(Un)Intended Effects of Preferential Tax Regimes

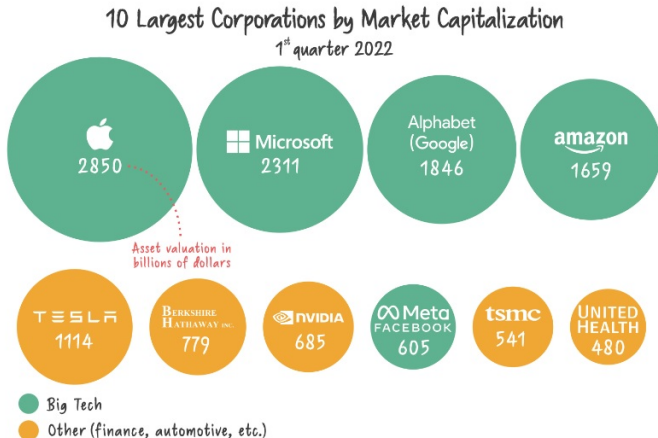## The Case of European Patent Boxes

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joint with M. Koethenbuerger and F. Liberini

Significance of Intellectual Property (IP)

- Intellectual property (IP) has become ever more important.

10 Largest Corporations by Market Capitalization
1st quarter 2022

Source: List of public corporations by market capitalization from Wikipédia

R&D Tax Incentives
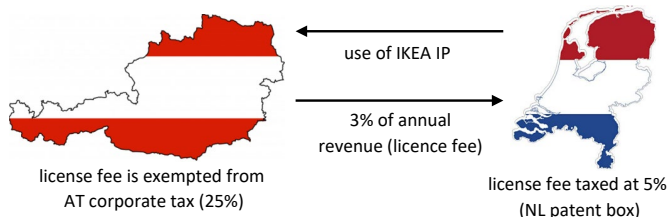
- Input-related tax incentives:
    - R&D tax allowances
    - R&D (super-) deduction
    - R&D tax credits

- Output-related tax incentives:
    - Innovation or patent box regimes
    - $\Rightarrow$ patent boxes grant a reduced tax rate of 5-10% on income from IP vis-a-vis "standard" profit income.
    - Patent boxes are intended to foster R&D.

Patent Box Regimes & Profit Shifting

- Since 2008, several countries implemented patent boxes.

- Patent boxes are suspected to elicit profit shifting because arms-length prices are not readily available for IP.

- OECD is concerned about the tax minimization strategies using patent boxes, but also emphasizes the productivity gains of R&D.

- Bloom, Van Reenen, and Williams (2019):

    "*Our take is that patent boxes are an example of a harmful form of tax competition that distorts the tax system under the guise of being a pro-innovation policy.*"

- We quantitatively analyse the fiscal effects of patent boxes.

Anecdotal Evidence: IKEA Tax Avoidance Scheme
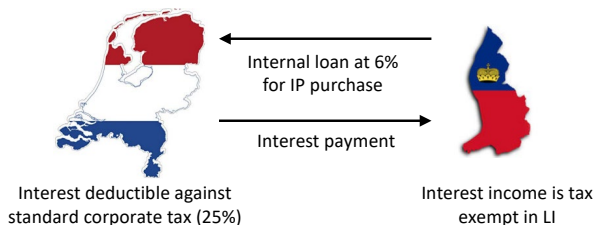
▶ IKEA: world largest furniture retailer, €38 bn. yearly revenue.

▶ IKEA IP bundled in Dutch affiliate INTER IKEA.

▶ IKEA retail stores pay 3% of annual revenue as license fee.

use of IKEA IP

3% of annual revenue (licence fee)

license fee is exempted from AT corporate tax (25%)

license fee taxed at 5% (NL patent box)

▶ Tax savings through profit shifting into the Dutch patent box.

IKEA: The Story continues...

▶ INTER IKEA bought IP from Luxembourg affiliate using a €6 bn. internal loan at 6% interest (inter-company av. lone rate: 2.5%) from the Lichtenstein IKEA Foundation.

▶ The interest payments of INTER IKEA to the IKEA Foundation, are tax deductible at the regular Dutch corporate tax rate of 25%.

Internal loan at 6%
for IP purchase

Interest payment

Interest deductible against
standard corporate tax (25%)

Interest income is tax
exempt in LI

▶ NL: interest deduction at 25% but IP income taxed at only 5%.
  ⇒ Estimated tax avoided: €1 bn. between 2009 and 2014.

Research Question

▶ Are patent boxes used as a vehicle for profit shifting?

▶ Are there productivity effects associated with patent boxes?

▶ Do firms respond by adjusting other profit shifting channels?

Previous literature:

▶ MNEs' pre-tax profits are tax sensitive due to profit shifting.
[Hines & Rice (1994), Huizinga & Laeven (2008), Dischinger (2010),
Dharmapala & Riedel (2013), Dyreng & Markle (2013), Huizinga et al. (2008).]

▶ Literature on the tax-sensitive choice of IP. location
[Dischinger & Riedel (2011), Karkinsky & Riedel (2012), Griffith et al. (2014).]

Empirical Analysis

- ▶ Components of profits – regular income, shifted profits, and productivity gains – cannot be separately observed.

- ▶ We estimate a profit shifting function for

  - ▶ MNE affiliates with and without qualifying IP income
    - → separates income shifted via IP and IP-related productivity

  - ▶ DOM affiliates with and without qualifying IP income
    - → separates IP-related productivity

- ▶ Estimate differences in the elasticity of unconsolidated pre-tax profits (on introd. of a patent box) between MNE & DOM affiliates.

Definition of Treatment

- Based on **historical (direct or indirect) IP ownership**, we define

    - **Treatment Group:** Affiliates with low costs of accessing the IP-related tax benefits.

    - **Control Group:** Affiliates with high costs (major investment) of accessing the IP-related tax benefits.

- Treatment: Access to tax benefit from patent box.

- Exploiting the IP related tax benefit depends on patent ownership which is endogenous to a number of real-economic factors.

    $\rightarrow$ Coarsened Exact Matching. CEM

- ORBIS firm level data: historical and years 2007-2013. DATA

- Location of affiliates: BE, LU, ES, FR, NL, and HU.

LN(profit) CEM-Matched Sample, 95% Confidence Intervals
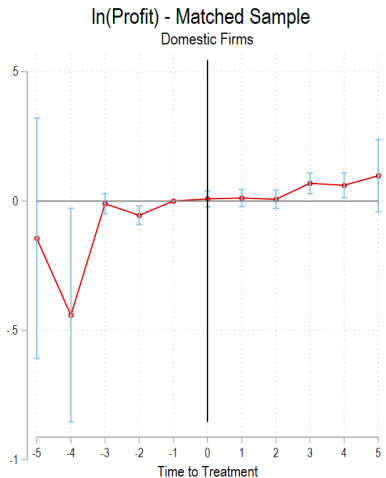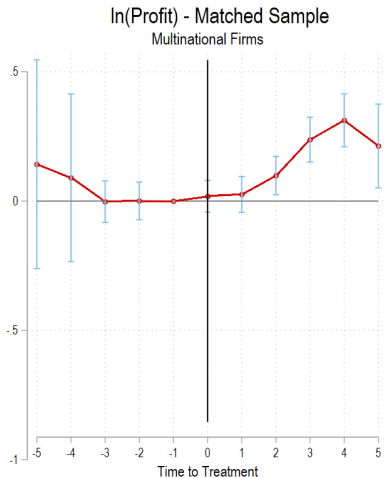
LN(EBIT) CEM-Matched Sample, 95% Confidence Intervals
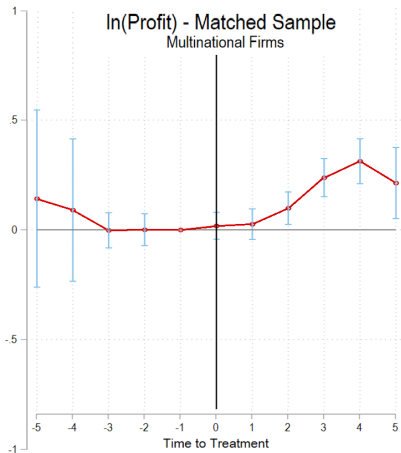
DD Model - Baseline Results

Dep. Variable:	Pre-Tax Profits				EBIT
	Homog. Treatment [1]	MNE vs DOM [2]	Controls [3]	Full Sample [4]	same as [3] [5]
After * Treated	0.0472***				
	(0.0142)				
After * Treated * DOM Affiliate		0.0358***	0.0346**	0.0346***	0.0320**
		(0.0147)	(0.0166)	(0.0130)	(0.0149)
After * Treated * MNE Affiliate		0.1335***	0.0854***	0.0755***	0.1063***
		(0.0300)	(0.0330)	(0.0261)	(0.0311)
Fixed Assets			0.0219***	0.0304***	0.0458***
			(0.0073)	(0.0043)	(0.0068)
Cost of Employees			0.2698***	0.2667***	0.2666***
			(0.0164)	(0.0092)	(0.0149)
Financial Leverage			-0.1745***	-0.1978***	-0.0327**
			(0.0157)	(0.0091)	(0.0140)
MNE Affiliate in Low-Tax Country			0.0535**	0.0907***	0.0602***
			(0.0268)	(0.0166)	(0.0245)
Treatment Year Dummies	YES	YES	YES	YES	YES
Year x Industry Dummies	YES	YES	YES	YES	YES
Observations	131,592	131,592	131,592	409,776	131,794
Total Number of Affiliates	28,532	28,532	28,532	90,662	28,379
Treated MNE Affiliates	1,624	1,624	1,624	2,033	1,624
Treated DOM Affiliates	12,624	12,624	12,624	43,298	12,624

*Note: All models are estimated using a linear panel model with affiliate level fixed effects. The sample includes all affiliates matched with CEM. Treatment is defined as patent ownership directly by the affiliate or indirectly by the majority shareholder by the year 2000. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

DD Model: Role of Tax Havens

Dep. Variable:	Pre-Tax Profits		EBIT	
	SH in TH [1]	AF in TH [2]	SH in TH [4]	AF in TH [5]
After * Treated * DOM Affiliate	0.0350** (0.0166)	0.0346** (0.0166)	0.0323** (0.0150)	0.0320** (0.0150)
After * Treated * MNE Affiliate				
linked to Tax Haven	-0.1250 (0.0861)	0.0878** (0.0391)	-0.0690 (0.0873)	0.1178*** (0.0388)
not linked to Tax Haven	0.1003*** (0.0339)	0.0838** (0.0401)	0.1186*** (0.0321)	0.0983*** (0.0372)
Controls	YES	YES	YES	YES
Treatment Year FE	YES	YES	YES	YES
Year x Industry Dummies	YES	YES	YES	YES
Observations	139,229	139,229	144,400	144,400
Affiliates	28,532	28,532	28,379	28,379
Treated MNE Affiliates	1,624	1,624	1,624	1,624
Treated DOM Affiliates	12,624	12,624	12,624	12,624

*Note: All models are estimated using a linear panel model with affiliate level fixed effects. The sample includes all affiliates matched with CEM. Treatment is defined as direct patent ownership by the affiliate or indirectly by the majority shareholder, by the year 2000. For affiliates of multinationals, treatment effect varies according to the type of link the affiliate has with a tax haven (TH). SH (AF) indicates that the majority shareholder (an affiliate in the conglomerate) resides in a tax haven. The variable "Any" indicates that either an affiliate, the majority shareholder or both reside in a tax haven. Control variables are identical to the ones in [3], Table 9, but are omitted from the table. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Revenue Implications

► Profits shifted into the patent box and productivity effects have positive impact on corporate tax revenues.

► Difference response in EBIT and Pre-Tax Profit indicates outward shifting of profits from patent box country.

► Tax base adjustments not necessarily mean higher tax revenues:

  ► inward shifted profits are subject to preferential rate

  ► profits shifted outwards (int.debt) benefit from regular rate

► Negative fiscal implications are likely, given the large difference between the regular and the preferential tax rates.

Conclusion

▶ Our results are in line with Bloom, Van Reenen, and Williams (2019) that patent boxes are used as profit shifting devices.

▶ But patent boxes also have a productivity effect: profit shifting and productivity effects in proportion $2/3$ and $1/3$, respectively.

▶ Patent boxes stimulate profit shifting via royalty payments and, in reverse direction, debt shifting, lowering fiscal revenue.

⇒ Fiscal effects might be smaller than expected.

▶ A tax haven link does not neutralize incentives to use patent boxes, unless the majority shareholder resides in the tax haven.

THANK YOU!

DD Model: Confounding Tax Incentives

Dep. Variable:	Pre-Tax Profits			EBIT		
	Parent Tax	Minimum Tax	Tax Haven	Parent Tax	Minimum Tax	Tax Haven
	[1]	[2]	[3]	[4]	[5]	[6]
After * Treated * DOM Affiliates	0.0285*	0.0285*	0.0289*	0.0251*	0.0255*	0.0257*
	(0.0163)	(0.0163)	(0.0163)	(0.0147)	(0.0147)	(0.0147)
After * Treated * MNE Affiliates:						
in low-tax countries	0.0912*	0.1045**		0.1463***	0.1298***	
	(0.0549)	(0.0461)		(0.0526)	(0.0452)	
in high-tax countries	0.1306***	0.1219***		0.1495***	0.1389***	
	(0.0346)	(0.0320)		(0.0336)	(0.0308)	
linked to a tax haven			-0.0886			0.0608
			(0.1286)			(0.0955)
not linked to a tax haven			0.1088***			0.1317***
			(0.0306)			(0.0292)
Controls	YES	YES	YES	YES	YES	YES
Treatment Year FE	YES	YES	YES	YES	YES	YES
Year x Industry FE	YES	YES	YES	YES	YES	YES
Observations	139,229	139,229	139,229	144,400	144,400	144,400
Affiliates	28,532	28,532	28,532	27,896	27,896	27,896
Treated MNE Affiliates	1,624	1,624	1,624	1,624	1,624	1,624
Treated DOM Affiliates	12,624	12,624	12,624	12,624	12,624	12,624

*Note: Models are estimated using a linear panel model with FE. The sample includes all affiliates matched with CEM. Treatment is defined as direct patent ownership by the affiliate or indirectly by the majority shareholder, by the year 2000. For multinational affiliates, treatment is allowed to vary according to the confounding tax incentives faced by the conglomerate the affiliate belongs to. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Diff-in-Diff Approach

- Identify affiliates (ownership struc.) in countries with a patent box.

- Trace direct and indirect IP ownership pre 2000.

- Estimate the effect of patent boxes on the unconsolidated pre-tax profit of affiliate i in sector s at time t.

$$\pi_{ist} = \underbrace{\beta_0 + \beta_1 k_{it} + \beta_2 \ell_{it} + \beta_3 f_{it} + \beta_4 TAX_{it} \times MNE_i +}_{\text{Hines \& Rice component}}$$

$$\underbrace{\gamma_1 T_{it} \times DOM_i + \gamma_2 T_{it} \times MNE_i}_{\text{DDD component}} + \underbrace{\theta_\tau + \lambda_{st} + \eta_i}_{\text{FEs}} + \epsilon_{ist}$$

TAX_{it}: composite tax index, capturing tax incentives of MNE.

T_{it}: 1 for EU affiliates with historical IP ownership and after the introduction/amendment of the patent box, and 0 otherwise.

Extensions & Robustness Checks

- Restrictions to eligibility of IP income `PBR`

    $\rightarrow$ non-eligibility of income of acquired patent eliminates profit shifting

- Full sample & alternative matching (PSM vs. CEM) `AMM`

- Alternative treatment definition `ATD`
  (IP ownership through minority shareholder)

- Alternative sample composition `ASC`
  (longer time span, 2007-2015, including the UK)

Identification Strategy: Treatment Effect

- Treatment is defined by the year of introduction or major adjustments in the patent box.

	BE	NL*	LU	ES	HU	FR*
Year of Introd. (*maj.Adj.)	2008	2010	2008	2008	2012	2010
Top Corporate Tax Rate	0.33	0.25	0.292	0.28	0.19	0.333
Separate Rate on IP	NO	YES	NO	NO	NO	YES
Base Adjustment	YES	YES	YES	YES	YES	NO
Effective Tax rate	0.066	0.05	0.058	0.112	0.095	0.15
New Patents	YES	YES	YES	YES	YES	YES
Existing Patents	NO	NO	NO	YES	YES	YES
Acquired Patents	YES	YES	YES	NO	YES	YES
Trademarks/Logos/Knowhow	NO	NO	YES	YES	YES	NO

Coarsened Exact Matching (CEM)

$\rightarrow$ Use historical IP Ownership, as to *before* any IP-Box existed

$\rightarrow$ Match affiliates of MNEs (DOMs) owning IPs with affiliates of MNEs (DOMs) having similar characteristics, but no IP ownership.

Coarsened Exact Matching: "bins" observations with common

- Country, industrial sector, age

- Performance (profit margin), size (sales), intangibles (ratio of intangibles to total assets), indirect IP ownership, share of (indirect) IPs registered in the EU - (av. 1996-2006)

and match (one-to-one) based on distance for the k- dimensional relative frequencies of the treated $f_{\ell_1,\ldots,\ell_k}$ and control $g_{\ell_1,\ldots,\ell_k}$ units:

$$\mathcal{L}(f,g) = \frac{1}{2} \sum_{\ell_1,\ldots,\ell_k} |f_{\ell_1,\ldots,\ell_k} - g_{\ell_1,\ldots,\ell_k}|$$

Results: Matching (CEM)

	Full Sample (N=90,662)			Matched Sample (N=28,532)		
	$\mathcal{L}$	Mean Diff.	T-test	$\mathcal{L}$	Mean Diff.	T-test
Country	0.091	-0.096	-	0	0	-
MNE/Domestic	0	0	-	0	0	-
Industrial Sector	0.217	-5.475	-	0	0	-
Age in year 2000	0.157	4.246	0.000	0.009	-0.0002	0.9767
Int. to Total Asset Ratio	0.033	-0.007	0.000	0.051	-0.0017	0.2376
Profit Margin	0.001	624.310	0.023	0.011	0.079	0.0789
Log(Sales)	0.203	0.803	0.000	0.047	0.019	0.2884
Num. Employees	0.176	36.457	0.000	0.026	0.003	0.9992
Number of Indirect Patents	0.137	339.360	0.000	0.063	4.7548	0.5665

The matched sample includes 14,266 treated affiliates matched with an equal number of non-treated affiliates. The percentage of affiliates controlled by MNEs is equal to 9.09% in the original sample, and equal to 11.50% in the matched sample. After matching 846 out of 2,348 strata, the overall $\mathcal{L}$ statistic measure is reduced from 0.9856 to 0.6350.

Go Back

Data Source: Orbis Database

- Historical data
  - patent ownership at any level of conglomerate (pre-2000)
  - financial accounts on affiliate performance (1996-2006)

- Current data (2007-2013)
  - identify EU affiliates' HQ (MNE vs. DOM)
  - track changes in ownership structure
  - yearly affiliate-specific tax indicators
  - unconsolidated financial accounts of affiliates

- Location of affiliates:
  Belgium, Luxembourg, Spain, France, Netherlands, and Hungary.

Descriptive Statistics: Sample Composition

	Full Sample		Matched Sample	
	Treated	Control	Treated	Control
Affiliates of MNEs	2,033	6,216	1,642	1,642
Affiliates of DOMs	12,653	69,760	12,624	12,624
Total	14,683	75,976	14,266	14,266

Tax Measure	Full Sample	Treated	Control
τ_i	32.58	32.76	32.37
τ_p	29.75	29.83	28.97
τ_{min}	27.40	27.59	27.19
$(\tau_i - \tau_p)$	2.83	2.94	3.39
$(\tau_i - \tau_{min})$	4.80	5.18	5.12

(In)Direct Patent Ownership & PB Restrictions

Dep. Variable: Pre-Tax Profits	Direct Patents [1]	Acquired Patents [2]	Existing Patents [3]
After * DOM Treated Affiliates	0.0348**	0.0342**	0.0345**
	(0.0166)	(0.0166)	(0.0166)
After * MNE Treated Affiliates			
without direct patents	0.0955***		
	(0.0341)		
with direct patents	-0.0422		
	(0.0809)		
in unrestricted PB countries		0.0998***	0.1941***
		(0.0338)	(0.0715)
in restricted PB countries		-0.0592	0.0650*
		(0.1098)	(0.0352)
Controls	YES	YES	YES
Treatment Year FE	YES	YES	YES
Year x Industry Dummies	YES	YES	YES
Observations	139,229	139,229	139,229
Affiliates	28,532	28,532	28,532
Treated MNE Affiliates	1,624	1,624	1,624
Treated DOM Affiliates	12,624	12,624	12,624

Note: All models are estimated using a linear panel model with affiliate level fixed effects. The sample includes all affiliates matched with CEM. Treatment is defined as direct patent ownership by the affiliate or indirectly by the majority shareholder, by the year 2000. The treatment effect varies according to whether patents are owned (in)directly (Column [1]) and whether the patent box legislation allows to qualify acquired (Column [2]) or existing (Column [3]) patents. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Propensity Score (PS) Matching & Full Sample

Dep. Variable	Baseline	PS Matching		Full
Pre-Tax Profits	CEM Matching	PS (5%)	PS (1%)	Sample
	[1]	[2]	[3]	[4]
After * Treated * DOM Affiliate	0.0346**	0.0378**	0.0380**	0.0346***
	(0.0166)	(0.0191)	(0.0186)	(0.0130)
After * Treated * MNE Affiliate	0.0854***	0.1033***	0.1023***	0.0755***
	(0.0330)	(0.0382)	(0.0378)	(0.0261)
Fixed Assets	0.0219***	0.0330***	0.0335***	0.0304***
	(0.0073)	(0.0098)	(0.0098)	(0.0043)
Cost of Employees	0.2698***	0.3264***	0.3271***	0.2667***
	(0.0164)	(0.0243)	(0.0238)	(0.0092)
Financial Leverage	-0.1745***	-0.1823***	-0.1881***	-0.1978***
	(0.0157)	(0.0212)	(0.0207)	(0.0091)
MNE Affiliate in Low-Tax Country	0.0535**	0.0148	0.0141	0.0907***
	(0.0268)	(0.0304)	(0.0302)	(0.0166)
Treatment Year Dummies	YES	YES	YES	YES
Year x Industry Dummies	YES	YES	YES	YES
Observations	131,592	84,166	86,795	409,776
Affiliates	28,532	17,816	18,328	90,662
Treated MNE Affiliates	1,642	1,003	1,009	2,033
Treated DOM Affiliates	12,624	7,905	8,155	43,298

*Note: All models are estimated using a linear panel model with affiliate level fixed effects. The samples vary across columns: [1] uses the CEM matched sample of Table 9 Column [3]; [2] and [3] use propensity score (PS) matching where we discard the 5 percent and 1 percent of the treatment observations at which the propensity score density of the control observations is the lowest; [4] uses the full unmatched sample. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Generalized DD Model

Dependent Variable: Pre-tax Profits	Short/Long Term Effects [1]		Pre- and Post-Treatment [2]	
	MNE	DOM	MNE	DOM
Treated x (1 and 2) Years PRE-T			0.0076	0.0112
			(0.0404)	(0.0217)
x Year of Treatment	0.0694**	0.0285*	0.0750*	0.0368
	(0.0327)	(0.0180)	(0.0477)	(0.0253)
x 1 Year POST-T	0.0687*	0.0309*	0.0744	0.0392
	(0.0369)	(0.0188)	(0.0494)	(0.0392)
x 2 Year POST-T	0.1250***	0.0156	0.1306***	0.0237
	(0.0407)	(0.0206)	(0.0524)	(0.0270)
x (3, 4 and 5) Year POST-T	0.2570***	0.0494***	0.2628***	0.0579**
	(0.0492)	(0.0236)	(0.0583)	(0.0293)
Controls	YES	YES	YES	YES
Treatment Year FE	YES	YES	YES	YES
Year x Industry FE	YES	YES	YES	YES
Observations	139,229	139,229	139,229	139,229
Affiliates	28,532	28,532	28,532	28,532
Treated MNE Affiliates	1,624	1,624	1,624	1,624
Treated DOM Affiliates	12,624	12,624	12,624	12,624

Note: All models are estimated using a linear panel model with affiliate level fixed effects. The sample includes all affiliates matched with CEM. Treatment is defined as direct patent ownership by the affiliate or indirectly by the majority shareholder, by the year 2000. Treatment effects are allowed to vary over post-treatment (POST-T) years. Model in Column [2] controls for pre-treatment (PRE-T) effects. Control variables are identical to the ones in Column [3], Table 9, but are omitted from the table. Standard errors are clustered at the shareholder level and reported in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.