

Figure 1. Fraser index vs. Ginarte-Park index

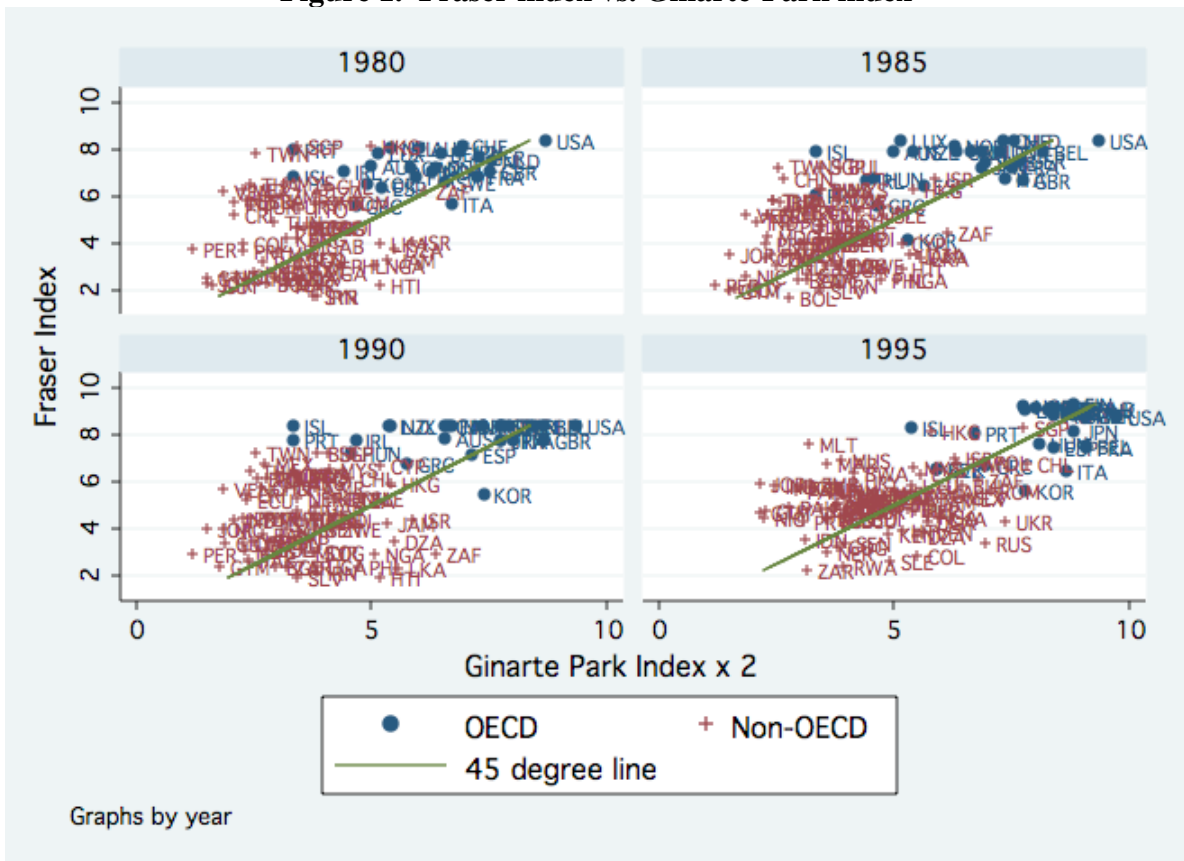


Figure 2. Effective patent rights index: Box plot

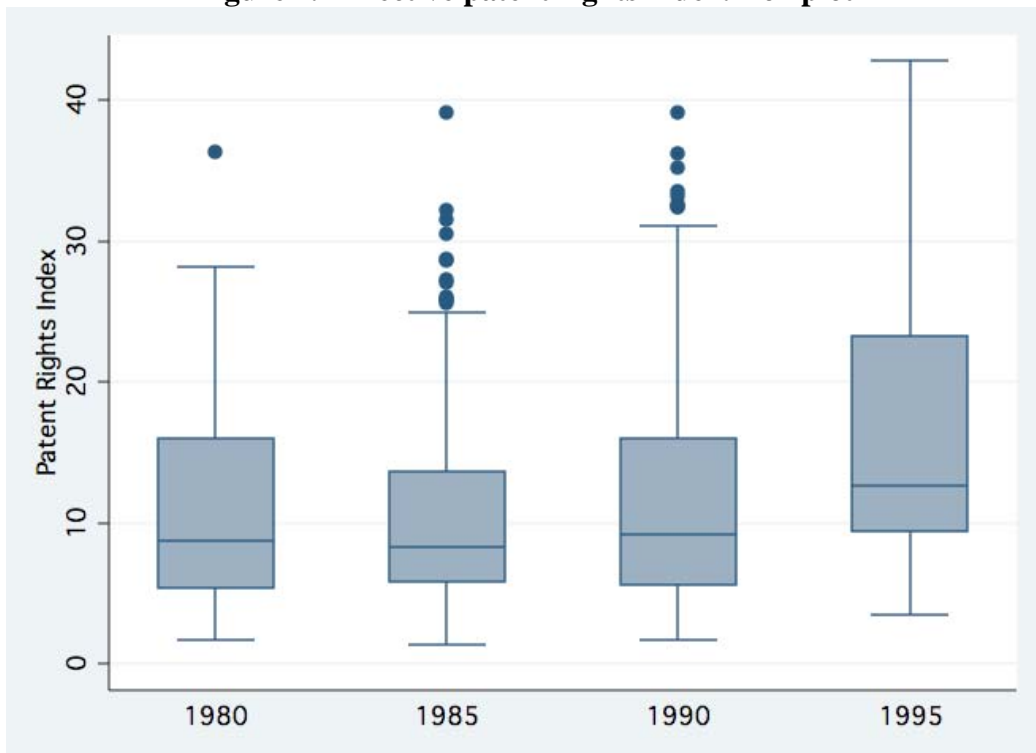


Figure 3. Effective patent rights index: Variance decomposition

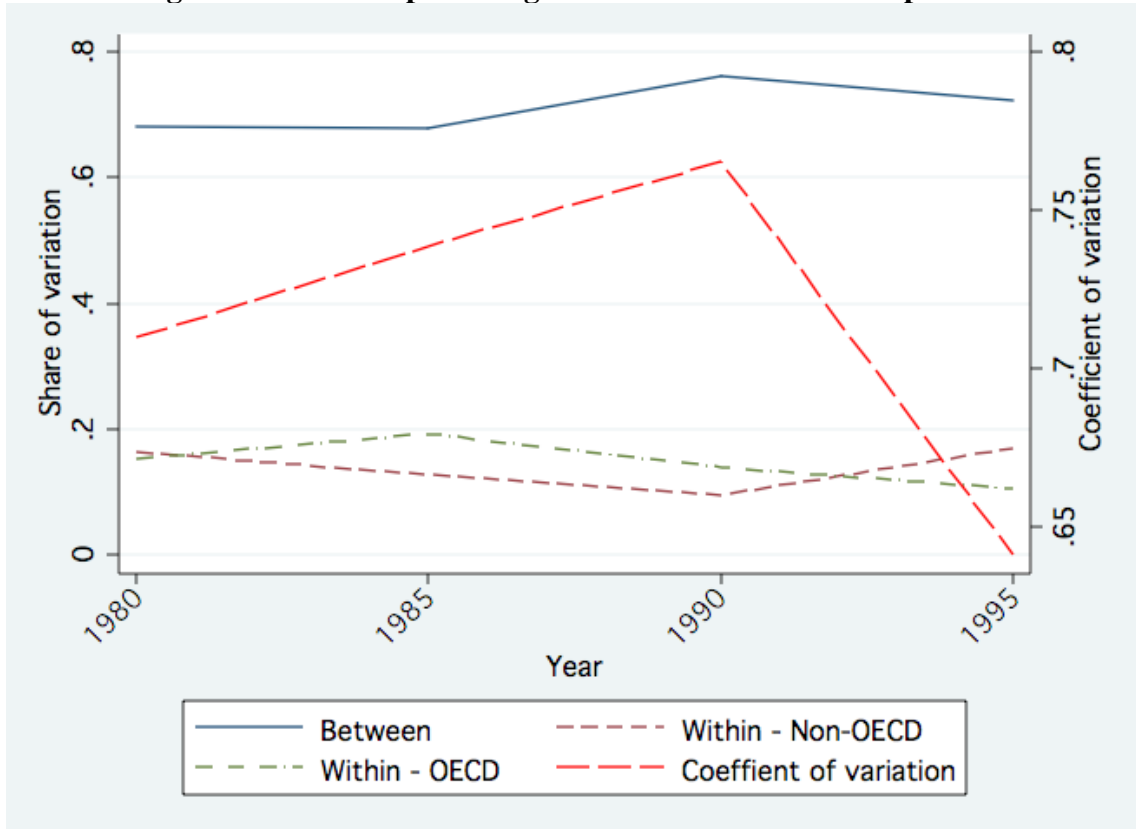


Figure 4. Patent intensity, by industry

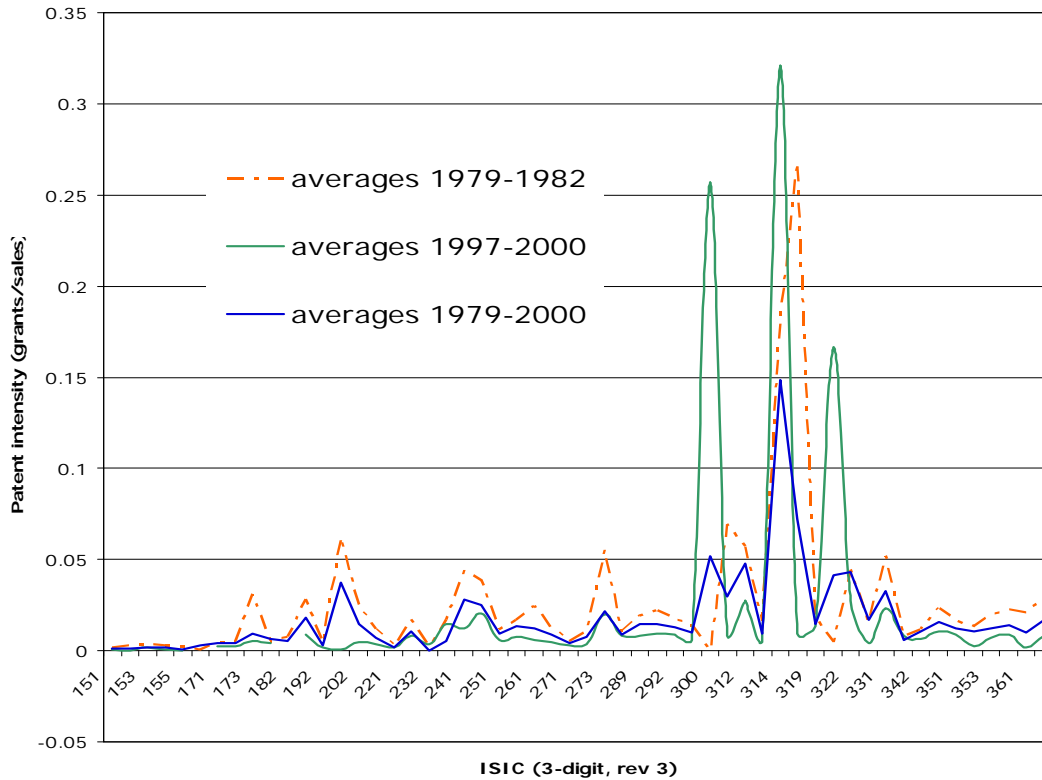


Figure 5: Patent intensity and effective patent rights

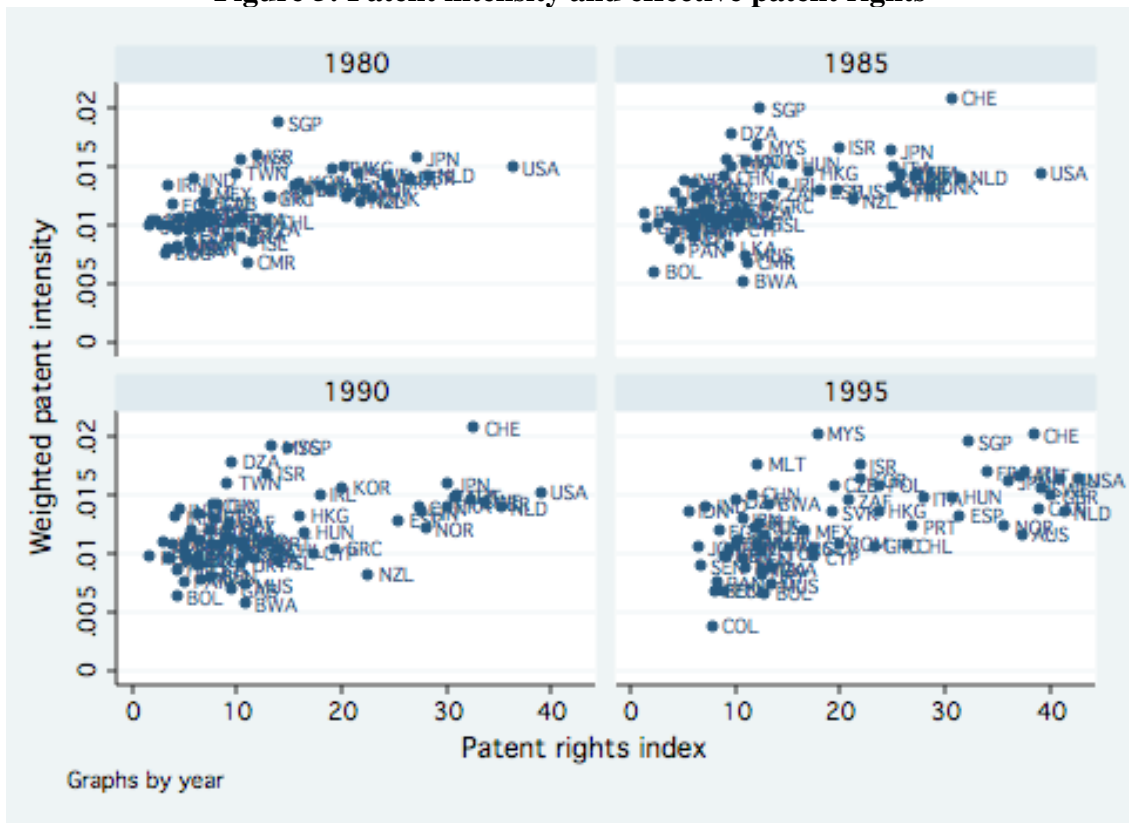


Table 1. Effective patent rights index: Top and bottom countries

1980		1985		1990		1995	
Top countries							
U.S.A.	39.30	U.S.A.	39.06	U.S.A.	39.06	U.S.A.	42.75
Netherlands	28.20	Belgium	32.23	Belgium	36.22	Netherlands	41.36
Switzerland	28.12	Netherlands	31.47	Netherlands	35.22	Denmark	41.26
Germany	28.01	Switzerland	30.55	U.K.	33.57	Finland	41.01
Japan	27.14	Germany	28.73	Germany	33.14	U.K.	40.15
Bottom countries							
Nicaragua	2.38	Nicaragua	2.38	Guyana	3.17	Niger	5.38
Peru	2.22	Bolivia	2.30	Pakistan	3.17	Guatemala	5.10
Guatemala	1.90	Guyana	1.69	Jordan	2.95	Nicaragua	5.00
Guyana	1.78	Guatemala	1.50	Guatemala	2.15	Rwanda	4.64
Jordan	1.72	Peru	1.31	Peru	1.73	Zaire	3.51

Table 2. Patent intensity

Industry (ISIC3 rev 3)	
Food and beverages (15)	0.0012
Tobacco (16)	0.0045
Textiles (17)	0.0058
Apparel (18)	0.0058
Leather (19)	0.0105
Wood products (20)	0.0250
Paper products (21)	0.0072
Publishing, printing (22)	0.0063
Coke and petroleum products (23)	0.0108
Basic chemicals (241)	0.0272
Other chemicals (242) (incl. pharmaceuticals)	0.0240
Rubber and plastics (25)	0.0110
Other non-metal (26)	0.0106
Basic metals (27)	0.0107
Fabricated metals (28)	0.0114
Machinery and equipment (29)	0.0122
Office, accounting, and computing machinery (30)	0.0513
Electric motors, generators and transformers (311)	0.0290
Electricity distribution and control apparatus (312)	0.0463
Insulated wire and cable (313)	0.0095
Accumulators, primary cells and primary batteries (314)	0.1420
Electric lamps and lighting equipment (315)	0.0695
Electronic valves, tubes and other electronic components (321)	0.0425
TV and radio transmitters (322)	0.0423
TV and radio receivers (323)	0.0163
Medical appliances and instruments (331)	0.0323
Motor vehicles, trailers and semi-trailers (34)	0.0105
Other transport equipment (35)	0.0123
Furniture and other manufactures (36)	0.0130

Notes: Patent intensity calculated as ratio of patents granted to sales during 1979-2000. For industries with low ratios of patents to sales, we aggregated the 3-digit industries to the 2-digit level. We exhibited more of the 3-digit industries with high ratios of patents to sales or of particular interest.

Table 3. Descriptive statistics

VA growth	Fraser Index	GP index	Effective patent rights index	Patent rights index (average)	Patent intensity 79-00	R&D/Sales 79-00	Capital (\$ mill.)	Labor
1981-85								
-0.005	5.35	2.07	11.853	4.745	0.018	0.023	781	18,229
(0.153)	(1.923)	(0.833)	(7.490)	(1.548)	(0.022)	(0.023)	(8,551)	(43,172)
2962	2962	2962	2962	2962	2962	2962	1,688	2,918
1986-90								
0.126	5.475	2.061	12.322	4.798	0.018	0.023	588	30,195
(0.197)	(1.827)	(0.909)	(8.412)	(1.643)	(0.022)	(0.023)	(2,032)	(108,727)
3185	3185	3185	3185	3185	3185	3185	1,844	3,157
1991-95								
0.036	5.624	2.176	13.218	4.988	0.018	0.023	954	34,845
(0.224)	(1.921)	(0.984)	(9.400)	(1.694)	(0.022)	(0.023)	(2,823)	(152,166)
3244	3244	3244	3244	3244	3244	3244	1,691	3,232
1996-2000								
-0.007	6.349	2.952	19.854	6.126	0.018	0.023	1,564	40,664
(0.224)	(1.672)	(1.034)	(11.177)	(1.698)	(0.022)	(0.023)	(4,348)	(168,115)
2837	2837	2837	2837	2837	2837	2837	1,396	2,781

Notes: Each panel reports means in the first row, standard deviations in the second row and numbers of observations in the third row.

Table 4. Main estimates

VARIABLES	(1) 1981-1985	(2) 1986-1990	(3) 1991-1995	(4) 1996-2000
Initial value added	-0.0154*** (0.00427)	-0.0496*** (0.00619)	-0.0382*** (0.00906)	-0.0117* (0.00599)
Effective patent rights x patent intensity	0.0129* (0.00707)	0.0128* (0.00708)	0.0442*** (0.0101)	0.0191** (0.00941)
Observations	2962	3185	3244	2837
R-squared	0.549	0.577	0.464	0.459

Notes: Dependent variable was the average of the growth of ln industry value added over 5-year period. Effective patent rights specified as product of GP index and Fraser index; patent intensity was computed over 1979-2000. All regressions included country and industry fixed effects. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1).

INDUSTRY	Patent	(1)	(2)	(3)	(4)
	intensity	1981-1985	1986-1990	1991-1995	1996-2000
ISIC 19 (Leather)	0.0105	0.0011 (0.0006)	0.0014 (0.0006)	0.0047 (0.0010)	0.0025 (0.0011)
ISIC 20 (Wood products)	0.0250	0.0027 (0.0013)	0.0034 (0.0015)	0.0111 (0.0024)	0.0060 (0.0026)
ISIC 242 (Other chemicals)	0.0240	0.0026 (0.0013)	0.0033 (0.0015)	0.0107 (0.0023)	0.0057 (0.0025)
ISIC 30 (Office, accounting & computing machinery)	0.0513	0.0056 (0.0027)	0.0070 (0.0031)	0.0228 (0.0050)	0.0122 (0.0054)

Notes: Each panel presents, for the industry and 5-year period: change in the average growth of ln industry value added associated with one standard deviation increase in effective patent rights, standard error (in parentheses), and average growth rate of industry value added for the corresponding period. Counterfactual calculations are based on estimated coefficients from Table 4.

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
Initial value added	-0.0154*** (0.00427)	-0.0497*** (0.00619)	-0.0383*** (0.00906)	-0.0117* (0.00600)
Effective patent rights x patent intensity x GDP per capita	0.00137** (0.000691)	0.00157** (0.000723)	0.00419*** (0.000982)	0.00181** (0.000851)
Observations	2962	3185	3244	2837
R-squared	0.549	0.577	0.464	0.459

Notes: Dependent variable was the average of the growth of ln industry value added over 5-year period. Effective patent rights specified as product of GP index and Fraser index; patent intensity was computed over 1979-2000. All regressions included country and industry fixed effects. Robust standard errors in parentheses (***) p<0.01, ** p<0.05, * p<0.1).

Table 7. Factor accumulation and productivity growth

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
Change in	0.0553	0.182***	0.255***	0.291***
log of capital services	(0.0523)	(0.0567)	(0.0627)	(0.0813)
Change in	0.888***	0.788***	0.626***	0.892***
log of labor	(0.0541)	(0.103)	(0.0713)	(0.0631)
Effective patent rights	0.0120**	-0.00695	0.00423	0.0442**
x patent intensity	(0.00525)	(0.00607)	(0.00588)	(0.0181)
Observations	1598	1856	1638	1419
R-squared	0.828	0.652	0.599	0.780

Notes: Estimated equation specified in (4). Dependent variable was the average of the growth of ln industry value added over 5-year period. Depreciation rate, $\delta = 0.1$, growth rate of capital, $\gamma = 0.05$. Effective patent rights specified as product of GP index and Fraser index; patent intensity was computed over 1979-2000. All regressions included country and industry fixed effects. Robust standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$).

Table 8. Effective patent rights

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
Geometric mean:	0.0967*	0.0754	0.371***	0.163*
(Fraser x GP) ^{1/2}	(0.0500)	(0.0514)	(0.0798)	(0.0901)
Average: (GP +	0.0757**	0.0614	0.284***	0.123*
0.5 x Fraser)	(0.0373)	(0.0374)	(0.0601)	(0.0675)
Fraser index	0.0776**	0.0545	0.261***	0.186**
	(0.0342)	(0.0359)	(0.0636)	(0.0920)
GP index	0.0530	0.0908	0.347***	0.0885
	(0.0630)	(0.0683)	(0.0834)	(0.0818)

Notes: Each panel reports the coefficient of the interaction of patent rights with patent intensity in a regression of the growth of ln industry value added on initial value added and patent rights x patent intensity with country and industry fixed effects over the 5-year period. Patent intensity was computed over 1979-2000. Panels differ in construction of the index of effective patent rights. Robust standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$).

Table 9. Patent intensity

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
Patent applications	0.0153*	0.0131	0.0605***	0.0216**
- sales ratio	(0.00815)	(0.00870)	(0.0119)	(0.0104)
R&D-sales	0.0172**	0.0115	0.0638***	0.0210**
ratio	(0.00860)	(0.0102)	(0.0125)	(0.00991)

Notes: Each panel reports the coefficient of the interaction of patent rights with patent intensity in a regression of the growth of ln industry value added on initial value added and patent rights x patent intensity with country and industry fixed effects over the 5-year period. Effective patent rights were specified as the product of GP index and Fraser index. Panels differ in construction of patent intensity. Robust standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$).

Table 10. Confounds

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
<u>A. Financial development</u>				
Effective patent rights	0.0227***	-0.00317	0.0261***	0.0263***
x patent intensity	(0.00686)	(0.00819)	(0.0101)	(0.00861)
Financial development	-0.661***	0.0551	1.202***	-0.117
x patent intensity	(0.209)	(0.281)	(0.378)	(0.198)
<u>B. Trade openness</u>				
Effective patent rights	0.0173*	-0.000451	0.0364***	0.0304***
x patent intensity	(0.00981)	(0.00949)	(0.0105)	(0.00973)
Trade openness	-0.107	0.541**	0.604*	-1.124**
x patent intensity	(0.176)	(0.244)	(0.340)	(0.443)
<u>C. Human capital</u>				
Effective patent rights	0.0166	0.00585	0.0227	0.0244**
x patent intensity	(0.0108)	(0.00960)	(0.0162)	(0.0110)
Human capital	-0.0366	0.0540	0.0774	-0.0557
x patent intensity	(0.0686)	(0.0742)	(0.175)	(0.122)

Notes: Each panel reports the coefficients of the interaction of effective patent rights with patent intensity and the interaction of the confound with patent intensity in a regression of the growth of ln industry value added on initial value added, effective patent rights x patent intensity, confound x patent intensity, and country and industry fixed effects over the 5-year period. Effective patent rights were specified as the product of GP index and Fraser index, and patent intensity was computed over 1979-2000. Confounds were, respectively, financial development, trade openness, and human capital. Robust standard errors in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 11. Instrumental variables estimates

VARIABLES	(1)	(2)	(3)	(4)
	1981-1985	1986-1990	1991-1995	1996-2000
<u>A. Instruments for effective patent rights</u>				
Effective patent rights	0.0178*	0.0211**	0.0601***	0.0235
x patent intensity	(0.0107)	(0.00903)	(0.0157)	(0.0151)
<u>B. Instruments for patent intensity</u>				
Effective patent rights	0.219	0.229***	0.230***	0.128***
x patent intensity	(0.139)	(0.0795)	(0.0709)	(0.0337)

Notes: Each panel reports the coefficient of the interaction of effective patent rights with patent intensity in a regression of the growth of ln industry value added on initial value added, effective patent rights x patent intensity, and country and industry fixed effects over the 5-year period. Panel A: Effective patent rights specified as product of GP index and Fraser index, and instrumented by legal origin (La Porta et al. 2008). Panel B: Patent intensity computed over 1979-2000, and instrumented by the Ciccone and Papaioannou (2010) method. Specifically, using the robust regression (rreg) procedure in STATA, the first stage regressed growth of industry value-added on industry and country fixed effects, and the index of effective patent rights, while allowing the coefficient of the index to vary with industry, excluding ISIC 151. In the second stage, the industry patent intensity was instrumented by the industry-varying coefficient of the index of effective patent rights from the first stage. Robust standard errors in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.