2.267* (1.215)	.745 (1.080)	2.764** (1.092)	.504 (.977)	2.214* (1.219)	.762 (1.060)	2.784*** (1.062)	.704 (.958)	2.385** (1.174)
Concentration	-4.899 (5.801)	-8.597* (4.986)	-12.712 (8.288)	-13.793* (7.323)	-4.990 (5.807)	-8.805* (5.022)	-12.477 (8.262)	-13.749* (7.258)	-4.875 (5.801)	-8.859* (5.062)	-12.928 (8.447)	-13.692* (7.349)
Sales growth	-.403 (.328)	-.556 (.360)	-.460 (.350)	-.570 (.361)	-.402 (.327)	-.545 (.356)	-.462 (.350)	-.565 (.360)	-.402 (.327)	-.561 (.363)	-.461 (.348)	-.573 (.363)
Total patents	-.181 (1.445)	1.224 (1.431)	-1.033 (1.354)	.296 (1.449)	-.266 (1.450)	1.125 (1.453)	-1.096 (1.354)	.237 (1.449)	-.237 (1.419)	1.113 (1.429)	-.910 (1.313)	.404 (1.427)
Patent quality	-.272 (2.496)	-.007 (2.410)	-.192 (2.461)	.001 (2.401)	-.356 (2.503)	-.136 (2.418)	-.235 (2.471)	-.090 (2.411)	-.259 (2.499)	-.034 (2.411)	-.105 (2.446)	.023 (2.386)
Patent age	-.243 (.173)	-.222 (.165)	-.439** (.191)	-.375* (.199)	-.248 (.173)	-.221 (.167)	-.446** (.195)	-.375* (.201)	-.256 (.174)	-.266 (.164)	-.422** (.188)	-.377** (.191)
Log pseudolikelihood	-227.965	-224.842	-225.263	-223.398	-227.874	-224.770	-225.315	-223.4012	-227.966	-224.3612	-225.410	-223.249
Marginal effects												
The Commons (average)	.079 (.079)	.203** (.085)	-.020 (.079)	.101 (.082)	.090 (.072)	.213*** (.081)	-.008 (.075)	.111 (.073)	.089 (.089)	.267*** (.093)	-.037 (.096)	.141 (.095)
The Commons (cumulativeness=10%)		.030 (.094)		-.038 (.083)		.053 (.090)		-.019 (.075)		.044 (.104)		-.040 (.091)
The Commons (cumulativeness=90%)		.431*** (.129)		.285 (.145)		.423*** (.120)		.283** (.130)		.560*** (.143)		.381** (.172)
Test of the difference between high and low cumulativeness, p-value		.005		.043		.005		.038		.001		.023
The Commons (concentration =10%)			-.114 (.100)	.029 (.110)			-.094 (.095)	.046 (.097)			-.147 (.124)	.065 (.129)
The Commons (concentration =90%)			.088 (.072)	.184 (.068)			.090 (.068)	.186*** (.063)			.088 (.083)	.229*** (.075)
Test of the difference between high and low concentration, p-value			.010	.072			.012	.071			.012	.106

Notes: 1) In columns 1 to 8 we use the total citations received by December 2004 to eliminate the possibility that contributing to The Commons might result in an increase in forward citations (e.g., Rysman and Simcoe 2008). This is similar to our calculations used in Table 2/3 in the paper. 2) All regressions include year dummies and market fixed effects. Number of observations=286. This number of observations is lower than 363 because of the use of conditional fixed effects Poisson models, which drops markets without OSS entry over the entire sample period. 3) Robust standard errors, clustered by market, are in parentheses. 4) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-6: Robustness test using sample from year 1999 to 2008, conditional fixed-effect Poisson regression

Dependent variable: OSS entry	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.140 (.101)	.155 (.109)	.042 (.160)	.066 (.162)	-.172 (.124)	-.182 (.142)	-.152 (.141)	-.144 (.185)
The Commons * Cumulativeness			.346*** (.096)	.320*** (.096)			.300*** (.099)	.268** (.108)
The Commons * Concentration					.903** (.378)	.948** (.407)	.568 (.355)	.606 (.469)
Cumulativeness	.572 (1.323)	.568 (1.418)	3.054** (1.288)	2.928** (1.404)	.346 (1.232)	.268 (1.262)	2.618* (1.339)	2.362 (1.489)
Concentration	-8.884 (6.716)	-10.751 (8.553)	-14.011** (6.209)	-15.658* (8.586)	-15.699* (8.935)	-15.518* (9.503)	-17.458** (7.560)	-17.782** (8.739)
Sales growth	-.443 (.365)	-.328 (.392)	-.605 (.419)	-.497 (.434)	-.506 (.390)	-.424 (.413)	-.626 (.422)	-.528 (.439)
Total patents	-.513 (1.472)	-.866 (1.621)	1.058 (1.470)	.776 (1.594)	-1.195 (1.478)	-1.531 (1.602)	.460 (1.479)	.107 (1.691)
Patent quality	-.174 (2.545)	-.885 (2.527)	-.105 (2.431)	-.564 (2.413)	.094 (2.536)	-.553 (2.404)	.055 (2.428)	-.392 (2.341)
Patent age	-.227 (.212)	-.160 (.220)	-.180 (.209)	-.135 (.213)	-.402* (.232)	-.303 (.215)	-.290 (.226)	-.226 (.218)
OIN patents		-.037 (.072)		-.039 (.066)		-.042 (.070)		-.040 (.067)
SSO patents		-.018 (.083)		-.025 (.070)		.029 (.089)		.007 (.086)
OSS demand		.297* (.156)		.221 (.147)		.303* (.155)		.237 (.151)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	260	260	260	260	260	260	260	260
Log pseudolikelihood	-212.602	-210.717	-208.344	-207.227	-210.583	-208.753	-207.641	-206.547
Marginal effects								
The Commons (average)	.140 (.101)	.155 (.109)	.307* (.160)	.312* (.164)	.033 (.077)	.033 (.085)	.207** (.105)	.198 (.138)
The Commons (cumulativeness=10%)			.111 (.157)	.130 (.159)			.037 (.112)	.047 (.128)
The Commons (cumulativeness=90%)			.566*** (.190)	.551*** (.195)			.431*** (.135)	.398** (.185)
Test of the difference between high and low cumulativeness, p-value			.001	.001			.002	.013
The Commons (concentration =10%)					-.046 (.088)	-.050 (.101)	.157 (.113)	.145 (.163)
The Commons (concentration =90%)					.124 (.080)	.129 (.084)	.264** (.106)	.260** (.122)
Test of the difference between high and low concentration, p-value					.017	.020	.109	.196

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-7: Robustness test using sample from year 1999 to 2007, conditional fixed-effect Poisson regression

Dependent variable: OSS entry	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.166 (.118)	.177 (.126)	.112 (.188)	.131 (.191)	-.088 (.150)	-.133 (.159)	.008 (.193)	-.023 (.228)
The Commons * Cumulativeness			.351*** (.099)	.326*** (.100)			.324*** (.101)	.285** (.116)
The Commons * Concentration					.694* (.393)	.822** (.400)	.260 (.356)	.385 (.477)
Cumulativeness	.905 (1.299)	.783 (1.356)	3.245** (1.348)	3.006** (1.448)	.735 (1.250)	.532 (1.251)	3.053** (1.340)	2.654* (1.508)
Concentration	-9.177 (6.649)	-9.075 (7.647)	-14.851** (6.555)	-14.526* (7.993)	-14.152* (8.602)	-13.031 (8.419)	-16.171** (7.092)	-15.631** (7.798)
Sales growth	-.547* (.332)	-.453 (.349)	-.696* (.388)	-.603 (.394)	-.593* (.347)	-.538 (.356)	-.704* (.389)	-.623 (.394)
Total patents	-.050 (1.442)	-.409 (1.568)	1.369 (1.501)	1.084 (1.614)	-.485 (1.461)	-.891 (1.540)	1.150 (1.490)	.723 (1.682)
Patent quality	.598 (2.858)	-.049 (2.742)	.707 (2.716)	.321 (2.631)	.949 (2.906)	.429 (2.686)	.821 (2.726)	.497 (2.601)
Patent age	-.159 (.214)	-.081 (.222)	-.160 (.216)	-.095 (.221)	-.291 (.245)	-.203 (.221)	-.202 (.236)	-.143 (.225)
OIN patents		-.025 (.081)		-.031 (.076)		-.026 (.080)		-.030 (.076)
SSO patents		.020 (.086)		.014 (.072)		.060 (.090)		.033 (.088)
OSS demand		.279 (.151)		.209 (.149)		.285* (.151)		.220 (.153)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	225	225	225	225	225	225	225	225
Log pseudolikelihood	-188.888	-187.365	-184.880	-184.056	-187.799	-186.019	-184.758	-183.826
Marginal effects								
The Commons (average)	.166 (.118)	.177 (.126)	.384* (.198)	.383* (.203)	.071 (.099)	.055 (.106)	.319* (.166)	.286 (.192)
The Commons (cumulativeness=10%)			.185 (.188)	.199 (.191)			.135 (.160)	.124 (.169)
The Commons (cumulativeness=90%)			.658*** (.234)	.638*** (.241)			.571*** (.203)	.507** (.250)
Test of the difference between high and low cumulativeness, p-value			.001	.001			.001	.014
The Commons (concentration =10%)					.009 (.113)	-.018 (.121)	.296* (.178)	.251 (.219)
The Commons (concentration =90%)					.141 (.097)	.138 (.101)	.345** (.159)	.324* (.169)
Test of the difference between high and low concentration, p-value					.077	.040	.466	.419

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-8: Robustness test adding "Top 4 incumbents market share", conditional fixed-effect Poisson regression, includes baseline controls

Dependent variable: OSS entry	(1)	(2)	(3)	(4)	(5)	(6)
The Commons	-.127 (.114)	-.114 (.137)	.237* (.135)	.169 (.187)	-.068 (.118)	-.059 (.141)
The Commons * Cumulativeness		.284*** (.101)		.298*** (.097)		.266*** (.100)
The Commons * Concentration	.810** (.330)	.516 (.319)			1.170*** (.425)	.845** (.396)
The Commons * Top 4 incumbent market share			-.130 (.147)	-.159 (.135)	-.261* (.144)	-.230* (.137)
Cumulativeness	.257 (1.076)	2.313* (1.243)	.412 (1.195)	2.453** (1.109)	.252 (1.062)	2.174* (1.298)
Concentration	-11.613 (7.959)	-13.190** (6.696)			-10.889 (7.323)	-12.528** (6.278)
Sales growth	-.543 (.383)	-.660* (.363)	-.334 (.463)	-.461 (.451)	-.174 (.418)	-.311 (.421)
Total patents	-1.273 (1.398)	.232 (1.463)	-.262 (1.284)	1.328 (1.281)	-1.194 (1.381)	.189 (1.429)
Patent quality	-.594 (2.433)	-.583 (2.355)	-.687 (2.398)	-.466 (2.283)	-.722 (2.422)	-.731 (2.288)
Patent age	-.433** (.187)	-.337* (.194)	-.312* (.169)	-.295* (.169)	-.512** (.197)	-.411** (.203)
Top 4 incumbents market share	.911 (1.235)	.909 (1.133)	1.114 (1.321)	1.204 (1.153)	1.270 (1.159)	1.186 (1.127)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	286	286	286	286	286	286
Log pseudolikelihood	-225.372	-222.646	-226.879	-223.455	-223.776	-221.439
Marginal effects						
The Commons (average)	.052 (.077)	.211** (.105)	.184* (.102)	.326** (.162)	.086 (.075)	.232** (.105)
The Commons (cumulativeness=10%)		.054 (.114)		.160 (.158)	-.018 (.089)	.085 (.113)
The Commons (cumulativeness=90%)		.418*** (.134)		.544*** (.191)	.205** (.082)	.426*** (.135)
Test of the difference between high and low cumulativeness, p-value		.005		.002	.006	.008
The Commons (concentration =10%)	-.020 (.087)	.165 (.111)				.157 (.110)
The Commons (concentration =90%)	.135 (.079)	.263** (.106)				.318*** (.114)
Test of the difference between high and low concentration, p-value	.014	.106				.033
The Commons (Top 4 incumbent market share =10%)			.217* (.120)	.365** (.180)	.151* (.084)	.290** (.119)
The Commons (Top 4 incumbent market share =90%)			.150 (.096)	.283* (.148)	.017 (.084)	.171* (.102)
Test of the difference between high and low top 4 incumbents market share, p-value			.377	.241	.070	.093

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-9: Robustness test adding "Top 4 incumbents market share", conditional fixed-effect Poisson regression, includes full set of controls

Dependent variable: OSS entry	(1)	(2)	(3)	(4)	(5)	(6)
The Commons	-.137 (.144)	-.109 (.185)	.231 (.154)	.172 (.197)	-.090 (.155)	-.066 (.193)
The Commons * Cumulativeness		.250** (.109)		.269*** (.097)		.235** (.105)
The Commons * Concentration	.863** (.377)	.565 (.436)			1.187** (.495)	.869* (.525)
The Commons * Top 4 incumbent market share			-.107 (.161)	-.136 (.153)	-.229 (.158)	-.205 (.153)
Cumulativeness	.290 (1.094)	2.154* (1.321)	.487 (1.265)	2.353** (1.121)	.259 (1.112)	2.009 (1.366)
Concentration	-11.244 (8.449)	-13.271* (7.754)			-10.599 (8.265)	-12.601* (7.633)
Sales growth	-.500 (.389)	-.605* (.372)	-.322 (.478)	-.452 (.468)	-.179 (.432)	-.297 (.435)
Total patents	-1.517 (1.505)	-.042 (1.634)	-.456 (1.518)	1.108 (1.456)	-1.410 (1.484)	-.056 (1.597)
Patent quality	-1.307 (2.308)	-1.104 (2.261)	-1.335 (2.339)	-.935 (2.231)	-1.291 (2.267)	-1.134 (2.173)
Patent age	-.309* (.172)	-.246 (.181)	-.218 (.190)	-.213 (.191)	-.039** (.193)	-.322 (.200)
Top 4 incumbents market share	1.173 (1.150)	1.183 (1.087)	1.347 (1.203)	1.421 (1.097)	1.452 (1.121)	1.394 (1.105)
OIN patents	-.075 (.070)	-.072 (.067)	-.066 (.074)	-.066 (.070)	-.068 (.071)	-.064 (.068)
SSO patents	.034 (.088)	.015 (.085)	.002 (.069)	.006 (.055)	.035 (.087)	.017 (.085)
OSS demand	.317** (.157)	.257* (.155)	.296* (.165)	.223 (.156)	.288 (.160)	.234 (.155)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Market fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	286	286	286	286	286	286
Log pseudolikelihood	-223.222	-221.227	-225.012	-222.357	-222.022	-220.278
Marginal effects						
The Commons (average)	.054 (.092)	.202 (.138)	.188* (.113)	.317* (.169)	.081 (.096)	.219 (.141)
The Commons (cumulativeness=10%)		.063 (.131)		.168 (.162)		.088 (.134)
The Commons (cumulativeness=90%)		.384** (.181)		.513** (.202)		.391** (.181)
Test of the difference between high and low cumulativeness, p-value		.022		.005		.025
The Commons (concentration =10%)	-.023 (.108)	.151 (.162)			-.025 (.117)	.141 (.164)
The Commons (concentration =90%)	.142 (.087)	.259** (.122)			.202** (.094)	.307** (.131)
Test of the difference between high and low concentration, p-value	.022	.195			.017	.098
The Commons (Top 4 incumbent market share =10%)			.215 (.136)	.350* (.192)	.138 (.105)	.269* (.153)
The Commons (Top 4 incumbent market share =90%)			.160 (.102)	.281* (.152)	.020 (.103)	.164 (.140)
Test of the difference between high and low top 4 incumbents market share, p-value			.507	.377	.149	.180

Notes: 1) Robust standard errors, clustered by market, are in parentheses. 2) * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B-10: The impact of a broader set of IP actions by IBM, conditional fixed-effect Poisson regression, includes full set of controls

Dependent variable: OSS entry	(1)	(2)	(3)	(4)
The Commons	.464*** (.163)	.507** (.196)	.401*** (.151)	.430** (.186)
The Commons in 2005 X Year 04	.783*** (.185)	.815*** (.200)		
The Commons in 2005 X Year 03	.287* (.153)	.318** (.138)		
The Commons in 2005 X Year 02		.137 (.187)		
IBM matched patents X Year 04			.422*** (.110)	.437*** (.119)
IBM matched patents X Year 03			.124 (.117)	.140 (.114)
IBM matched patents X Year 02				.083 (.141)
IBM matched patents			.134 (.551)	.113 (.535)
Cumulativeness	-1.391 (1.303)	-1.660 (1.356)	-1.023 (1.303)	-1.151 (1.319)
Concentration	-12.893* (7.641)	-13.991* (7.888)	-12.657* (7.522)	-13.203* (7.774)
Sales growth	-.422 (.326)	-.424 (.333)	-.327 (.3271)	-.328 (.333)
Total patents	-3.064** (1.551)	-3.339** (1.512)	-3.138** (1.461)	-3.293** (1.444)
Patent quality	-2.981 (2.326)	-3.146 (2.287)	-3.320 (2.170)	-3.455 (2.143)
Patent age	-.339 (.217)	-.369* (.224)	-.250 (.247)	-.267 (.253)
OIN patents	-.037 (.071)	-.034 (.070)	-.026 (.070)	-.023 (.069)
SSO patents	-.032 (.074)	-.037 (.077)	-.040 (.077)	-.042 (.079)
OSS demand	.286* (.146)	.279* (.146)	.287* (.154)	.282* (.152)
Log pseudolikelihood	-218.234	-217.934	-219.385	-219.203

Notes: 1) All regressions include year dummies and market fixed effects. Number of observations=286. 2) Robust standard errors, clustered by market, are in parentheses. 3) * significant at 10%, ** significant at 5%, *** significant at 1%. 4) *Year 04 (03/ 02)* is a dummy that turns on for year 2004 (2003 / 2002). 5) *IBM matched patents* is measured using the log of claims-weighted patent count of IBM patents that were not pledged but belong to the same primary USPTO classification at the subclass level as its patents in The Commons and that were applied for in the same year.

Table B-11: Falsification test on proprietary product entry, use sample from year 2002 to 2006

Dependent variable: Product entry by start-ups	Sample based on proprietary entry only	Sample based on both proprietary entry and OSS entry
	(1)	(2)
The Commons	.027 (.044)	.022 (.044)
The Commons *OSS-market		.197*** (.044)
Cumulativeness	-3.580*** (1.299)	-3.546*** (1.283)
Concentration	3.355 (4.826)	3.732 (4.673)
Sales growth	.001 (.273)	-.012 (.270)
Total patents	5.767*** (1.804)	5.887*** (1.772)
Patent quality	8.008** (3.668)	8.128** (3.609)
Patent age	.275 (.298)	.275 (.293)
Log pseudolikelihood	-308.188	-332.435
Marginal effects		
[1] Commons (proprietary market)	.027 (.044)	.022 (.044)
[2] Commons (OSS market)		.220*** (.061)
Test of the difference between [1] and [2], p-value		.001

Notes: 1) All regressions include year dummies and market fixed effects. 2) Robust standard errors, clustered by market, are in parentheses. 3) * significant at 10%, ** significant at 5%, *** significant at 1%. 4) Column (1) is based on a sample consisting of proprietary entry into 29 software markets from 2002 to 2006, and therefore with 145 observations in total. 5) Column (2) is based on a sample consisting of product entry into 29 OSS markets and 29 proprietary software markets from 2002 to 2006. However, 20 markets are dropped because there is no entry observed throughout the sample period; therefore, this sample has 190 observations in total.

Table B-12: Average product entry into an OSS market in a year

The numbers in the table below presents the mean value of "*Product Entry*$_{jt}$" used in columns 5-8 in table 8 for OSS markets, split along three dimensions: (1) by markets where The Commons is small vs. large; (2) by markets with low vs. high cumulativeness/concentration; and (3) by period (i.e., pre-Commons (1999-2004) vs. post-Commons (2005-2009)).

Markets where The Commons is small (large) are defined as those where the number of claims-weighted patents in The Commons is below the 25th percentile (above the 75th percentile). Within the markets where The Commons is small/large: the low vs. high cumulativeness/concentration is defined based on a median split.

As shown by this table, because we only use PROMT codes to identify entry into OSS markets in table 8, the variance of "*Product Entry*$_{jt}$" for OSS markets before and after The Commons by the size of The Commons and by the level of cumulativeness/concentration is very small.

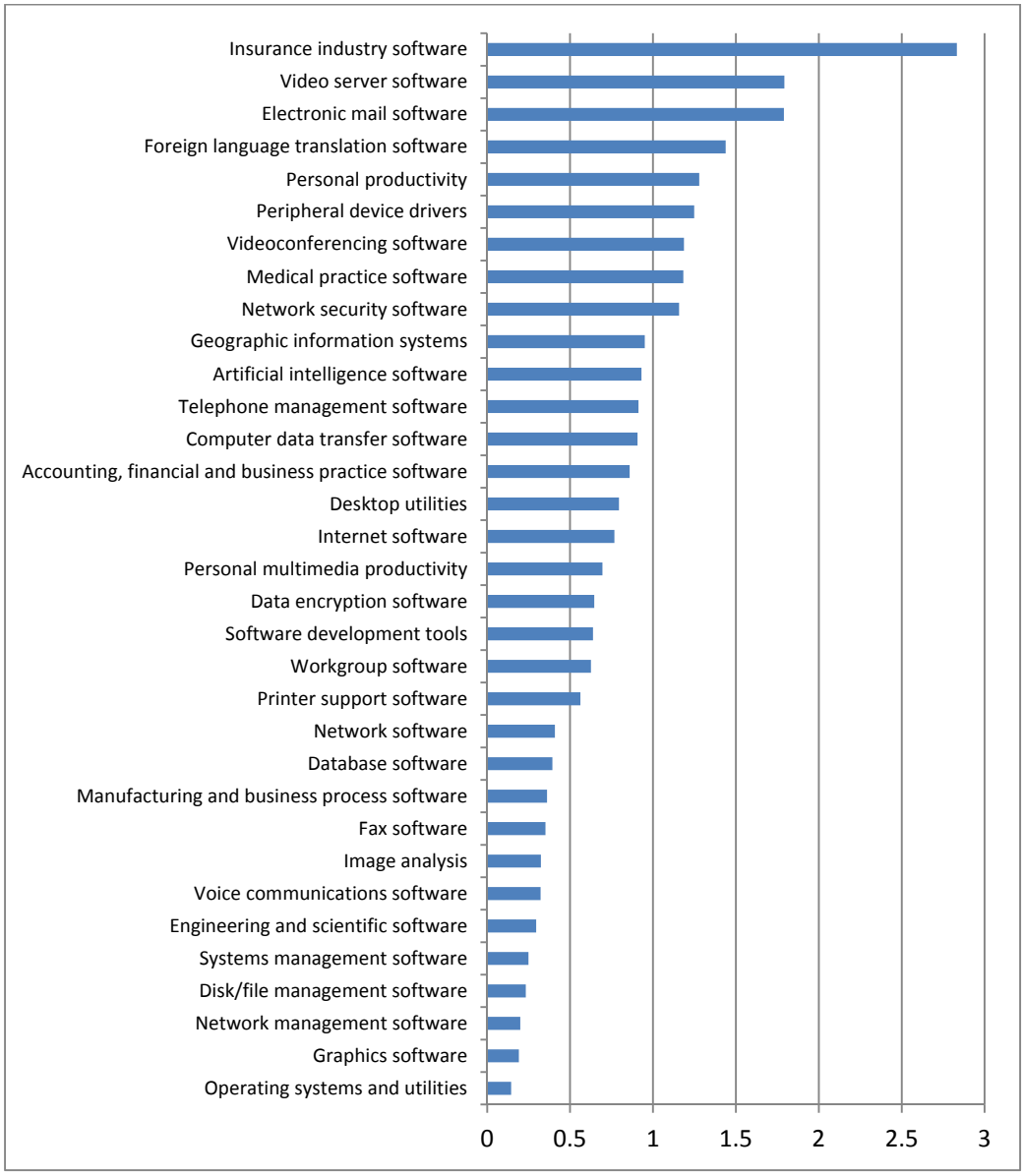
By the size of The Commons and the level of cumulativeness				
	Low cumulativeness		High cumulativeness	
	Pre-Commons	Post-Commons	Pre- Commons	Post-Commons
Markets where The Commons is small	0	.083	0	.077
Markets where The Commons is large	0	.167	.2	.588
By the size of The Commons and the level of concentration				
	Low concentration		High concentration	
	Pre-Commons	Post-Commons	Pre- Commons	Post-Commons
Markets where The Commons is small	0	0	0	.143
Markets where The Commons is large	0	.388	.2	.353

Table B-13: Falsification test on proprietary product entry, conditional fixed-effect Poisson regression with the full set of controls

Dependent variable: Product entry by start-ups	Sample based on proprietary entry only				Sample based on both proprietary entry and OSS entry			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The Commons	.050 (.052)	.026 (.072)	.154 (.113)	.139 (.114)	.044 (.050)	.017 (.071)	.147 (.111)	.130 (.112)
The Commons* Cumulativeness		.040 (.090)		.111 (.081)		.046 (.091)		.117 (.082)
The Commons* Concentration			-.276 (.266)	-.416 (.270)			-.274 (.261)	-.419 (.263)
The Commons * OSS-market					.266*** (.043)	.348*** (.111)	.352 (.262)	.315 (.257)
The Commons* Cumulativeness* OSS-market						-.212 (.258)		-.225 (.322)
The Commons* Concentration* OSS-market							-.302 (.890)	.187 (1.084)
Cumulativeness	-2.917 (2.122)	-2.237 (3.010)	-3.328 (2.185)	-1.649 (2.982)	-2.977 (2.096)	-.2.275 (3.004)	-3.405 (2.160)	-1.690 (2.970)
Concentration	-3.296 (6.303)	-3.647 (6.452)	-1.269 (7.011)	-1.243 (6.828)	-4.184 (5.940)	-4.427 (6.097)	-2.104 (6.660)	-2.115 (6.453)
Sales growth	.154 (.267)	.161 (.276)	.148 (.266)	.160 (.269)	.128 (.263)	.137 (.272)	.121 (.263)	.136 (.266)
Total patents	5.096 * (2.797)	5.202* (2.808)	6.325** (2.885)	7.246** (2.925)	5.262* (2.742)	5.402** (2.755)	6.493** (2.834)	7.456*** (2.872)
Patent quality	7.080 (5.446)	6.822 (5.619)	8.430 (5.416)	8.410 (5.527)	7.932 (5.365)	7.178 (5.554)	8.756* (5.345)	8.785 (5.471)
Patent age	.257 (.269)	.275 (.263)	.318 (.303)	.399 (.307)	.254 (.264)	.271 (.258)	.314 (.297)	.395 (.299)
OIN patents	.056 (.057)	.057 (.056)	.045 (.055)	.041 (.055)	.056 (.055)	.057 (.054)	.045 (.053)	.042 (.053)
SSO patents	-.069 (.062)	-.071 (.065)	-.079 (.062)	-.091 (.066)	-.065 (.061)	-.067 (.065)	-.074 (.062)	-.086 (.066)
OSS demand	-.162 (.216)	-.163 (.212)	-.206 (.227)	-.231 (.223)	-.185 (.211)	-.185 (.208)	-.228 (.222)	-.255 (.218)
Log pseudolikelihood	-441.266	-441.047	-439.866	-438.5566	-491.680	-491.171	-490.227	-488.608
Marginal effects								
[1] Commons (proprietary market)	.051 (.052)	051 (.053)	.092 (.063)	.114* (.065)	.044 (.050)	.045 (.052)	.083 (.060)	.106* (.062)
[2] Commons (OSS market)					.309*** (.067)	.261*** (.090)	.365*** (.090)	.324** (.138)
Test of the difference between [1] and [2], p-value					.001	.003	.001	.064
[3] Commons (proprietary market, cumulativeness=10%)		.033 (.062)		.066 (.068)		.024 (.062)		.053 (.066)
[4] Commons (proprietary market, cumulativeness=90%)		.074 (.080)		.180** (.088)		.071 (.080)		.174** (.085)
Test of the difference between [3] and [4], p-value		.656		.172		.615		.151
[5] Commons (proprietary market, concentration=10%)			.115 (.080)	.147 (.081)			.108 (.078)	.143* (.079)
[6] Commons (proprietary market, concentration =90%)			.069 (.050)	.078 (.053)			.062 (.049)	.074 (.051)
Test of the difference between [5] and [6], p-value			.300	.122			.294	.110

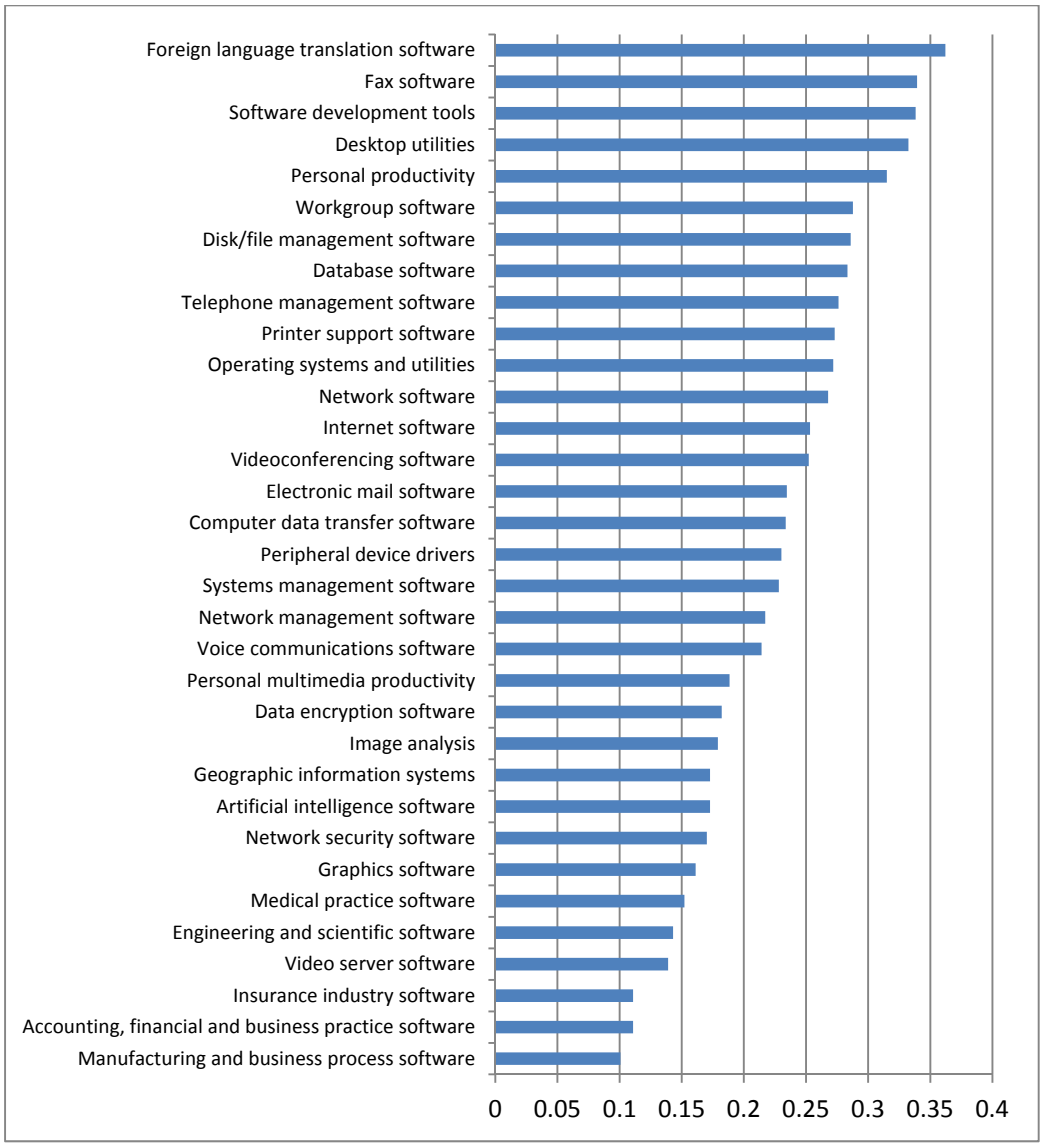
Notes: 1) All regressions include year dummies and market fixed effects. 2) Robust standard errors, clustered by market, are in parentheses. 3) * significant at 10%, ** significant at 5%, *** significant at 1%. 4) Columns (1) to (4) are based on a sample consisting of proprietary entry into 29 software markets from 2002 to 2009, and therefore with 232 observations in total. 5) Columns (5) to (8) are based on a sample consisting of product entry into 29 OSS markets and 29 proprietary software markets. However, because 18 markets are dropped because there is no entry observed throughout the sample period; therefore, this sample has 320 observations in total. 6) These results need to be interpreted with caution, as in this exercise we only used entry events (for both OSS and proprietary products) identified through PROMPT articles assigned with product codes.

Figure B-1: The extent of cumulativeness across markets



Notes: The numbers on the horizontal axis are the extent of cumulativeness.

Figure B-2: The extent of concentration across markets



Notes: The numbers on the horizontal axis are the extent of concentration.