Taxes and the co-location of intangibles and tangibles

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Motivation

- Intangible assets are increasingly seen as important for multinational corporations ...
  - ... as a value creating inputs
  - ... as a mean to relocate taxable profits
- Common perception is that intangible assets are highly mobile and are widely used to reduce the tax burden
- This is reflected by a number of recent tax reforms which aim to reduce tax planning via the use of intangible assets
  - CFC rules, transfer pricing regulations
  - CCCTB proposal, which does not include intangible assets in the apportionment factors

Motivation

- The fact that intangible assets are seen as a joint input and therefore very (completely) mobile is common starting point for both academic research and tax policy design
- In fact, some of the tax policy decisions might create a link between the location of tangible and intangible assets (e.g. rules which use the ratio between passive and active income)
- Furthermore, there might be non-tax reasons why intangible and tangible assets need to be located together (e.g. legal protection, principal agents problems,...)

Contribution of the paper

- (Confirm that intangible assets are an important factor in value creation)
- Find out whether (and why) intangible assets and tangible assets co-locate
- Identify how much the location of tangible and intangible assets react to taxation
  - Each asset type individually
  - Both asset types jointly

Previous literature - Importance of Intangibles

- Importance of intangible assets for the emergence of MNEs
  - The threat of dissipation of intangible assets creates an incentive to engage in FDI rather than foreign outsourcing (Horstmann and Markusen, 1986)
  - The joint input characteristic of intangible assets is a key determinant in the emergence of MNEs (Markusen, 2002)
- Intangibles are identified as important determinant of firm value on the stock market (Hall, 2001)

Previous literature - Profit shifting

- Strand of literature using US data to identify the role of intangible assets in profit shifting
  - Intangible assets are key determinant for investment and profit shifting between US and Puerto Rico (Grubert and Slemrod, 1998)
  - R&D intensive subsidiaries engage in a greater volume of intercompany transactions (Grubert, 2003)
  - R&D intensive firms are more likely to use tax havens (Desai et al., 2006)

Previous literature - Tax elasticities

- Large literature on tax elasticity of tangible assets (see De Mooij and Ederveen, 2003 and 2008, for a meta study)
- Check the box rules in the US have fostered set up of hybrid entities to move intangible assets to low tax jurisdictions (Grubert and Mutti, 2009)
- Dischinger and Riedel (2011) find a negative tax effect on the location of intangible assets within multinationals
- Recent strand of literature focuses on the impact of taxation on the location of patents
  Karkinsky and Riedel (2009, 2011), Griffith et al. (2011) and Ernst and Spengel (2011)

Data

- Firm-Level data from ORBIS
- Panel data (i.e. changes over time can be observed)
- Unconsolidated accounts for subsidiaries/parents of multinational companies
- EU 27 countries plus Switzerland and US
- Time period of 1999 to 2008
- 395,676 observations in 68,864 firms (1,440 parents)

Descriptive statistics I - Country coverage

	Firms		observations	
Country	Subsidiaries	Parents	Subsidiaries	Parents
Austria	788	19	1,550	35
Belgium	2,871	123	22,211	896
Germany	7,264	173	22,730	580
Denmark	1,623	130	7,177	554
Spain	5,474	153	37,687	1,072
Finland	981	30	7,037	210
France	12,059	147	90,514	993
United Kingdom	17,628	22	93,854	71
Greece	460	3	3,617	27
Ireland	1,466	8	5,438	14
Italy	4,372	269	30,557	1,840
Luxembourg	355	30	1,215	75
Netherlands	2,792	23	11,670	60
Portugal	1,168	26	6,318	171
Sweden	3,568	194	23,370	1,028
United States	1,194	52	1,673	85
Eastern Europe	4,781	35	28,958	234
Other Europe	20	3	100	7
Total	**68,864**	**1,440**	**395,676**	**7,952**

Descriptive statistics II - Headquarter countries

HQ country	Number Headquarters	Number of owned subsidiaries	Observations
Austria	201	1,022	4,550
Belgium	244	1,955	13,460
Switzerland	409	2,241	13,296
Germany	1,085	7,394	37,240
Denmark	299	1,630	8,719
Spain	294	2,966	18,954
Eastern Europe	114	460	2,786
Finland	117	1,066	6,897
France	612	10,989	74,918
United Kingdom	842	8,699	43,663
Greece	39	224	1,584
Ireland	173	906	4,824
Italy	542	3,539	21,900
Luxembourg	231	1,200	6,670
Netherlands	377	2,859	15,953
Other	1,628	5,252	27,389
Portugal	64	516	2,818
Sweden	433	3,963	24,637
Tax Havens	395	1,227	6,386
United States	1,910	10,756	59,032
Total	**10,009**	**68,864**	**395,676**

Descriptive statistics III - Firm specific variables

Variable	Minimum	Mean	Maximum	Median	Standard Deviation	Number of observations
EBIT	-67,170	2,720	184,943	678	11,618	395,676
Intangible assets	0	1,689	124,449	4	7,818	395,676
Tangible assets	0	8,514	124,568	1,298	17,852	395,676
Cost of employees	0	11,609	1,740,104	4,198	29,399	222,376
Number of employees	0	270	29,870	97	727	216,713
Taxation	-347,842	1,019	562,856	202	5,088	251,005
Total assets	1	97,903	5,550,341	26,381	260,803	395,676
Non current liabilities	0	17,668	1,378,607	947	75,052	395,676
Current liabilities	0	37,837	1,933,283	9,608	107,827	395,676
Turnover	0	75,238	2,863,077	25,489	168,152	352,943
Fixed assets	0	51,175	3,520,012	5,489	193,309	395,676

Descriptive statistics IV - Country level variables

Variable	Minimum	Mean	Maximum	Median	Standard Deviation	Number of observations
Population (in thousands)	390	46,561	304,375	58,942	28,757	395,676
Unemployment	1.80	7.82	19.90	8.00	2.91	395,676
GDP per capita growth rate	-5.05	2.18	12.85	2.03	1.60	395,676
R & D expenditure	0.25	1.82	4.17	1.82	0.72	389,392
GDP per capita	1,487	22,205	56,3889	23,199	6,844	395,676
No. of trademarks	1,210	51,047	304,129	42,531	30,736	382,791
No. of patents residents	10	13,122	241,347	13,519	17,787	374,252
No. of patents nonresidents	6	5,088	224,733	2,954	13,054	374,254
Corruption perception index	2.60	7.30	10.00	7.40	1.52	395,667
No. of tax treaties	17.00	81.87	101.00	86.00	18.27	374,163

Empirical Analysis - Roadmap

- Identify role of intangible assets in production
- Reaction of (in-)tangible assets on taxation
- Reaction of (in-)tangible assets on taxation and co-location of both asset types
- Tax savings through (concentration of) intangible assets?

Empirical Analysis - Importance of Intangibles

- Identify role of intangible assets in production
- Estimate a standard Cobb-Douglas production function with tangible capital and labour
- Include intangible assets as additional production factor
- Repeat analysis on the corporate group level
- Include a measure of concentration of location of intangible assets within corporate group

Importance of intangible assets

Dependent Variable: log(Output)				
log(Tangible assets)	0.202 **	0.199 **	0.133 **	0.126 **
	(0.003)	(0.003)	(0.003)	(0.003)
log(No. of Employees)	0.540 **	0.538 **	0.518 **	0.516 **
	(0.004)	(0.004)	(0.004)	(0.004)
log(Intangible assets)		0.005		0.010 **
		(0.002)		(0.001)
R squared	0.289	0.289	0.338	0.338
No. of Observations	118,697	118,697	118,697	118,697
Subsidiary fixed effects	yes	yes	yes	yes
Time fixed effects	no	no	yes	yes

Importance of intangible assets

Dependent Variable: log(Output)						
log(Tangible assets)	0.109 **	0.099 **	0.094 **	0.096 **	0.089 **	0.086 **
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
log(No. of Employees)	0.740 **	0.738 **	0.735 **	0.730 **	0.728 **	0.726 **
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
log(Intangible assets)		0.016 **	0.016 **		0.013 **	0.014 **
		(0.002)	(0.002)		(0.002)	(0.002)
Concentration intangible assets			-0.111 **			-0.100 **
			(0.019)			(0.019)
R squared	0.562	0.563	0.563	0.567	0.567	0.568
Number of Observations	39,305	39,305	39,305	39,305	39,305	39,305
Group fixed effects	yes	yes	yes	yes	yes	yes
Time fixed effects	no	no	no	yes	yes	yes

Tax elasticities of (in-) tangible assets

- Identify how elastic tangible and intangible assets are with respect to corporate taxation
- First estimate the elasticities separately, i.e. ignoring co-location
- Then estimate the elasticities simultaneously, taking co-location into account

Tax elasticity of intangible assets

Dependent Variable: log(Intangible assets)				
Statutory Tax Rate	-1.501**	-0.352	-1.618**	-1.457**
log(Total assets)		0.795**		0.811**
log(GDP per capita)	1.296**	-0.404**	1.179**	0.777**
log(Population)	4.413**	2.594**	0.335**	0.088*
log(Unemployment)	-0.213**	-0.150**	-0.898**	-0.700**
GDP per capita growth rate	0.018**	0.022**	-0.007	0.009
Corruption	0.165**	0.148**	0.314**	0.314**
Parent tax rate	-0.753**	-0.747**	0.104	-0.430**
No. tax treaties	-0.007**	-0.013**	0.001	0.004**
log(No. Trademarks)	0.107**	-0.016	-0.376**	-0.252**
log(No. Patents)	0.134**	0.155**	0.051**	0.112**
log(R&D expenditure)	0.000	-0.246**	-1.236**	-1.218**
No. of observations	178,282	178,282	178,282	178,282
No. of firms	38,738	38,738	38,738	38,738
Subsidiary fixed effects	yes	yes	no	no
Time fixed effects	yes	yes	yes	yes

Tax elasticity of tangible assets

Dependent Variable: log(Fixed assets)				
Statutory Tax Rate	-1.663**	-0.657**	-1.084**	-0.585**
log(Total assets)		0.998**		1.185**
log(GDP per capita)	1.060**	-0.403**	0.061**	-0.381**
log(Population)	1.852**	0.661**	0.107**	-0.042**
log(Unemployment)	-0.232**	-0.030**	-0.591**	-0.136**
GDP per capita growth rate	0.008**	0.010**	-0.029**	0.003
Corruption	0.037**	0.049**	0.058**	0.074**
Parent tax rate	-0.111	-0.126*	0.370**	-0.545**
No tax treaties	0.013**	0.003*	-0.005**	0.001**
Tax depreciation ind. buildings	-0.603**	-0.405**	-0.734**	-0.723**
Tax depreciation machinery	0.080	0.022	-0.396**	0.144**
No. of observations	200,861	200,861	200,861	200,861
No. of firms	40,380	40,380	40,380	40,380
Subsidiary fixed effects	yes	yes	no	no
Time fixed effects	yes	yes	yes	yes

Tax elasticity of intangibles **and** tangible assets

	System I		*System II*		*System III*		*System IV*	
	y_1	y_2	y_1	y_2	y_1	y_2	y_1	y_2
log(Fixed Assets) [y_2]	0.909**		0.856**		-0.553*		-2.920	
log(Intangible assets) [y_1]		0.279**		0.116		0.711**		0.415**
Statutory tax rate	-0.826**	0.709**	-0.753**	0.179	-3.396**	-1.340**	-2.301	-0.471**
log(Total assets)			-0.197	1.082**			3.004	0.615**
log(GDP per capita)	1.060**	-0.134**	1.140**	-0.418**	2.334**	1.954**	-1.375**	0.145
log(Population)	0.127**	-0.042**	0.086*	-0.095**	7.580**	2.473**	0.854	-0.158
log(Unemployment)	-0.493**	-0.253**	-0.595**	-0.052**	-0.302**	0.116**	-0.313**	0.055
GDP per capita growth rate	0.015**	-0.026**	0.007	0.001	0.015**	-0.011**	0.027**	-0.004
Corruption	0.216**	-0.012	0.223**	0.040	0.191**	-0.021	0.155**	-0.027
Parent tax rate	-0.011	0.110	0.124	-0.589**	-0.848**	0.195	-0.742**	0.147
No. tax treaties	0.005**	0.000	0.005**	0.003**	-0.006**	0.010	-0.004	0.006**
log(No. Trademarks)	-0.268**		-0.249**		0.185**		-0.129	
log(No. Patents)	0.072**		0.103**		0.184**		0.405	
log(R&D expenditure)	-1.074**		-1.183**		-0.029		-0.256	
Tax depreciation ind. buildings		-0.967**		-0.870**		-1.256**		-0.633**
Tax depreciation machinery		0.039		0.267**		0.616**		0.209**

Tax elasticity in a system of equation

- Systems I and II use a pooled cross section, can be interpreted as long run effects
  - Strong evidence for co-location
  - Tax effect only on intangible assets
- Systems III and IV use de-meaned values, can be interpreted as short run effects
  - One sided evidence for co-location, intangible assets explain the location of fixed assets, but not vice versa
  - Tax effect on both type of assets, but stronger for intangibles

Tax saving through intangible assets?

- Previous result: Intangibles have a higher tax elasticity
- Can firms with more intangibles reduce their tax burden?
- Previous result: Firms seem to have a lower output with more concentrated location of intangibles
- Does the more concentrated location of intangibles help to reduce the tax burden?

Tax saving through intangible assets?

Dependent Variable: Taxation/EBIT				
log(Total assets)	0.003	0.003	0.010 **	0.003 **
	(0.003)	(0.003)	(0.001)	(0.001)
Debt ratio	-0.088 **	-0.088 **	-0.096 **	-0.099 **
	(0.013)	(0.013)	(0.007)	(0.007)
log(Intangible assets)	-0.006 **	-0.006 **	-0.002 *	-0.002 **
	(0.001)	(0.001)	(0.001)	(0.001)
Statutory tax rate	0.288 **	0.287 **	0.514 **	0.497 **
	(0.081)	(0.082)	(0.035)	(0.035)
Concentration of intangible assets		-0.002		-0.082 **
		0.011		(0.007)
No. of corporate groups	7,386	7,386	7,386	7,386
No. of observations	47,203	47,203	47,203	47,203
Group fixed effects	yes	yes	no	no
Time fixed effects	yes	yes	yes	yes

Conclusions

- Intangible assets are usually considered to be (completely) mobile
- This paper investigates whether intangible assets and tangible assets co-locate
- Evidence suggests that in the long run tangible and intangible assets co-locate
- Intangible assets appear to be more elastic with respect to taxation, especially in the short run
- Evidence for the importance of intangible assets can be found, which the indication of non-tax costs of concentrating intangible assets in one location
- Further the data suggest that a higher level and more concentrated intangible assets can reduce the tax burden

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Complete tables

Tax elasticity of intangible assets

Dependent Variable: log(Intangible assets)				
Statutory Tax Rate	-1.501 **	-0.352	-1.618 **	-1.457 **
	(0.233)	(0.223)	(0.235)	(0.210)
log(Total assets)		0.795 **		0.811 **
		(0.007)		(0.004)
log(GDP per capita)	1.296 **	-0.404 **	1.179 **	0.777 **
	(0.168)	(0.161)	(0.028)	(0.025)
log(Population)	4.413 **	2.594 **	0.335 **	0.088 *
	(0.531)	(0.508)	(0.047)	(0.042)
log(Unemployment)	-0.213 **	-0.150 **	-0.898 **	-0.700 **
	(0.034)	(0.033)	(0.028)	(0.025)
GDP per capita growth rate	0.018 **	0.022 **	-0.007	0.009
	(0.004)	(0.004)	(0.006)	(0.005)
Corruption	0.165 **	0.148 **	0.314 **	0.314 **
	(0.012)	(0.012)	(0.009)	(0.008)
Parent tax rate	-0.753 **	-0.747 **	0.104	-0.430 **
	(0.168)	(0.161)	(0.105)	(0.094)
No. tax treaties	-0.007 **	-0.013 **	0.001	0.004 **
	(0.002)	(0.002)	(0.001)	(0.001)
log(No. Trademarks)	0.107 **	-0.016	-0.376 **	-0.252 **
	(0.034)	(0.033)	(0.028)	(0.025)
log(No. Patents)	0.134 **	0.155 **	0.051 **	0.112 **
	(0.044)	(0.042)	(0.021)	(0.019)
log(R&D expenditure)	0.000	-0.246 **	-1.236 **	-1.218 **
	(0.071)	(0.068)	(0.046)	(0.041)
No. of observations	178,282	178,282	178,282	178,282
No. of firms	38,738	38,738	38,738	38,738
Subsidiary fixed effects	yes	yes	no	no
Time fixed effects	yes	yes	yes	yes

Tax elasticity of tangible assets

Dependent Variable: log(Tangible assets)				
Statutory Tax Rate	-1.663 **	-0.657 **	-1.084 **	-0.585 **
	(0.128)	(0.095)	(0.169)	(0.102)
log(Total assets)		0.998 **		1.185 **
		(0.003)		(0.002)
log(GDP per capita)	1.060 **	-0.403 **	0.061 **	-0.381 **
	(0.078)	(0.058)	(0.026)	(0.016)
log(Population)	1.852 **	0.661 **	0.107 **	-0.042 **
	(0.254)	(0.188)	(0.011)	(0.007)
log(Unemployment)	-0.232 **	-0.030 **	-0.591 **	-0.136 **
	(0.016)	(0.012)	(0.019)	(0.012)
GDP per capita growth rate	0.008 **	0.010 **	-0.029 **	0.003
	(0.002)	(0.002)	(0.005)	(0.003)
Corruption	0.037 **	0.049 **	0.058 **	0.074 **
	(0.006)	(0.004)	(0.008)	(0.005)
Parent tax rate	-0.111	-0.126 *	0.370 **	-0.545 **
	(0.091)	(0.067)	(0.082)	(0.049)
No tax treaties	0.013 **	0.003 *	-0.005 **	0.001 **
	(0.001)	(0.001)	(0.000)	(0.000)
Tax depreciation ind. buildings	-0.603 **	-0.405 **	-0.734 **	-0.723 **
	(0.163)	(0.121)	(0.092)	(0.056)
Tax depreciation machinery	0.080	0.022	-0.396 **	0.144 **
	(0.071)	(0.053)	(0.078)	(0.047)
No. of observations	200,861	200,861	200,861	200,861
No. of firms	40,380	40,380	40,380	40,380
Subsidiary fixed effects	yes	yes	no	no
Time fixed effects	yes	yes	yes	yes

Tax elasticity of intangibles **and** tangible assets

	System I		*System II*		*System III*		*System IV*	
	y_1	y_2	y_1	y_2	y_1	y_2	y_1	y_2
log(Fixed Assets) [y_2]	0.909 **		0.856 **		-0.553 *		-2.920	
	(0.076)		(0.119)		(0.271)		(2.590)	
log(Intangible assets) [y_1]		0.279 **		0.116		0.711 **		0.415 **
		(0.018)		(0.014)		(0.141)		(0.114)
Statutory tax rate	-0.826 **	0.709 **	-0.753 **	0.179	-3.396 **	-1.340 **	-2.301	-0.471 **
	(0.217)	(0.193)	(0.229)	(0.132)	(0.772)	(0.284)	(1.648)	(0.120)
log(Total assets)			-0.197	1.082 **			3.004	0.615 **
			(0.140)	(0.012)			(2.180)	(0.062)
log(GDP per capita)	1.060 **	-0.134 **	1.140 **	-0.418 **	2.334 **	1.954 **	-1.375 **	0.145
	(0.026)	(0.027)	(0.061)	(0.017)	(0.697)	(0.131)	(0.542)	(0.132)
log(Population)	0.127 **	-0.042 **	0.086 *	-0.095 **	7.580 **	2.473 **	0.854	-0.158
	(0.044)	(0.015)	(0.039)	(0.010)	(1.584)	(0.611)	(0.658)	(0.185)
log(Unemployment)	-0.493 **	-0.253 **	-0.595 **	-0.052 **	-0.302 **	0.116 **	-0.313 **	0.055
	(0.045)	(0.030)	(0.030)	(0.019)	(0.037)	(0.042)	(0.094)	(0.031)
GDP per capita growth rate	0.015 **	-0.026 **	0.007	0.001	0.015 **	-0.011 **	0.027 **	-0.004
	(0.006)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.011)	(0.003)
Corruption	0.216 **	-0.012	0.223 **	0.040	0.191 **	-0.021	0.155 **	-0.027
	(0.013)	(0.009)	(0.016)	(0.006)	(0.023)	(0.024)	(0.043)	(0.014)
Parent tax rate	-0.011	0.110	0.124	-0.589 **	-0.848 **	0.195	-0.742 **	0.147
	(0.093)	(0.075)	(0.118)	(0.050)	(0.183)	(0.145)	(0.336)	(0.100)
No. tax treaties	0.005 **	0.000	0.005 **	0.003 **	-0.006 **	0.010	-0.004	0.006 **
	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.007)	(0.001)
log(No. Trademarks)	-0.268 **		-0.249 **		0.185 **		-0.129	
	(0.025)		(0.023)		(0.050)		(0.088)	
log(No. Patents)	0.072 **		0.103 **		0.184 **		0.405	
	(0.017)		(0.017)		(0.047)		(0.214)	
log(R&D expenditure)	-1.074 **		-1.183 **		-0.029		-0.256	
	(0.040)		(0.040)		(0.061)		(0.216)	
Tax depreciation ind. Buildings		-0.967 **		-0.870 **		-1.256 **		-0.633 **
		(0.095)		(0.065)		(0.192)		(0.169)
Tax depreciation machinery		0.039		0.267 **		0.616 **		0.209 **
		(0.073)		(0.052)		(0.084)		(0.080)