

# Patent Boxes

*Presentation to the Aghion-Howitt Conference on  
Economics of Creative Destruction*

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## What's a patent box?

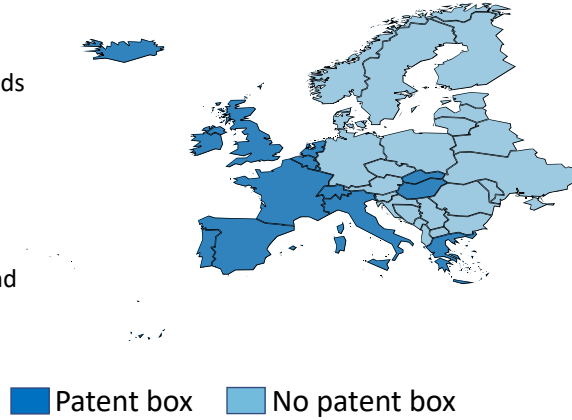
- Special corporate tax rate on income that can be allocated to patents.
  - In some countries, other intangible property
  - Obvious problems of income allocation
  - Tax rates range from 0 to 16%, most <10%
- Why a patent box
  - Another policy to encourage investment in innovation?
  - Prevent the shifting of intangible income to low tax jurisdictions?

## Which countries have IP boxes?

Mostly European (+ Japan):

- |               |             |
|---------------|-------------|
| Belgium       | Luxembourg  |
| Cyprus        | Malta       |
| France        | Netherlands |
| Greece        | Portugal    |
| Hungary       | Slovakia    |
| Iceland       | Spain       |
| Ireland       | Switzerland |
| Italy         | Turkey      |
| Liechtenstein | UK          |

Countries with a patent box in 2016

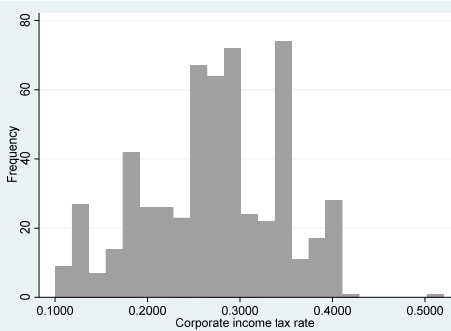


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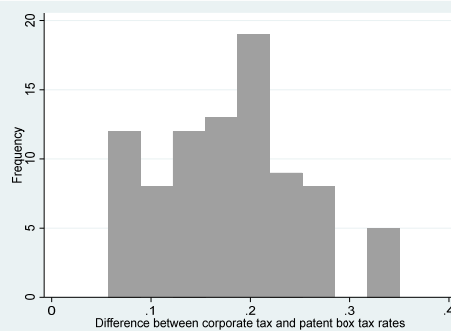
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## Tax variables (2016)



**Statutory corporate tax rate**  
For 36 OECD countries plus Estonia, Slovenia  
Range 10%-55%



**Corporate tax rate less patent box rate**  
For countries with patent box  
Differential is 5%-35%

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## R&D tax incentives & patent boxes

- Why are R&D tax credits preferred?
  - Directly related to cost and location of activity (firm decisions)
  - No incentives to transfer patents to low tax jurisdictions
  - No tax subsidy for patent trolling
  - No incentive to keep zombie patents alive to reduce taxes
  - Patent boxes target the most appropriable part of innovation, which is not where we need an innovation subsidy
  - Much higher audit cost for patent box income; depending on box design,
    - Relative size of non-R&E budget can affect credit
    - Incentive to choose projects with high non-R&E expenses

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## Gaessler, Hall, & Harhoff (RP 2021)

- Our questions:
  - Do patent boxes induce transfers of patent ownership to lower tax countries?
    - How is this affected by features of the patent box and other tax regulations?
  - Do patent boxes increase patentable invention in a country?
  - Are more valuable patents transferred, using conventional indicators of value?

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## Aggregate transfer results

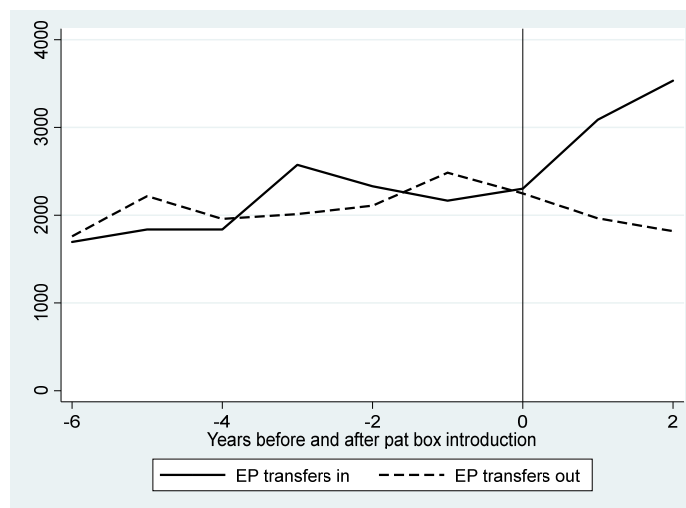
- Seller corporate tax rate remains a strong influence on patent transfer, regardless of the presence of a patent box
  - E.g., Apple patents from US to Ireland
- Patent boxes do not seem to encourage transfer to a country **unless existing and/or acquired patents are included without a development condition**
  - A 10 per cent increase in patent tax advantage associated with 18 per cent increase in transfers in this case
  - Intra-group transfers respond to patent box wedge if there is also a CFC restriction

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## Patent transfers at time of patent box introduction



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## Patent boxes and invention

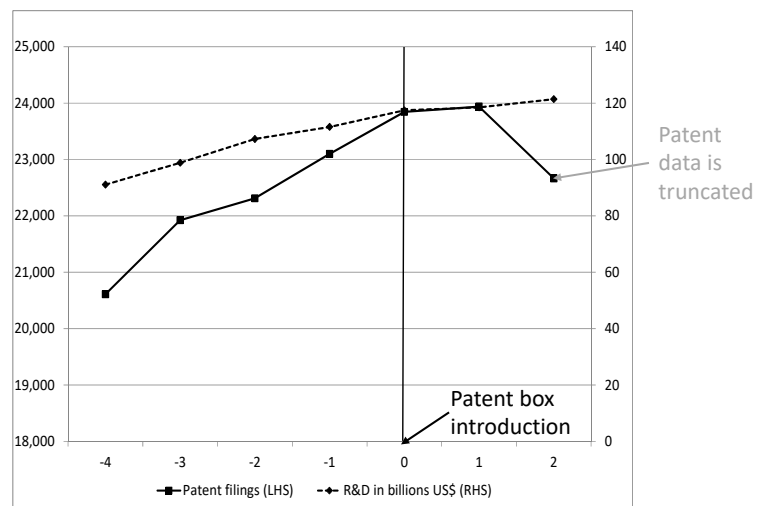
- Does the presence of a patent box increase patentable invention in a country?
  - Difficult to see because all countries have an upward trend in patents (control with year dummies)
  - log (EP filings in a country-year) on
    - the patent box, corporate tax rates, log population, log GDP per capita, log R&D per GDP, country and year dummies.
  - We find a *small negative* impact of the patent box on patented invention.
  - Similar but insignificant results for business R&D.

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## Aggregate patenting and business R&D – around patent box introduction



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## Summary

- Do patent boxes induce transfers of patent ownership to lower tax countries?
  - Transfers respond to seller country corporate tax
  - Also respond to patent boxes, but only if existing/acquired patents without development condition included
  - CFC rules do impact transfer by MNEs
- Do patent boxes increase patentable invention in a country?
  - Controlling for country characteristics, patented invention falls
  - Controlling for country characteristics, R&D does not change significantly
- Are more valuable patents transferred internationally?
  - Simple model of choice
  - Yes, probability rises with value index
  - Impact of value declines as selling country tax rate increases

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## Consequences of G-7 Agreement

- Global 15% minimum corporate tax rate.
  - MNE headquarters country to apply difference to income from country with a lower rate.
  - If HQ moves to low tax jurisdiction, each country can tax firm's operations within its borders at the minimum rate.
  - Seems to outlaw most patent box rates, but details to be negotiated

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# BACKUP SLIDES

## Recent studies on patent boxes

- Most studies on applications, two studies on transfers, none on priority filings and only one on subsequent invention

Authors	Years	Level of observation	Dependent variable	Result
Alstadsaeter et al. (2015)	2000-2011	Firm-tech-country	Number of EP patent filings by applicant country-tech field	Broader pat box makes affiliate locations more attractive but small negative impact on invention
Bradley et al. (2015)	1990-2012	Country	Inventor pats; owner pats; mismatch	Domestic inventing increases if rate falls; no impact on mismatch
Bösenberg & Egger (2015)	1996-2012	Country-technology	Number of EP applications and <i>pre-grant</i> transfers by applicant country-tech field	Filings respond to tax rates; more valuable patents transferred.
Schwab & Todtenhaupt (2016)	2000-2012	MNC affiliate	Worldwide patent grants	Pat box in other countries generates positive spillovers on R&D
Koethenbueger et al. (2016)	2007-2013	MNC affiliate	Stated profit before tax by subsidiary	Evidence that pat box used for profit shifting
Ciaramella (2017)	1997-2015	Firm	<i>Granted</i> EP application transfers	Recipient patent box increases prob of transfer

## Summary of evidence on patent boxes

- Do firms transfer patents to patent box countries?
  - Evidence that patent location responds to corporate tax rates even before the boxes
  - Some additional transfer from patent boxes
  - Griffith et al. 2014 - empirical model of patent location and taxes to simulate introduction of a patent box.
    - Attracts patent income, lose large amounts of revenue
- Do patent boxes increase domestic invention?
  - Mixed evidence, mostly no
- Also, some evidence of international spillovers and profit shifting to lower tax areas

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## Patent Transfers – Transfer Example

International Ocmohuereu B.V. - P.O. Box 220 - 5600 AE Eindhoven - The Netherlands  
 European Patent Office  
 Erhardtstrasse 27  
 80331 MÜNCHEN  
 Germany


order n. con: betr.	doorkennummer accs: intern. dia.	in-dialling Durchwahl	datum, date
PHA 23486 EP EE.	+31 40 27 43505		2003-01-10

REQUEST FOR REGISTRATION OF A TRANSFER (Rule 20(1), EPC)

Re: European Patent Application No. 99202415.8  
 Applicant: Koninklijke Philips Electronics N.V.  
 Assignment to BROADBAND ROYALTY CORPORATION

I, the undersigned, hereby request the registration of the transfer of the above-identified European Patent Application to BROADBAND ROYALTY CORPORATION on the basis of the enclosed instrument of assignment.

The Professional Representative



J.L. van der Veger

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16



## Basic patent box features

Country	Years with IP box	R&E tax credit@	Includes existing patents	Includes acquired patents	Corp tax rate (statutory)	IP box rate (statutory)
Belgium	2007-	x	yes%	yes%	34	6.8
Cyprus	2012-		yes	yes	10	2.5
France	1971-	x	yes	yes#	34	16
Hungary	2003-	x	yes	yes	20	10
Ireland	1973-2010	x	yes	no	12.5	0
Liechtenstein	2011-		yes	yes	12.5	2.5
Luxembourg	2008-		no	yes	29	5.84
Malta	2010-		yes	yes	35	0
Netherlands	2007-	x	yes%	yes%	25.5	5
Portugal	2014-	x	no	no	31.5	15
Spain	2008-	x	yes	no	30	12
Switzerland	2011-		yes	yes	21	8.8
UK	2013-	x	yes	yes%	22	10

# if held for at least 2 years. % if further developed.

@Some kind of R&D tax credit (beyond expensing) available during the period.

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## Details on patent box incentives

- Variations in IP covered (sometimes even informal IP)
- Variations in treatment of income and expense
  - Gross income in some countries, rather than net
  - Recapture of past R&D expense deductions in some cases
- Use affected by CFC rules (home country taxes income received in low tax country at domestic rate)
  - However, the ECJ has limited the application of CFC rules within the EEA area.
- In practice, variation in patent box features
  - Use of patent box as a “natural experiment” somewhat imprecise
  - Accounting for the features leaves little variation for identification
- Note: can transfer patent income to low tax jurisdiction even without a patent box (subject to CFC rules)

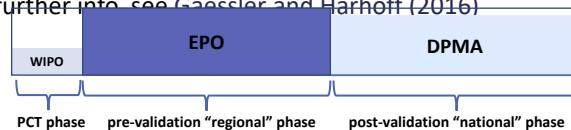
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## MPI for Innovation and Competition Patent Transfers Data 2016

- Dataset Covers Transfers of European Patents (EP) 1981-2014
  - 1.2 million registered patent ownership transfers
  - Patents with „change in ownership information“ in WIPO, DPMA and EPO data
  - Sector allocation: firms, individuals, universities, non-profit, etc.
  - Distinction between market, M&A and intra-group patent transfers
  - About 12% of these transfer are cross-country
  - For further info, see Gaessler and Harhoff (2016)



Notes: DPMA: German Patent an Trademark Office. EPO: European Patent Office. WIPO: International Bureau of the World Intellectual Property Organization. Only a subset of EP patents experiences a prior PCT phase and not all EP patents are validated in Germany

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## Patent Transfer Flows – Europe (2000-2014)

Code	Country	Year patent box introduced	Patents transferred out	Patents transferred in	Difference in patents transfers
AT	Austria		1313	1041	-272
BE	Belgium	2007	1073	1540	467
CH	Switzerland	2011	6049	9354	3305
CY	Cyprus	2012	158	219	61
DE	Germany		12266	9449	-2817
DK	Denmark		1078	861	-217
ES	Spain	2008	398	322	-76
FI	Finland		1611	1838	227
FR	France	1971	4730	4282	-447
GB	UK	2013	8949	4084	-4865
HU	Hungary	2003	127	241	115
IE	Ireland	1973	473	1906	1433
IS	Iceland		28	90	62
IT	Italy		1784	1316	-469
LI	Liechtenstein	2011	306	271	-35
LU	Luxembourg	2008	724	2607	1883
MT	Malta	2010	36	77	42
NL	Netherlands	2007	6068	8023	1955
NO	Norway		452	503	51
PT	Portugal	2014	105	165	60
SE	Sweden		2672	3514	841

- generally positive balance for countries with patent boxes
- exception: UK

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## Patent Transfer in and out Flows – Rest of World and Tax Havens (2000-2014)

Code	Country	Tax haven	Patents transferred out	Patents transferred in	Difference in patents transfers
AU	Australia		1088	503	-586
BB	Barbados	yes	569	1710	1141
BM	Bermuda	yes	205	809	604
BS	Bahamas	yes	44	129	85
CA	Canada		3214	1846	-1368
CW	Curacao	yes	478	527	49
GG	Guernsey	yes	211	269	58
GI	Gibraltar	yes	28	86	58
HK	Hong Kong	yes	145	611	467
IL	Israel		872	643	-228
IM	Isle of Man	yes	105	141	36
JE	Jersey	yes	67	132	66
JP	Japan		4205	2579	-1627
KR	South Korea		528	809	281
KY	Cayman Islands	yes	500	1507	1007
MC	Monaco	yes	70	38	-33
MX	Mexico		62	176	115
NZ	New Zealand		161	78	-83
SG	Singapore	yes	236	1354	1118
US	US		23520	20293	-3227

- generally negative balance for large countries (US, JP, CA, AU)
- generally positive balance for tax havens

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## Model for aggregate patent transfers

- # patents transferred from “seller” country  $S$  to “buyer” country  $B$

$$E(\#transfers_{S \rightarrow B} | S, B, t, tax) = \alpha_S + \beta_B + \lambda_t + f(tax_{S_t}, tax_{B_t})$$

where  $t$  = calendar time.

- Tax variables:
  - Statutory corporate tax rates in  $B$  and  $S$
  - Dummies for patent box or difference between corp tax rate and patent box rate in each country
  - Alternatively: difference in corp tax rates and difference in patent box wedge between countries  $B$  and  $S$ .
- Unit of observation: country pairs at time  $t$
- 37 countries: EU24, NO, IS, CH, US, JP, KR, CA, AU, NZ, CL, MX, TR, IL
- Method of estimation is Poisson with robust standard errors

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<b>Aggregate results – patent transfers</b>			
Dependent variable: # patents transferred from seller to buyer country during the year			
	----- All transfers -----	Within group	
Buyer corp tax rate	0.81 (1.28)		
Buyer patent tax wedge	-0.04 (0.76)		
Seller-buyer corp tax	0.35 (0.90)	-0.31 (0.95)	0.29 (1.24)
Buyer-seller pat tax wedge	1.35** (0.63)	0.33 (0.55)	0.40 (0.74)
D (dev condition)*wedge	-1.95* (1.03)		
D (CFC rules for buyer)		-0.37** (0.17)	-0.02 (0.27)
D (CFC)*corp tax diff		3.31*** (1.13)	1.20 (1.77)
D (CFC)*wedge diff		1.27 (1.04)	2.22* (1.26)
Seller corp tax rate	1.11 (1.03)		
Seller patent tax wedge	-1.52** (0.63)		
19,980 observations on 1,332 country pairs; robust s.e. clustered on pairs.			
All regressions include dummies for buyer and seller countries, and years 2000-2014			
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<b>Patent boxes and invention</b>				
Dependent variable:	Log (EP filings)		Log (BERD)	
D (patent box)	-0.13* (0.06)		-0.08 (0.04)	
Patent box tax wedge		-0.49* (0.24)		-0.41 (0.22)
Corporate tax rate	-1.45 (1.12)	-1.43 (1.14)	-0.06 (0.46)	-0.05 (0.46)
Log population	-0.97 (1.19)	-1.00 (1.21)	-0.08 (0.52)	-0.07 (0.52)
Log GDP per capita	1.55*** (0.34)	1.51*** (0.35)	1.60*** (0.21)	1.60*** (0.21)
Log R&D per GDP	0.70*** (0.19)	0.72*** (0.19)	----	----
Standard error	0.25	0.25	0.11	0.11
Unit of observation is country-year: 555 observations on 37 countries, 2000-2014				
All regressions include a complete set of country and year dummies				
Standard errors are robust and clustered on country.				
Development/existing/acquired patent restrictions are insignificant.				

## Patent level analysis

- Sample: ~700,000 EP granted patents filed 2000-2012, granted by 2014
- Look at first transfer only
- Either Probit or hazard rate model of probability of an international transfer as a function of
  - Patent characteristics – family size, claims, forward citations, number of inventors
  - Applicant characteristics – patent portfolio size, D (research active in more than one country), D (corporation, not research active MNC)
  - Dummies for applicant country, application year
- 3,428,110 observations at risk, with 104,664 transfers, 343,154 patents.

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## Patent level analysis

Dependent variable: Dummy for first international transfer of patent

	All
Patent family size (docdb)	0.063*** (0.001)
Claims	0.021*** (0.001)
Forward citations	0.010*** (0.001)
Inventors	0.040*** (0.002)
Applicant patent portfolio size	-0.040*** (0.001)
Dummy for research active MNE	0.271*** (0.003)
Dummy for corporation, not MNE	-0.022*** (0.003)

A complete set of applicant country and application year dummies included in all regressions. Left-out category is individuals and non-profits.

Estimates - average marginal impact on probability; all non-dummy variables in logs.  
3,428,110 observations on 343,154 patents; 104,664 transfers

Standard errors are clustered by patent.

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