The Impact of Profit Shifting on Taxes Paid by German Multinationals

Katharina Finke
ZEW Mannheim, Germany

ETPF/IFS Conference
April, 28 2014

Motivation

- International tax rate differentials are substantial.
- MNE potentially benefit from these differentials by structuring intra-group transactions in a tax efficient way.

Recent initiatives to address BEPS

- OECD Action Plan (2013)
- EU Commission (2012,2013)
- G-20 (2013)

⇒ What do we know about the scale of the problem?

⇒ To what extent are MNE reducing their tax payments by reallocating profits?

⇒ How much revenue are high-tax countries losing?

Motivation

- International tax rate differentials are substantial.
- MNE potentially benefit from these differentials by structuring intra-group transactions in a tax efficient way.

Recent initiatives to address BEPS

- OECD Action Plan (2013)
- EU Commission (2012,2013)
- G-20 (2013)

⇒ What do we know about the scale of the problem?

⇒ To what extent are MNE reducing their tax payments by reallocating profits?

⇒ How much revenue are high-tax countries losing?

Motivation

- International tax rate differentials are substantial.
- MNE potentially benefit from these differentials by structuring intra-group transactions in a tax efficient way.

Recent initiatives to address BEPS

- OECD Action Plan (2013)
- EU Commission (2012,2013)
- G-20 (2013)

$\Rightarrow$ What do we know about the scale of the problem?

$\Rightarrow$ To what extent are MNE reducing their tax payments by reallocating profits?

$\Rightarrow$ How much revenue are high-tax countries losing?

A Brief Literature Review

Some stylized numbers receiving great attention in the media

- EU loses EUR 1 tn in income each year (R. Murphy, 2012).
- UK tax gap (for 700 largest firms) amounts to GBP 12 billion (R. Murphy, 2008)
- In Germany income from corporate income tax statistics and national accounts data differ by EUR 90 bn (S. Bach, 2008).

$\Rightarrow$ These numbers mainly capture conceptual differences in profit measures.

$\Rightarrow$ Major problem: firms' true economic profit before profit shifting is not observable.

$\Rightarrow$ A meaningful counterfactual is needed.

A Brief Literature Review

Some stylized numbers receiving great attention in the media

- EU loses EUR 1 tn in income each year (R. Murphy, 2012).
- UK tax gap (for 700 largest firms) amounts to GBP 12 billion (R. Murphy, 2008)
- In Germany income from corporate income tax statistics and national accounts data differ by EUR 90 bn (S. Bach, 2008).

$\Rightarrow$ These numbers mainly capture conceptual differences in profit measures.

$\Rightarrow$ Major problem: firms' true economic profit before profit shifting is not observable.

$\Rightarrow$ A meaningful counterfactual is needed.

A Brief Literature Review - Econometric Studies

Focus on the instruments of profit shifting

- Intra-firm debt financing: Newberry/Dhaliwal (2001), Desai/Foley/Hines (2004), Büttner/Wamser (2007), Huizinga/Laeven/Nicodeme (2008)
- Transfer prices for intra-firm sales: Clausing (2003), Clausing (2006), Overesch/Schreiber (2010)
- Location of intangible assets: Desai/Foley/Hines (2006), Dischinger/Riedel (2011)

Focus on the results of profit shifting

- Reported profitability of MNE entities in different countries: Grubert/Mutti (1991), Huizinga/Laeven (2008), Blouin/Robinson/Seidman (2012), Dharmapala/Riedel (2013)
- Tax payments of domestic and multinational firms: Egger/Eggert/Winner (2010)

A Brief Literature Review - Econometric Studies

Focus on the instruments of profit shifting

- Intra-firm debt financing: Newberry/Dhaliwal (2001), Desai/Foley/Hines (2004), Büttner/Wamser (2007), Huizinga/Laeven/Nicodeme (2008)
- Transfer prices for intra-firm sales: Clausing (2003), Clausing (2006), Overesch/Schreiber (2010)
- Location of intangible assets: Desai/Foley/Hines (2006), Dischinger/Riedel (2011)

Focus on the results of profit shifting

- Reported profitability of MNE entities in different countries: Grubert/Mutti (1991), Huizinga/Laeven (2008), Blouin/Robinson/Seidman (2012), Dharmapala/Riedel (2013)
- Tax payments of domestic and multinational firms: Egger/Eggert/Winner (2010)

Propensity Score Matching

Intuition behind the approach

⇒ What can we learn about profit-shifting by multinationals from comparing MNEs' tax payments to tax payments of domestic firms?

- Naive comparison yields biased results.
- Identify reasonable control group based on observable characteristics (matching technique).
- If variables in X determine MNE/profit-shifting possibility, outcome (tax payment) is mean independent of the MNE status conditional on X (Rosenbaum/Rubin 1983).
- Propensity score reduces dimensionality of the matching problem.

Propensity Score Matching

Intuition behind the approach

⇒ What can we learn about profit-shifting by multinationals from comparing MNEs' tax payments to tax payments of domestic firms?

- Naive comparison yields biased results.
- Identify reasonable control group based on observable characteristics (matching technique).
- If variables in X determine MNE/profit-shifting possibility, outcome (tax payment) is mean independent of the MNE status conditional on X (Rosenbaum/Rubin 1983).
- Propensity score reduces dimensionality of the matching problem.

Propensity Score Matching

Identification of control group

- Integration in multinational group is endogeneous.
- International trade theory provides broad literature on the determinants of FDI.
- e.g. Dunning's OLI framework (1980), Markusen (1995), Helpman et al. (2004), Mayer/Ottaviano (2007)
- Within the EU firm specific characteristics dominate regional determinants (Barba Navaretti et al. (2010))
  - Age
  - Company size
  - Productivity
  - Knowledge intensity
- Additional variables (debt ratio, tangibility) are added that determine the tax base

Estimation

First Step

- Estimate the probability of being treated (probit model)

$$\begin{aligned} Pr(MNE) &= \beta_0 + \beta_1 age + \beta_2 ln(tasstets) + \beta_3 ln(prod) + \beta_4 innov \\ &+ \beta_5 dr + \beta_6 tangi + \beta_7 rdint + \beta_8 NACE + \epsilon \end{aligned} \quad (1)$$

- To avoid problem of simultaneity, the same model is also estimated for new MNE, i.e. firms which switch treatment status.

Second Step

- Estimation of ATT

$$ATT = \frac{1}{NT} \sum_{i=1}^{NT} (T_{1,i} - \sum_{j=1}^{NC} w(i,j) T_{0,j}) \quad (2)$$

Estimation

First Step

- Estimate the probability of being treated (probit model)

$$\begin{aligned} Pr(MNE) &= \beta_0 + \beta_1 age + \beta_2 ln(tasstets) + \beta_3 ln(prod) + \beta_4 innov \\ &+ \beta_5 dr + \beta_6 tangi + \beta_7 rdint + \beta_8 NACE + \epsilon \end{aligned} \quad (1)$$

- To avoid problem of simultaneity, the same model is also estimated for new MNE, i.e. firms which switch treatment status.

Second Step

- Estimation of ATT

$$ATT = \frac{1}{NT} \sum_{i=1}^{NT} (T_{1,i} - \sum_{j=1}^{NC} w(i,j) T_{0,j}) \quad (2)$$

Data

- DAFNE database provided by Bureau van Dijk.
- Detailed information on balance sheet and profit and loss account positions (unconsolidated).
- German corporations; cross-section for the years 2007 and 2009;
- Detailed ownership information.
- Treatment group: Firms that are part of a multinational group.
  - Subsidiaries owned directly/indirectly by foreign parent company.
  - Firms owning directly/indirectly foreign subsidiaries.
- 4500 firms; about 1500 MNE.

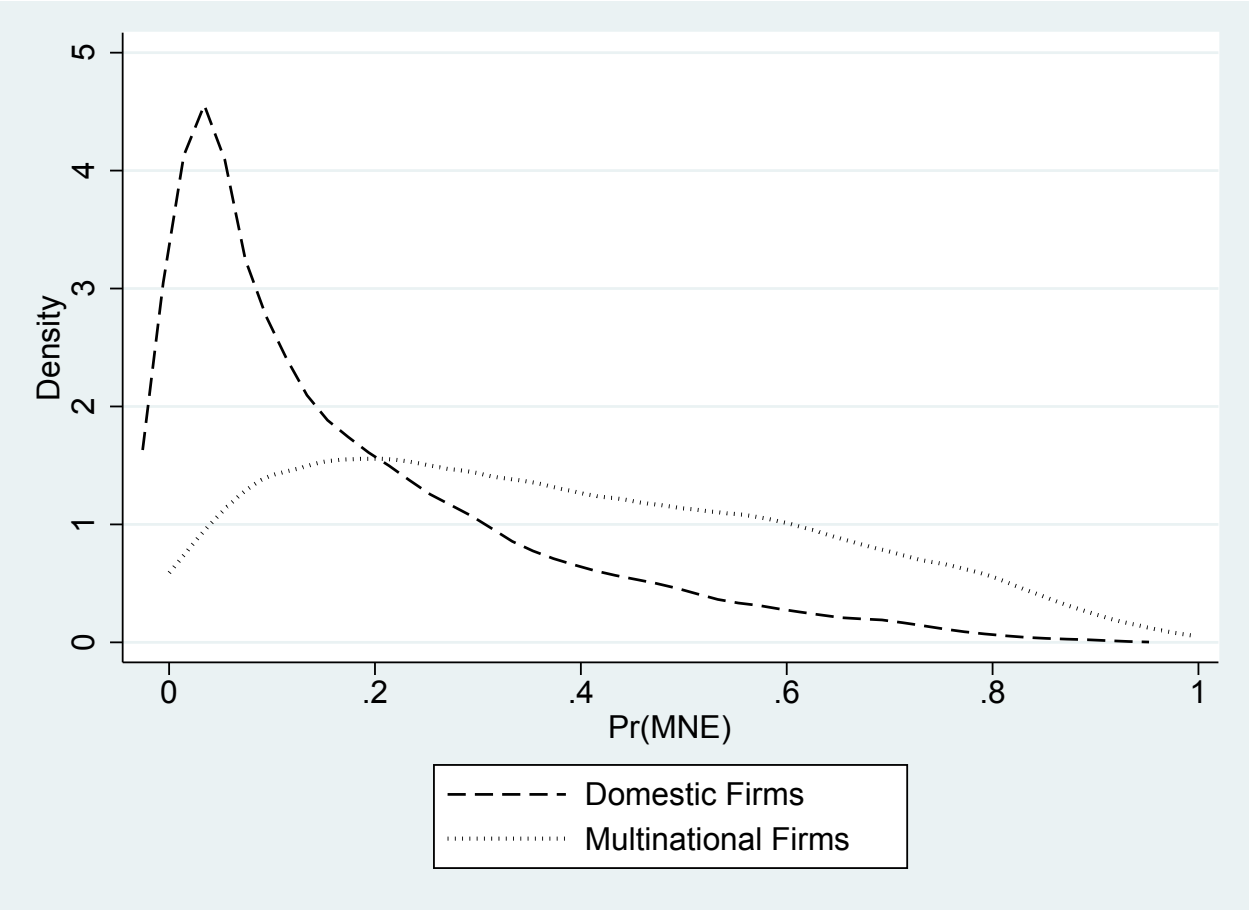
Data

Mean values of important firm characteristics before matching

characteristics	MNE=1	MNE=0	t-stat	p-value
age (years)	25.2	22.9	4.0871	0.0000
balance sheet total (in 1000 EUR)	126,399.5	27,023.6	18.8268	0.0000
share of intangibles (%)	2.1	1.2	7.5668	0.0000
productivity (log)	1.9	1.7	6.8619	0.0000
profitability (%)	10.4	9.9	1.2969	0.1947
debt ratio (%)	45.7	49.6	-6.3319	0.0000
tangibility (%)	12.7	17.1	-10.7983	0.0000
R&D intensity	3.2	2.4	11.4797	0.0000
profit tax (in 1000 EUR)	1,597.2	545.6	9.953	0,0000

Assessing the Matching Quality

Propensity Scores for domestic and multinational firms



Assessing the Matching Quality

Standardised Bias according to Rosenbaum/Rubin 1985

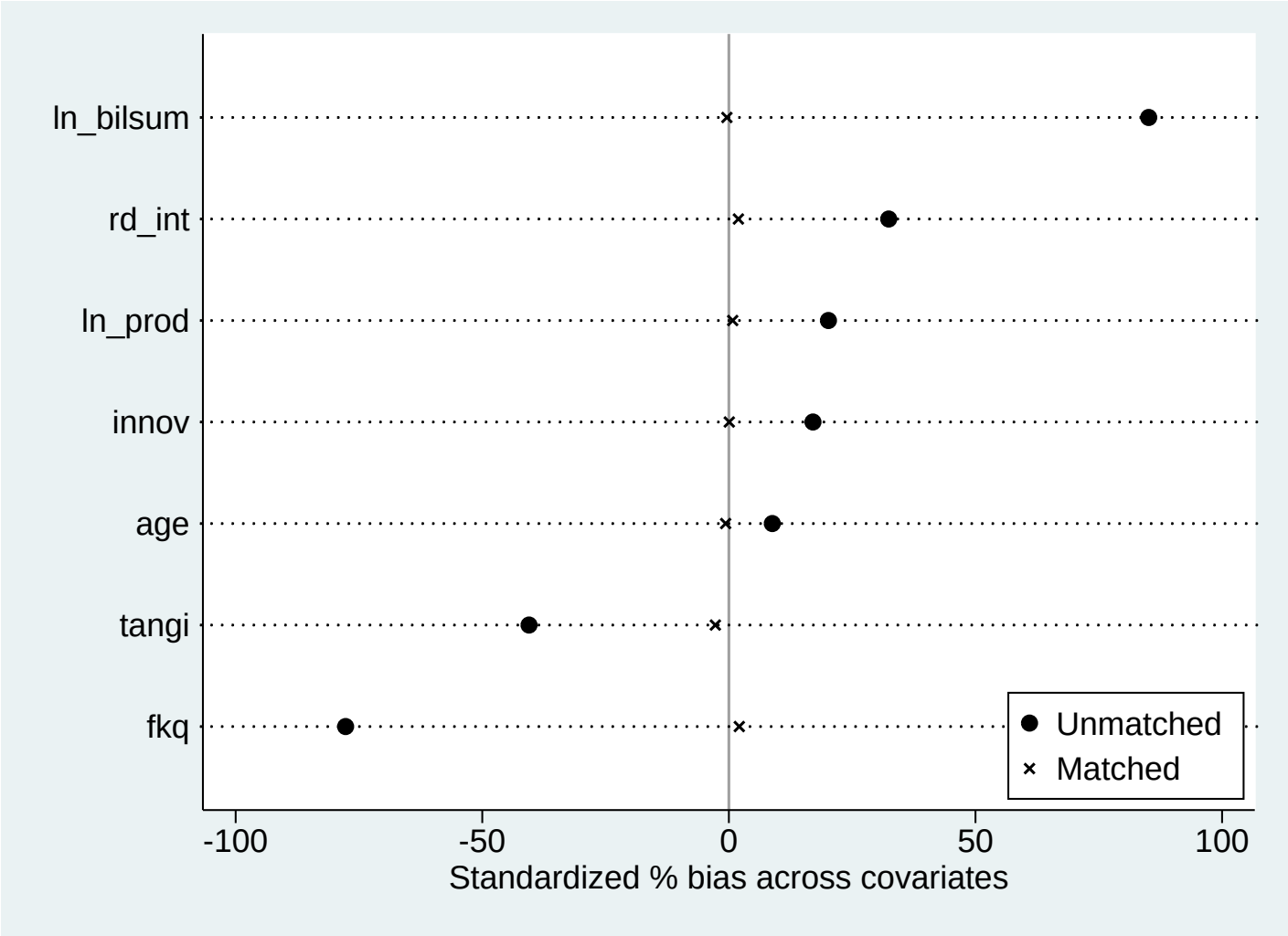
Variable		Mean		% Bias	% Reduction |Bias|	t	p>t
		MNE	Control				
age	Unmatched	26.284	23.977	8.81		2.82	0.00
	Matched	26.126	26.296	-0.70	92.59	-0.18	0.86
total assest (log)	Unmatched	10.581	9.242	85.12		26.51	0.00
	Matched	10.510	10.517	-0.40	99.53	-0.12	0.90
productivity (log)	Unmatched	0.021	0.013	17.04		5.69	0.00
	Matched	0.021	0.021	0.10	99.52	0.02	0.99
share of intangibles	Unmatched	1.902	1.738	20.18		6.47	0.00
	Matched	1.889	1.882	0.80	96.14	0.21	0.84
debt ratio	Unmatched	0.246	0.421	-77.71		-23.84	0.00
	Matched	0.249	0.245	2.10	97.28	0.65	0.51
capital intensity	Unmatched	0.132	0.200	-40.52		-12.34	0.00
	Matched	0.134	0.138	-2.70	93.25	-0.88	0.38
R&D intensity	Unmatched	3.322	2.270	32.41		10.58	0.00
	Matched	3.288	3.225	1.90	94.04	0.48	0.63

Note: Pseudo R^2 Raw: 0.227; Pseudo R^2 Matched: 0.001.; p>chi2 Raw:0.0000 p>chi2 Matched :0.995; Mean Bias Raw: 30%; Mean Bias Matched: 1.5%.

Matching successfully reduces the bias between MNE and domestic firms.

Assessing the Matching Quality

Graphical Illustration of Bias Reduction



Results I

ATT in 1000 EUR for different matching algorithms

	Tax Payment		Difference		S.E.	z-Stat.	p
	MNE	control	absolute (ATT)	relative			
NN(1)	1,595.611	2,199.712	-604.100	-0.27	318.380	-1.9	0.058
NN(5)	1,595.611	2,195.728	-600.117	-0.27	295.928	-2.03	0.043
Epan.-Kernel	1,598.206	2,265.583	-667.377	-0.29	285.165	-2.34	0.019

Note: Standard errors are calculated using bootstrapping procedure. Observations: 1,498 multinationals and 2,920 domestic firms in the common support area for NN matching and 1,500 multinationals and 2,920 domestic firms for kernel.

- MNE pay significantly less taxes than the domestic control group.
- Within the sample the effect adds up to 0.9 bn Euro.
- Sample only captures about 10% of German multinationals but about 13% of MNEs' aggregate total assets.
- Scaling the sample result by total assets and extrapolating with respect to MNEs' aggregate total assets yields a revenue loss of 8.6 bn Euro.

Results II

ATT in 1000 EUR for different types of MNE

MNE Typ	Tax Payment		Difference		S.E.	z-Stat.	p
	MNE	control	absolut (ATT)	relative			
all MNE	1,595.611	2,195.728	-600.117	-0.27	295.928	-2.03	0.043
low tax	1,591.619	2,212.937	-621.318	-0.28	307.217	-2.02	0.043
high tax	3,068.586	2,269.979	798.607	0.35	798.575	1.00	0.317
US owned	1,468.376	2,936.062	-1,467.687	0.49	804.594	-1.82	0.068
new	825.453	1,737.106	-911.653	-0.52	222.675	-4.09	0.000

Note: 5:1 NN-Matching with a caliper of 0.01. Standard errors are computed using bootstrapping procedure. Observations: (2) 1,350 MNE and 2,920 domestic firms, (3) 152 MNE, (4) 134 MNE (5) 556 MNE and 2920 domestic firms in the support region.

- The effect is larger if only MNE with entities in lower taxing jurisdictions are considered.
- No significant difference between domestic firms and MNE without low tax entities.
- Especially large effect for US owned German multinationals.

Results II

ATT in 1000 EUR for different types of MNE

MNE Typ	Tax Payment		Difference		S.E.	z-Stat.	p
	MNE	control	absolut (ATT)	relative			
all MNE	1,595.611	2,195.728	-600.117	-0.27	295.928	-2.03	0.043
low tax	1,591.619	2,212.937	-621.318	-0.28	307.217	-2.02	0.043
high tax	3,068.586	2,269.979	798.607	0.35	798.575	1.00	0.317
US owned	1,468.376	2,936.062	-1,467.687	0.49	804.594	-1.82	0.068
new	825.453	1,737.106	-911.653	-0.52	222.675	-4.09	0.000

Note: 5:1 NN-Matching with a caliper of 0.01. Standard errors are computed using bootstrapping procedure. Observations: (2) 1,350 MNE and 2,920 domestic firms, (3) 152 MNE, (4) 134 MNE (5) 556 MNE and 2920 domestic firms in the support region.

- The effect is larger if only MNE with entities in lower taxing jurisdictions are considered.
- No significant difference between domestic firms and MNE without low tax entities.
- Especially large effect for US owned German multinationals.

Results III

ATT in 1000 EUR; firm characteristics

characteristics	tax payment		difference		S.E.	z-stat.	p
	MNE	control	absolute (ATT)	relative			
all firms	1,595.611	2,195.728	-600.117	-0.27	295.928	-2.03	0.043
large	2,974.933	4,333.288	-1,358.355	-0.31	641.371	-2.12	0.034
small	144.105	225.033	-80.928	-0.36	28.865	-2.80	0.005
high debt	480.274	1,200.961	-720.687	-0.60	295.644	-2.44	0.015
low debt	2,423.315	2,917.602	-494.287	-0.17	409.157	-1.21	0.227
high R&D	1,010.408	1,781.447	-771.040	-0.43	423.801	-1.82	0.069
low R&D	1,567.174	2,247.120	-679.946	-0.30	322.477	-2.11	0.035

Note: 5:1 NN matching with a caliper of 0.01. Reported standard errors are computed using bootstrapping procedure. Observations: (2) 654 MNE and 552 domestic firms, (3) 266 MNE and 1,376 domestic firms, (4) 614 MNE 1351 and domestic firms, (5) 869 MNE and 1,569 domestic firms, (6) 331 MNE and 392 domestic firms, (7) 1,144 MNE and 2,528 domestic firms.

- Profit-shifting effect is also significant for small MNE.
- No significant effect for MNE with below average debt ratio.
- Larger effects for MNE with above average R&D intensity.

Results III

ATT in 1000 EUR; firm characteristics

characteristics	tax payment		difference		S.E.	z-stat.	p
	MNE	control	absolute (ATT)	relative			
all firms	1,595.611	2,195.728	-600.117	-0.27	295.928	-2.03	0.043
large	2,974.933	4,333.288	-1,358.355	-0.31	641.371	-2.12	0.034
small	144.105	225.033	-80.928	-0.36	28.865	-2.80	0.005
high debt	480.274	1,200.961	-720.687	-0.60	295.644	-2.44	0.015
low debt	2,423.315	2,917.602	-494.287	-0.17	409.157	-1.21	0.227
high R&D	1,010.408	1,781.447	-771.040	-0.43	423.801	-1.82	0.069
low R&D	1,567.174	2,247.120	-679.946	-0.30	322.477	-2.11	0.035

Note: 5:1 NN matching with a caliper of 0.01. Reported standard errors are computed using bootstrapping procedure. Observations: (2) 654 MNE and 552 domestic firms, (3) 266 MNE and 1,376 domestic firms, (4) 614 MNE 1351 and domestic firms, (5) 869 MNE and 1,569 domestic firms, (6) 331 MNE and 392 domestic firms, (7) 1,144 MNE and 2,528 domestic firms.

- Profit-shifting effect is also significant for small MNE.
- No significant effect for MNE with below average debt ratio.
- Larger effects for MNE with above average R&D intensity.

Results IV

ATT in 1000 EUR; alternative specifications

characteristics	tax payment		difference		S.E.	z-stat.	p
	MNE	control	absolute (ATT)	relative			
proxy tax base	1,540.744	1,886.874	-346.130	-0.18	311.790	-1.1	0.267
debt ratio	1,234.853	1,738.079	-503.226	-0.28	336.223	-2.01	0.045
modif EBIT	1,595.611	2,166.552	-570.941	-0.26	213.439	-2.32	0.021
without loss	2,762.243	3,437.349	-675.106	-0.19	297.504	-1.73	0.084

Note: 5:1 NN Matching with a caliper of 0.01. Reported standard errors are computed using bootstrapping procedures. Observations: (1)1,498 MNE and 2,920 domestic firms, (2) 697 MNE and 1,915 domestic firms.

- The effect is robust accross different specifications.

Results IV

ATT in 1000 EUR; alternative specifications

characteristics	tax payment		difference		S.E.	z-stat.	p
	MNE	control	absolute (ATT)	relative			
proxy tax base	1,540.744	1,886.874	-346.130	-0.18	311.790	-1.1	0.267
debt ratio	1,234.853	1,738.079	-503.226	-0.28	336.223	-2.01	0.045
modif EBIT	1,595.611	2,166.552	-570.941	-0.26	213.439	-2.32	0.021
without loss	2,762.243	3,437.349	-675.106	-0.19	297.504	-1.73	0.084

Note: 5:1 NN Matching with a caliper of 0.01. Reported standard errors are computed using bootstrapping procedures. Observations: (1)1,498 MNE and 2,920 domestic firms, (2) 697 MNE and 1,915 domestic firms.

- The effect is robust accross different specifications.

Results V

Impact of the German Tax Reform 2008

	BASELINE (2007)			FOLLOW UP (2009)			
Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
Tax Payment	1830.967	1141.104	-689.863	1114.198	818.551	-295.647	394.217
Std. E	124.392	102.073	160.911	142.51	104.977	177.001	239.21
t	14.72	1824.21	-4.29	1825.94	428.09	-687.64	1.65
P>t	0.000	0.000	0.000	0.000	0.000	0.095	0.099

- Tax reform 2008 reduced incentives for profit shifting.
- Corporate income tax was cut from 25% to 15%.
- Stricter earning stripping regulations and exit taxation were introduced.

$\Rightarrow$ Diff-in-Diff Matching shows that difference in tax payments between MNE and domestic firms is substantially reduced.

Concluding Remarks

- Propensity-Score Matching is one way to account for missing counterfactual.
- Results in this study suggest that MNE on average pay -600,000 EUR (about 27%) less profit taxes than domestic counterfactual.
- Extrapolated to the full sample: revenue loss about 8.6 bn Euro.
- Effect exists only for MNE with at least one subsidiary in low tax jurisdiction.
- Differential hypothesis lead plausible results.
- Reform 2008 substantially reduced difference in tax payments between MNE and domestic control group.

Concluding Remarks

- Propensity-Score Matching is one way to account for missing counterfactual.
- Results in this study suggest that MNE on average pay -600,000 EUR (about 27%) less profit taxes than domestic counterfactual.
- Extrapolated to the full sample: revenue loss about 8.6 bn Euro.
- Effect exists only for MNE with at least one subsidiary in low tax jurisdiction.
- Differential hypothesis lead plausible results.
- Reform 2008 substantially reduced difference in tax payments between MNE and domestic control group.

Thank you very much for your attention.

Katharina Finke
ZEW, Department of Corporate Taxation
and Public Finance
finke@zew.de
0049-621-1235-397

Regression Results (dep var. total tax)

	Coef.	Std. Err.	t	P>t
MNE	-811.7134	378.3569	-2.15	0.032
tangi	-3703.884	2266.462	-1.63	0.102
dr	2965.903	1536.515	1.93	0.054
ln(prod)	2461.209	1044.507	2.36	0.019
innov	-132.2658	180.0273	-0.73	0.463
ln(tassets)	1881.913	450.624	4.18	0
age	-10.00254	10.47824	-0.95	0.34
ind dummies	yes			
_cons	-31960.82	9551.045	-3.35	0.001

Regression Results (dep var. log(tax))

	Coef.	Std. Err.	t	P>t
MNE	-0.3478	0.0699	-4.98	0.0000
tangi	-0.9567	0.2532	-3.78	0.0000
dr	-0.1745	0.1571	-1.11	0.2670
ln(prod)	0.3984	0.0529	0.75	0.4520
innov	0.0048	0.0198	0.24	0.8090
ln(tassets)	0.8737	0.0245	35.66	0.0000
age	0.0009	0.65	0.65	0.5130
industry dummies	yes			
_cons	-3.9335	0.3439	-11.4	0.0000

Results

Sensitivity with respect to unobserved heterogeneity

Estimation of Rosenbaum-Bounds (Rosenbaum (2002))

Γ	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.7	2.8	2.9	3
crit. p	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.11	0.23	0.41

Note: The table illustrates the consequence of potentially existing unobserved effects on the significance level of results in the base specification. Γ is increased step-wise, i.e. the assumption of pure selection on observables is sequentially relaxed.

Results

Test: Diff-in-Diff without reform

	BASELINE (2005)			FOLLOW UP (2006)			
Outcome Variable	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DIFF-IN-DIFF
Tax Payment	1838.666	1563.924	-274.742	1568.118	1208.962	-359.155	-84.413
Std. E	129.842	104.206	166.487	158.549	82.323	178.647	244.198
t	14.16	1836.03	-1.65	1836.96	1292.35	-275.21	-0.35
P>t	0.000	0.000	0.099	0.000	0.000	0.044	0.73