Essays on Behavioral Responses of Multinational Enterprises to International Taxation

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Introduction

Economists have been observing cross-border flows of goods, capital, and people for decades. Yet the last period of economic integration is characterized by one distinguishing feature: the rise of multinational enterprises (see Markusen, 2002; Barba Navaretti and Venables, 2004; OECD, 2007). The very fact that these firms are active at many locations presents new challenges for policymakers. Indeed, if companies operate on an increasingly global basis, they find it easier not only to shift real economic activities but also taxable profits across national boundaries.[1] Since profits are still taxed on a national basis, profit shifting renders national tax systems obsolete, because it affects the ability of governments to raise corporate tax revenue and implies a change in the tax response of firms in terms of investment and location decisions.

As corporate tax rates vary considerably across countries, multinational enterprises can take advantage of international tax-rate differences. Figure 1

[1]The empirical literature on the impact of corporate taxation on multinational enterprises has shown that national tax levels can make a significant difference, on the one hand, to where business is done (e.g., De Mooij and Ederveen, 2003); and on the other hand, to where profits are reported (e.g., Huizinga and Laeven, 2008).

depicts the distribution of the mean statutory corporate tax rate over 167 countries.[2] While some low-tax or tax-haven countries have zero tax rates on corporate income (e.g., the Cayman Islands or the Bahamas), high-tax countries claim almost half of corporate profits. Although the German corporate income tax rate (inclusive of local business taxes) has been cut in several steps from 57.25% to 39.43%, on average, Germany is still among the high-tax locations. At the top end of the tax-rate distribution we observe Sudan with a mean statutory tax rate of almost 50%.[3]

If foreign investments or taxable profits are sensitive to taxation, the consequence may be that countries compete in statutory tax rates. The presumption is that this competition ultimately leads to a 'race to the bottom', where corporate tax rates converge to zero.[4] Although this has not been true so far, as Figure 2 demonstrates, there is a downward trend as the average statutory tax rate (over all 167 countries) came down from 32.86% in 1996 to 27.65% in 2005. However, in some countries, tax competition is more pronounced than in others. For instance, the average corporate tax rate in Eastern European countries declined from 32.2% in 1996 to 19.2% in 2005.

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[2]The mean statutory tax rates refer to the period from 1996 to 2005, as this is the time span for which firm-level data is available (see below).

[3]Mean statutory tax rates are also displayed in Table 1. Since German multinationals either do not have foreign investments in all 167 countries or the number of investments is not significantly high (data confidentiality), the table may not contain all 167 countries from Figure 1.

[4]Tax competition models predict that governments engage in wasteful competition for mobile capital (see Wilson, 1999) or taxable profits (see Haufler and Schjelderup, 2000) in statutory tax rates.

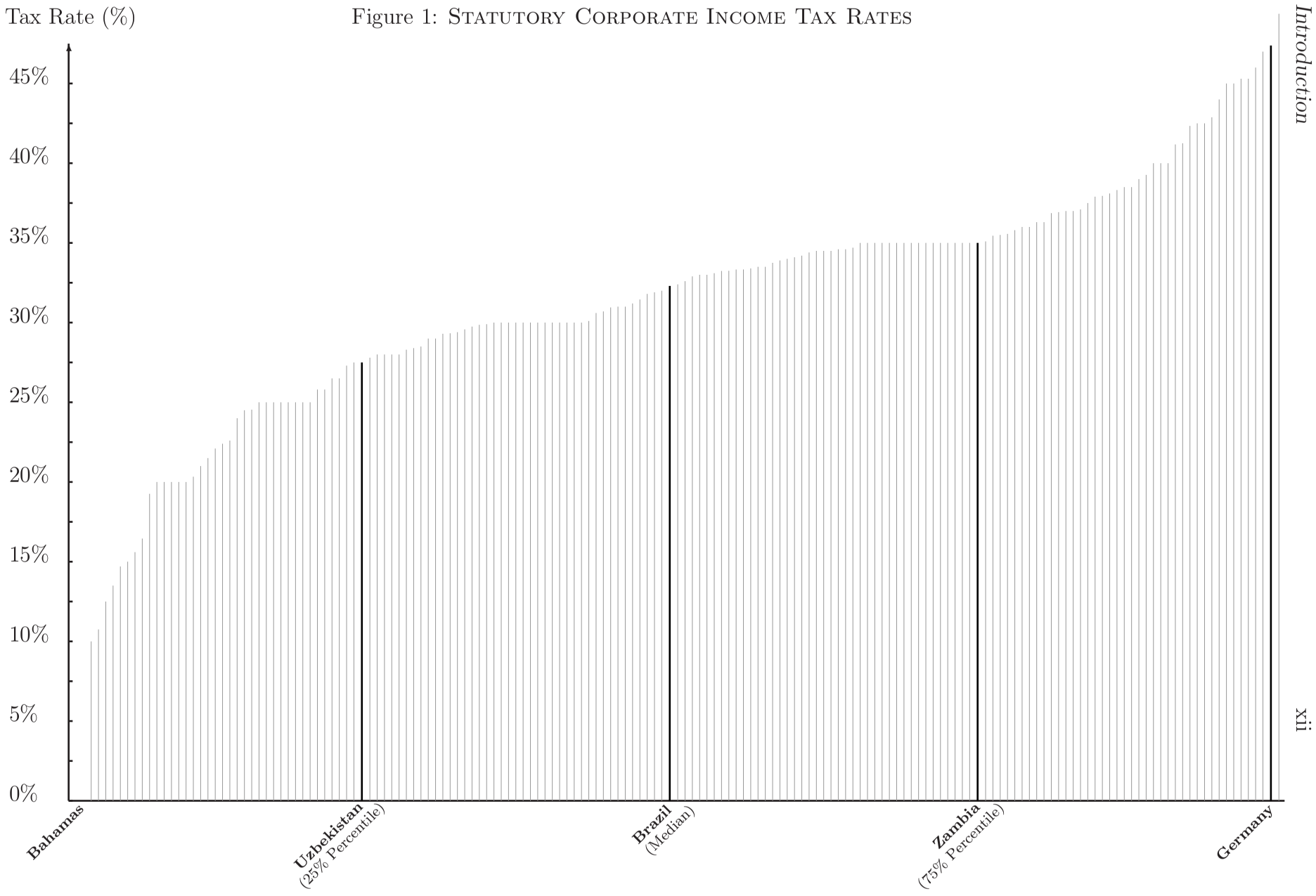
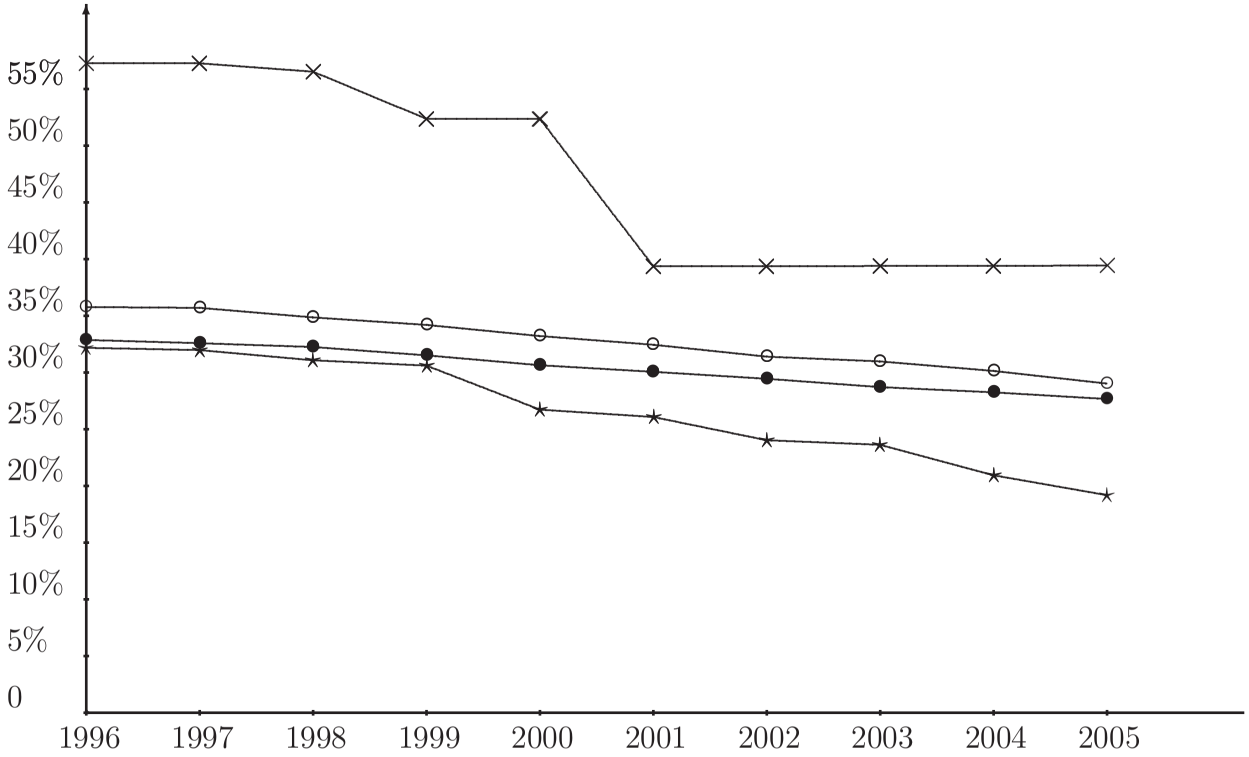


Figure 1: Statutory Corporate Income Tax Rates

Tax Rate (%) Figure 2: Average Statutory Corporate Income Tax Rate



Average corporate income tax rates (unweighted) from 1996 to 2005. Source: International Bureau of Fiscal Documentation (IBFD); World Tax Database, Ross School of Business, Michigan; tax surveys provided by Ernst&Young, PwC, and KPMG; local tax authorities. 'Eastern European Countries' refers to the new European Union (EU) member countries Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

This dissertation consists of four self-contained essays in public economics. Each of the essays aims at contributing to the understanding of the effects of corporate taxation on the activities of multinational enterprises, with an emphasis placed on issues related to the capital structure choice of multinationals. All empirical investigations are based on the Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see Lipponer, 2007, for an overview). This is a comprehensive dataset recording foreign direct investment (FDI) stocks of non-residents in Germany (inbound investment) and of residents in foreign economic territories (outbound investment). The current version is available as panel data from 1996 to 2005. One remarkable aspect of MiDi is that multinational enterprises are subject to mandatory reporting to the Bundesbank if investments exceed certain thresholds – in terms of an affiliate's balance-sheet total and the parent's ownership share. Therefore, we virtually observe all FDI activities of German multinationals as well as foreign FDI in Germany. Table 1, hence, displays the universe of foreign activities of German multinationals, thereby revealing the structure of German outbound FDI with regard to its geographical distribution. By far the most important host country, in terms of total and fixed assets, is the USA. As expected, European countries are also very important (e.g., the United Kingdom, France, Austria, or Italy). Considering 'Total Assets', the particular relevance of the Cayman Islands (as a tax-haven location), the Netherlands (as a location for holding companies), and Luxembourg (as a location for financial services) is highlighted. If we take into account 'Fixed Assets' as a measure for productive economic activity, however, these countries are of no particular importance. Finally, the last column reports the

mean statutory corporate tax rate of the countries (also displayed in Figure 1).

The first chapter of this dissertation investigates how taxes affect the affiliate-level investment decision of German multinationals, taking into account that a significant share of outbound investments are indirect rather than direct. While we consider direct investments as simple bilateral structures, where a parent firm is investing in a foreign affiliate; indirect structures involve at least three corporate entities, where the parent is investing via an intermediate entity in a foreign affiliate. The novel feature of this investigation is that it explicitly makes a distinction between direct and indirect investments, because an indirect structure possibly opens up enhanced opportunities for multinationals to avoid taxes. As a consequence, the role of corporate taxation in destination countries may change in case of an indirect investment. The empirical analysis, addressing endogeneity issues by using a switching regression model, confirms theoretical predictions: while direct investments are negatively affected by the host country's statutory tax rate, indirect investments are positively related to the statutory tax rate in host countries. This latter result is surprising, but it can be explained by an additional interest deduction associated with the indirect financing structure. However, if we consider cost of capital terms obtained from the theoretical analysis, we find negative effects on affiliate investment for both structures. The results carry an important implication for tax competition: the existence of conduit entities and low-tax conduit countries reduces the downward pressure on statutory tax rates. At the same time, though, competition for intermediate entities, i.e. competition in preferential tax treatments, may be intensified.

Table 1: German Outbound FDI

Country	Total Assets (in 1,000 €)	Total Assets (Rank)	Fixed Assets (in 1,000 €)	Number of Affiliates	Corporate Tax Rate
Algeria	116,995	87	67,441	4.20	0.324
Argentina	5,047,181	35	1,147,443	138.20	0.341
Australia	36,484,335	16	2,238,863	343.30	0.334
Austria	125,400,000	7	10,072,729	1,437.50	0.331
Bahamas	108,186	88	42,465	5.10	0.000
Bahrain	97,619	89	3,800	3.30	0.000
Bangladesh	22,554	105	1,847	3.70	0.350
Barbados	1,112,555	52	153	5.10	0.380
Belarus	23,049	104	13,058	4.30	0.278
Belgium	70,303,960	11	5,753,960	713.00	0.383
Bermuda	2,508,727	45	74,829	15.90	0.000
Bolivia	56,292	94	9,370	4.90	0.250
Bosnia-Herz.	328,881	69	71,651	11.78	——
Brazil	21,132,588	22	5,220,800	402.30	0.323
Brit. Virg. Isl.	224,000	76	8,144	7.10	0.135
Bulgaria	1,358,859	50	448,461	48.70	0.293
Canada	36,065,845	17	6,300,146	405.20	0.413
Canary Isl.	251,982	74	148,009	24.00	0.350
Cayman Isl.	142,200,000	5	196,659	56.00	0.000
Chile	1,365,030	49	193,132	66.10	0.156
China	14,304,017	27	4,877,777	455.50	0.330
Columbia	986,321	55	417,023	41.90	0.350
Costa Rica	93,016	91	22,502	12.50	0.300
Côte d'Ivoire	43,637	96	5,265	4.70	0.350
Croatia	3,199,476	41	1,029,772	57.30	0.265
Cyprus	531,004	62	116,991	37.20	0.215
Czech Rep.	24,221,518	19	8,399,625	808.40	0.326
Denmark	13,234,181	28	1,332,277	325.50	0.312
Domin. Rep.	51,046	95	20,669	9.20	0.250
Ecuador	175,214	81	47,297	17.30	0.315
Egypt	473,938	65	133,919	25.60	0.400
El Salvador	95,851	90	22,891	6.70	0.250
Estonia	176,958	80	59,689	21.90	0.258
Finland	2,966,741	43	1,119,198	123.50	0.283
France	140,100,000	6	13,092,047	2,174.80	0.369
Georgia	12,408	108	1,612	4.29	0.200
Ghana	24,793	102	6,864	4.78	0.333

Source: MiDi, Deutsche Bundesbank (1996 – 2005). All countries where less than 3 investments are observed are removed because of confidentiality reasons. 'Total Assets' is the sum of the balance-sheet total of foreign affiliates; 'Fixed Assets' is the sum of the balance-sheet item reporting the fixed assets of foreign affiliates; 'Corporate Tax Rate' is the unweighted statutory tax rate on corporate profits. Columns 2, 4, 5, and 6 refer to mean values.

Table 1: German Outbound FDI, cont.

Country	Total Assets (in 1,000 €)	Total Assets (Rank)	Fixed Assets (in 1,000 €)	Number of Affiliates	Corporate Tax Rate
Gibraltar	153,305	83	38,932	4.20	0.350
Greece	3,818,674	38	639,451	125.80	0.347
Guatemala	151,338	84	27,473	13.30	0.298
Guernsey	14,950,590	26	4,228	9.00	0.200
Honduras	21,419	106	7,263	4.30	0.296
Hong Kong	62,226,811	13	469,166	295.20	0.165
Hungary	21,795,837	21	6,667,901	608.80	0.193
India	4,158,093	37	717,253	146.70	0.369
Indonesia	2,777,715	44	675,942	72.30	0.300
Iran	88,946	92	18,655	11.30	0.453
Ireland	85,771,940	10	961,723	228.40	0.108
Isle of Man	324,125	70	86,517	14.00	0.100
Israel	257,320	72	39,776	19.70	0.358
Italy	100,100,000	9	9,058,002	1,142.30	0.423
Japan	103,000,000	8	4,268,239	309.70	0.453
Jersey	16,448,560	24	17,988	24.67	0.200
Kazakhstan	43,229	98	18,209	5.10	0.300
Kenya	72,516	93	9,939	12.20	0.318
Korea (South)	8,678,239	31	1,505,868	121.00	0.299
Latvia	479,133	63	79,148	28.70	0.221
Lebanon	10,569	109	964	3.90	0.125
Liberia	192,578	77	60,654	9.20	—
Libya	645,891	59	319,614	7.50	0.460
Liechtenstein	474,311	64	73,938	15.20	0.200
Lithuania	567,075	60	6,629	29.20	0.224
Luxembourg	324,700,000	3	3,317,432	269.60	0.351
Macedonia	396,492	66	128,047	5.20	0.150
Malaysia	5,226,932	34	1,238,460	150.30	0.284
Malta	1,056,003	54	69,367	21.50	0.350
Mauritius	544,713	61	22,361	7.00	0.300
Mexico	15,153,405	25	5,094,547	226.70	0.339
Moldova	31,042	99	16,075	3.11	0.226
Morocco	249,240	75	74,196	24.40	0.350
Namibia	26,734	100	6,641	5.20	0.350
Netherlands	232,400,000	4	7,041,790	1,343.60	0.345
Netherl. Antil.	20,546,803	23	3,179	15.60	0.363
New Zealand	8,254,009	32	106,797	63.30	0.330

Source: MiDi, Deutsche Bundesbank (1996 – 2005). All countries where less than 3 investments are observed are removed because of confidentiality reasons. 'Total Assets' is the sum of the balance-sheet total of foreign affiliates; 'Fixed Assets' is the sum of the balance-sheet item reporting the fixed assets of foreign affiliates; 'Corporate Tax Rate' is the unweighted statutory tax rate on corporate profits. Columns 2, 4, 5, and 6 refer to mean values.

Table 1: German Outbound FDI, cont.

Country	Total Assets (in 1,000 €)	Total Assets (Rank)	Fixed Assets (in 1,000 €)	Number of Affiliates	Corporate Tax Rate
Nicaragua	24,320	103	1,874	3.50	0.285
Nigeria	130,835	86	22,291	7.80	0.300
Norway	3,604,787	40	1,050,040	159.60	0.280
Oman	25,221	101	3,031	4.00	0.250
Pakistan	682,528	58	324,663	14.60	0.356
Panama	1,396,344	48	25,102	15.20	0.342
Paraguay	43,405	97	12,645	8.20	0.300
Peru	253,841	73	68,427	24.70	0.294
Philippines	962,754	57	164,346	50.50	0.329
Poland	25,048,498	18	6,051,136	908.90	0.299
Portugal	12,076,587	29	2,000,761	260.60	0.319
Romania	1,719,392	47	744,831	107.80	0.293
Russia	3,782,115	39	1,117,871	156.00	0.301
Saudi Arabia	167,876	82	14,470	10.20	0.355
Singapore	62,453,260	12	1,466,239	306.10	0.245
Slovak Rep.	5,793,021	33	2,603,507	189.40	0.306
Slovenia	1,317,628	51	259,794	64.50	0.250
South Africa	8,852,513	30	1,220,037	277.10	0.393
Spain	52,494,195	14	9,660,651	1,035.70	0.350
Sri Lanka	138,446	85	10,137	6.90	0.355
Sweden	22,692,875	20	2,828,143	395.50	0.280
Switzerland	50,256,958	15	5,749,394	1,288.80	0.245
Taiwan	2,153,280	46	195,853	78.60	0.250
Tanzania	10,481	110	1,485	4.10	0.310
Thailand	2,984,257	42	521,654	80.20	0.300
Tunisia	192,112	79	103,095	30.70	0.346
Turkey	4,406,224	36	1,715,605	165.60	0.360
UK	957,500,000	2	23,899,172	1,783.20	0.307
Ukraine	1,058,247	53	479,248	38.80	0.290
Unit. Arab E.	370,099	68	53,367	29.70	0.333
Uruguay	304,150	71	43,349	22.00	0.310
USA	1,167,000,000	1	115,000,000	2,561.70	0.411
Venezuela	964,261	56	302,407	41.50	0.340
Vietnam	192,499	78	37,623	12.30	0.310
Yugoslavia	376,785	67	119,227	11.60	0.203
Zimbabwe	16,250	107	8,140	4.00	0.338

Source: MiDi, Deutsche Bundesbank (1996 – 2005). All countries where less than 3 investments are observed are removed because of confidentiality reasons. 'Total Assets' is the sum of the balance-sheet total of foreign affiliates; 'Fixed Assets' is the sum of the balance-sheet item reporting the fixed assets of foreign affiliates; 'Corporate Tax Rate' is the unweighted statutory tax rate on corporate profits. Columns 2, 4, 5, and 6 refer to mean values.

The second chapter investigates tax-planning behavior of multinational firms by means of internal debt finance and the effectiveness of countermeasures via thin-capitalization rules. Such rules, which have become increasingly popular among governments to restrict multinationals' profit shifting, limit the deductibility of interest expenses associated with internal debt. A simple theoretical model which considers the financing decision of a multinational firm is used to obtain empirical implications. While the empirical analysis in Chapter 1 is based on outbound investment data, in Chapter 2 we change the perspective and employ German inbound investment data. The investigation confirms a significant impact of bilateral tax-rate differentials on the use of internal debt provided by foreign investors to the German subsidiaries. To test the impact of the German thin-capitalization rule (Sec. 8a KStG), we exploit the 2001 and 2004 amendments to the German corporate income tax law concerning the thin-capitalization rule. Both amendments had differential effects on foreign subsidiaries belonging to different company groups. This allows us to apply a difference-in-differences estimator to identify the effect of the rule. The results suggest that thin-capitalization restrictions are effective and induce significantly lower internal-debt-to-capital ratios.

Another behavioral response of multinational firms concerning thin-capitalization rules is investigated in the third chapter. However, while the focus in Chapter 2 is on multinationals' response with respect to internal debt, Chapter 3 goes beyond this analysis and examines the multinationals' response with respect to external debt. If multinational enterprises are able to substitute external for internal debt, the goal of governments, i.e. to secure the domestic corporate tax base by using thin-capitalization rules, possibly

fails, because such rules usually do not restrict the interest deduction associated with external debt. To address the basic problem of identifying the causal effect of thin-capitalization rules on external debt, the paper exploits the 2001 reform of the German thin-capitalization rule and applies propensity score matching techniques. The results of the study suggest that a tighter restriction on the deductibility of interest expenses for internal debt comes along with an expansion in external debt finance. This novel finding emphasizes the mobility of multinationals with respect to avoiding taxes. This mobility should be considered by policymakers, because otherwise any attempt to restrict profit shifting fails.

Chapter 4, finally, investigates the determinants of internal debt issued by foreign affiliates of multinational corporations. It contributes to the literature by analyzing the capital structure choice in a setting where internal debt can be used to shift profits to low-tax countries. In contrast to existing research, the theoretical analysis distinguishes between internal debt to minimize cost of capital across capital markets, and internal debt to shift taxable profits. The model yields the prediction that internal debt to minimize cost of capital is determined by the host country's statutory tax rate. Internal debt to shift profits, however, is determined by the tax-rate differential within the multinational group. The empirical analysis, which exploits differences in taxing conditions of 175 countries over a period of 10 years, confirms a robust and significant positive impact of tax-rate differences within the company group on the use of internal debt, supporting the view that internal debt is used to shift profits. Yet the host country's statutory tax rate is insignificant, indicating that internal debt is not used to minimize cost of capital. The results

prove robust if we take into account the potential effect of the German Controlled Foreign Corporation (CFC) rule (Hinzurechnungsbesteuerung), which aims at preventing profit shifting. However, the tax effects are rather small, even if we focus on majority-owned subsidiaries, suggesting that costs related to adjusting the capital structure are substantial. If profit shifting is important, as existing studies demonstrate, the findings imply that other channels to shift income, e.g. transfer pricing, are extensively used by multinational enterprises.

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Chapter 1

Foreign (In)Direct Investment and Corporate Taxation

Abstract

THIS PAPER INVESTIGATES the role of corporate taxation with respect to a multinational's investment decision in which the multinational can pursue either a direct or an indirect investment strategy. The latter strategy involves an intermediate corporate entity and opens up enhanced opportunities for international tax planning. The existence of preferential tax treatment for intermediate entities presumably changes the role of corporate taxation in destination countries, because it supports multinationals in avoiding taxes. The empirical findings of this study are consistent with theoretical predictions and suggest that tax effects differ, depending on the investment regime. The endogeneity of the regime choice – direct versus indirect – is taken into account by a switching regression approach.

1.1 Introduction

Economists agree that corporate taxation influences both the location choice and the investment decision of multinational firms (see Gresik, 2001; De Mooij and Ederveen, 2003). However, as companies become ever more international, another aspect is that multinational enterprises also find it increasingly easier to shift profits from high- to low-tax jurisdictions (see Hines, 1999; Devereux and Maffini, 2007). Differences in national tax systems and the complexity of the international tax law open up additional opportunities to avoid taxes. This implies that multinationals may establish sophisticated firm structures to exploit tax-avoidance opportunities.

In this paper we analyze how taxes affect the affiliate-level investment decision of German multinationals, taking into account that a significant share

of outbound investments are indirect rather than direct. While we consider direct investments as simple bilateral structures, where a parent company is directly investing in a foreign affiliate; indirect strategies involve at least three corporate entities, where the parent is investing via an intermediate or conduit entity in another foreign enterprise (see Weichenrieder and Mintz, 2008). Indirect investment structures possibly support multinationals in reducing corporate tax liabilities on a worldwide basis, because profits can be shifted from high- to low-tax (or even zero-tax) conduit locations. Moreover, tax-efficient indirect financing structures allow payments to be channeled from affiliates to parent companies, possibly without any tax deduction. As a consequence, the role of corporate taxation in destination countries may change.

Mintz (2004) demonstrates in a theoretical model that the analysis of investment decisions made by multinationals should explicitly differ between direct and indirect investments. In contrast to the existing empirical literature, this paper follows this structural distinction and empirically confirms that tax effects differ: while direct investments are negatively affected by foreign statutory tax rates, indirect investments are positively related to statutory tax rates in host countries. If we follow theoretical predictions and control for the tax-related cost of capital, we find adverse effects on affiliate-level investment for both structures. The potential endogeneity of the structural choice (direct versus indirect) is taken into account by a switching regression approach. The empirical investigation is based on the Microdatabase Direct Investment (MiDi), a comprehensive dataset of all German outbound investment positions provided by the Deutsche Bundesbank (the German Central

Bank; see Lipponer, 2007). The current version is available from 1996 to 2005 and contains data on companies' balance sheets as well as some further information, e.g. whether the investment is held directly or indirectly.

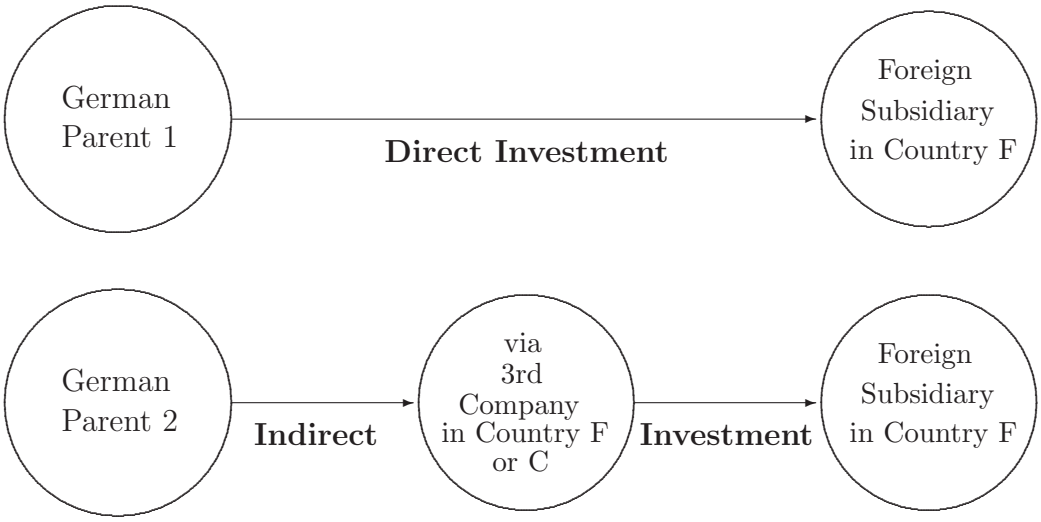
The novel empirical findings of this paper carry an important policy implication: the existence of conduit entities and low-tax conduit countries will lead to less aggressive international tax competition over statutory tax rates. Conversely, if tax discrimination in terms of preferential tax treatment for the conduit entities is reduced, tax competition is intensified (see Keen, 2001; Bucovetsky and Haufler, 2007).

The paper is organized as follows. Section 1.2 provides a general overview of direct and indirect investment structures, including some descriptive statistics. In Section 1.3, we set up a model that distinguishes between direct and indirect investments. Section 1.4 proposes an empirical estimation approach. Subsequently, Section 1.5 provides information about the data. Section 1.6 presents the empirical results. Section 1.7 examines the sensitivity of the results. Section 1.8 concludes.

1.2 Direct versus Indirect Investments

While the majority of foreign investments are direct, a considerable proportion of multinational outbound activities are indirect (see below). Figure 1.1 shows a stylized model which points out that German multinationals can, in

Figure 1.1: Direct versus Indirect Investment



principle, follow both investment regimes. Either the multinational decides to invest directly in the destination country F or it chooses an indirect structure and establishes a conduit entity, possibly in a third country C.[1] The choice of this organizational structure is presumably not random; it may depend on destination-country characteristics, firm preferences or strategies, as well as on the company-specific potential.

Figure 1.2 presents the annual number of German outbound investments from 1996 to 2005. There has been a significant increase in the number of investment objects in both regimes. Moreover, focusing on indirect observations, the left graph of Figure 1.3 shows the three most important conduit locations for German multinationals. The Netherlands attract more than a fourth of

[1]We mostly refer to 'conduit' entities. This emphasizes that these entities connect German parent firms to foreign subsidiaries in destination countries. Alternatively, we may refer to intermediate or holding companies.

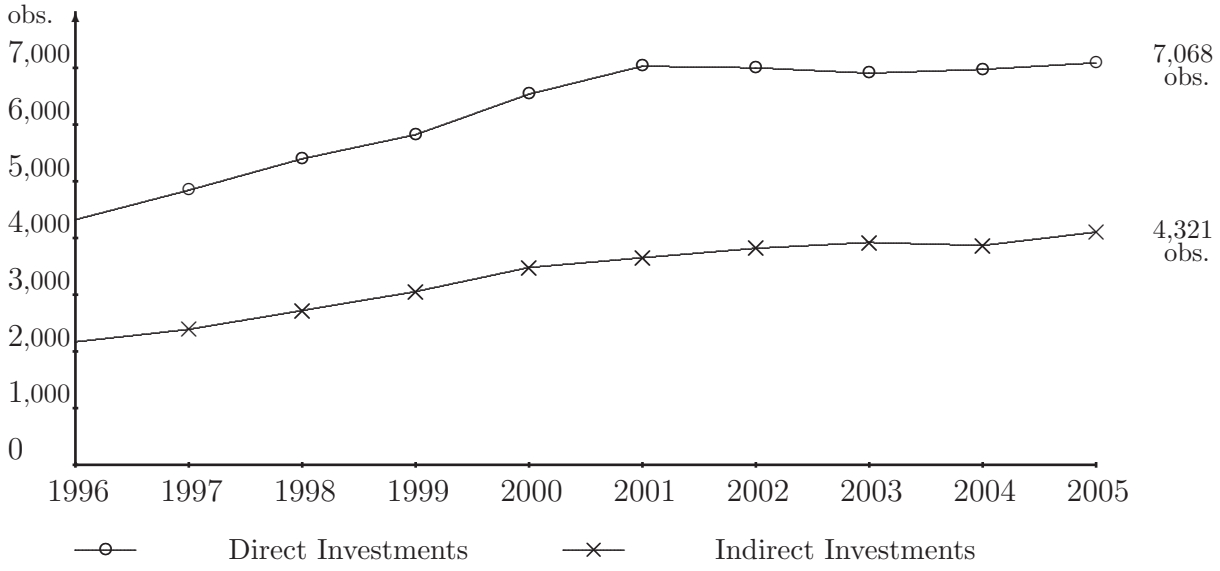
German conduit entities. Together with Switzerland and Austria, these three countries host almost 60% of all German conduit entities. The right-hand side of Figure 1.3 displays the three most important destination countries for indirect structures. Here, observations are more evenly distributed across countries: about one-fifth of German indirect outbound investment goes to Italy, France, and Spain.[2]

While this paper argues that differences in international taxation can explain why indirect structures exist, the classical case of an indirect entity may be associated with non-tax reasons. Indeed, headquarters or holding companies may provide services which it is useful to bundle centrally for legal or efficiency reasons. With regard to taxation, Weichenrieder and Mintz (2008) identify three potential roles of conduit entities. First, a conduit entity can be used for so-called treaty shopping, because some countries do offer preferential treatment with respect to withholding taxes.[3] Second, conduit entities in low-tax countries provide high-tax affiliates with internal debt. Borrowing from affiliates located in low-tax conduit countries and lending to affiliates

[2]Note that Figure 1.3 only considers three-country structures, i.e. structures where the destination country is different from the conduit country. If observations were included that allow host and conduit country to be identical, the United States would have been an important host as well as conduit country, because many US affiliates are held via US holding companies.

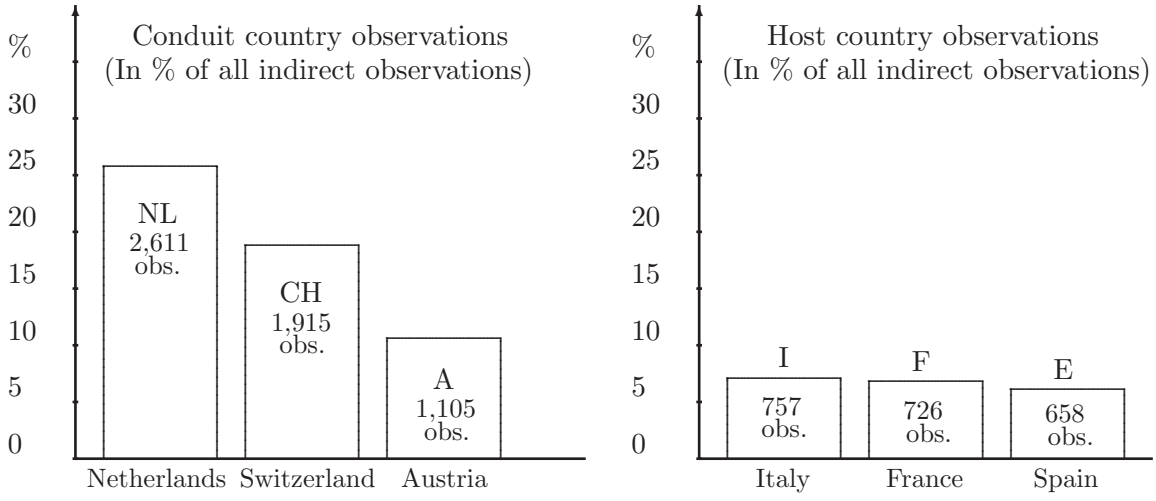
[3]Note that the conduit entity is not necessarily located in a third country. Some countries may provide special tax treatment for some firms, depending, for instance, on the legal form. The special treatment of holdings in the Netherlands, financial holdings in Luxembourg, or headquarters of foreign multinationals in Belgium (*co-ordination centers*) are well-known examples (see Council of the European Union, 1999). Even a holding in the same country is then possibly tax motivated. Profit and loss consolidation, which is often allowed on a national basis only, can also explain tax motivated conduit entities where no third country is involved (see Weichenrieder and Mintz, 2008).

Figure 1.2: Number of (In)Direct German Outbound Investments



Annual number of (in)direct outbound investments (1996 – 2005). The figure reflects the number of affiliates in host countries. Direct is defined as direct participation interest in non-holding companies. Indirect as participation interest held by holding and non-holding companies. All minority holdings, partnerships, and observations from the financial service sector are excluded. Source: Deutsche Bundesbank, MiDi.

Figure 1.3: Conduit & Host Countries (Indirect Investments)



Indirect three-country structures are the only structures considered, i.e. conduit countries are always different from host countries. The left panel shows the three most important conduit countries for German indirect outbound investments (1996 – 2005). The Netherlands, Switzerland, and Austria account for 56.76% of all observations. The right side depicts the three most important destination countries for indirect investments (1996 – 2005). Italy, France, and Spain account for 21.58% of all observations. Minority holdings, partnerships, and financial services are excluded. Source: Deutsche Bundesbank, MiDi.

in high-tax host countries will allow the latter to deduct interest payments from profits and save taxes. Under certain conditions, for example if the parent is also located in a high-tax country, this structure even allows for two interest deductions for one investment.[4] Finally, the low-tax conduit can reinvest income and defer any payments to the parent. This last point is especially relevant for outbound investments from countries using a tax credit system. However, income deferral of passive income may collide with controlled foreign company (CFC) rules, depending on the type of income (for further information about the US Subpart F legislation, see Hines, 1999; for the German rule, see Weichenrieder, 1996). Desai, Foley, and Hines (2003) confirm that tax deferral is an important strategy for US multinationals, because of the US tax system.[5] They show that indirectly owned affiliates are more sensitive to foreign tax-rate differences, because chains of ownership can mitigate the effects of the US foreign tax credit system by expanding opportunities to defer US tax liabilities. Incentives under ownership chains are then comparable to incentives under exemption systems, because multinationals can avoid repatriation taxes. Note, though, that implications of using ownership chains are basically very different, depending on the tax system of the parent country.

[4]This is called a double-dip structure and corresponds to the analysis in Section 1.3.2. Some important tax attributes encourage this double-dip situation in the case of indirect investments (see Mintz, 2004). First, parent country and host country do not limit interest deduction; second, the parent country exempts conduit income; third, the conduit country allows for special tax treatment of intermediate companies or is a low-tax country; fourth, the conduit country (the host country) imposes little or no withholding tax on income paid to the parent (conduit).

[5]In the US, companies are taxed on their worldwide income, irrespective of where it was earned. Afterwards, to avoid double taxation, a company receives a credit for the taxes it paid to a foreign government up to the amount it would have paid had it remained in the US (tax credit system). In contrast, the method used by Germany and other countries is called a territorial or exemption system. Here, only profits earned in the home country are taxed.

1.3 Theoretical Analysis

Consider a simple partial equilibrium model of a German multinational enterprise. The multinational is active in Germany G and also in a foreign country F. Production is determined by a concave production function with standard properties, where $f_G(K_G)$ denotes production in Germany, and $f_F(K_F)$ denotes production in the foreign country.[6] The model follows the analysis of Mintz (2004) and distinguishes two regimes, where Regime I (II) is the direct (indirect) investment regime.

1.3.1 Direct Structure (Regime I)

Profits are determined by output, $f_G(K_G)$ and $f_F(K_F)$. Both countries, Germany and the foreign country, tax profits at rates of τ_G and τ_F, respectively. We assume an interest rate i, which is identical for all types of borrowing and in both countries. We further assume that foreign-source income is tax exempt.[7] Overall profits of the multinational (home and foreign profits) are given by

$$\begin{aligned} \pi &= (1-\tau_G)(f_G(K_G) - iB_G) + iE_F \\ &+ (1-\tau_F)(f_F(K_F) - iB_F) - iE_F. \end{aligned} \tag{1.1}$$

[6]Capital is the only variable input factor. The production function exhibits a positive but decreasing marginal product of capital: $f'(\cdot) > 0$ and $f''(\cdot) < 0$.

[7]Germany basically exempts foreign earnings from domestic taxation.

The first line captures the profits of the German parent company. B_G refers to external debt finance. Accordingly, interest expenses iB_G are deductible from the tax base. Note that we abstract from opportunity costs for own capital iE_G. We may, however, define profits inclusive of iE_G. The second line refers to the profits of the foreign affiliate. The affiliate in F can borrow from third-party lenders B_F or finance with parent equity E_F. The parent receives dividends iE_F without tax deduction. We keep E_F in the model – albeit it would cancel out in this first case – because it emphasizes one crucial difference compared to the indirect structure (see below). The firm maximizes profits subject to the following constraints:

$$K_G + E_F = B_G,$$
$$K_F = E_F + B_F,$$
$$B_G \geq 0,\ B_F \geq 0.$$

Note that the first constraint implies that the parent also raises funds to finance the foreign affiliate; actually more than necessary for its own investment K_G. We further impose nonnegativity constraints on B_G and B_F. An additional assumption is that the host country tax rate is always lower than the home country tax rate ($\tau_G > \tau_F$). If we maximize the model with respect to K_G and K_F, taking into account all relevant restrictions, we obtain the following marginal conditions:

$$\begin{aligned} f'(K_G) &= i, \\ f'(K_F) &= i\frac{(1-\tau_G)}{(1-\tau_F)}. \end{aligned}$$

The first optimality condition points out that the decision of the parent company is not distorted by corporate taxation. Abstracting from i, we refer to the second expression as the tax wedge[8] or the tax-related cost of capital of the foreign affiliate. If we assume that the German tax rate always exceeds the foreign tax rate, new investment is exclusively parent-debt financed.[9] The equity transfer to the affiliate, therefore, is refinanced with external debt. Assuming that the parent's profits are positive (the parent is not tax-exhaust), overall profits of the multinational enterprise are maximized. While the optimality condition for the German part of the multinational implies tax neutrality, the required rate of return for the foreign investment is below i, because of simple tax arbitrage.

For a variation in the foreign statutory tax rate, we obtain the comparative static effect which is unambiguously negative: a higher foreign tax rate τ_F implies higher cost of capital and less investment

$$\frac{dK_F}{d\tau_F} = \frac{i(1-\tau_G)}{(1-\tau_F)^2 f''(K_F)} < 0.$$

[8]The term tax wedge simply reflects that the optimality condition is distorted, i.e. $f'(K_F) \neq i$. The tax wedge in the case of the foreign affiliate implies a reduction of the cost of capital.

[9]We obtain this extreme result – complete debt finance – because we do not introduce any costs associated with debt (and because $\tau_G > \tau_F$). While these costs are neglected in this model, the corporate finance literature refers to concepts where debt finance is associated with additional costs (for surveys, see Myers, 2001; Graham, 2003).

1.3.2 Indirect Structure (Regime II)

We rely on one structural difference when introducing the conduit structure: the parent company still transfers equity funds to a foreign affiliate, but now to a conduit entity. Subsequently, the conduit provides the foreign affiliate F with internal debt, for which interest expenses are tax deductible. The meaning of the above notation slightly changes: E_F now refers to internal debt if we consider the foreign affiliate; it refers to equity if we consider the parent firm. Any further activity of the conduit is not modeled, because we are only interested in investment activities of the affiliate in F. The multinational's profits are determined by

$$\begin{aligned} \pi &= (1-\tau_G)(f_G(K_G) - iB_G) + iE_F \\ &+ (1-\tau_F)(f_F(K_F) - iB_F - iE_F). \end{aligned} \tag{1.2}$$

We assume that transfers, including interest payments to the conduit, can be channeled from the affiliate to the parent without any tax deduction. The model then describes the so-called double-dip structure, because the multinational can deduct interest payments in the host country and in the home country.[10] We maximize the model subject to the above constraints and obtain two expressions for the cost of capital:

[10]Intuitively, the German parent takes up more capital than necessary to finance its own investment. Interest expenses in Germany are deductible for corporate tax purposes. The foreign affiliate is internal debt financed, and associated interest expenses are again deductible. Hence we have two interest deductions for the same investment.

$$\begin{aligned} f'(K_G) &= i, \\ f'(K_F) &= i\frac{(1-\tau_G-\tau_F)}{(1-\tau_F)}. \end{aligned}$$

The foreign affiliate's capital costs are further reduced, because of the additional interest deduction. A variation in the foreign tax rate yields the following positive expression

$$\frac{dK_F}{d\tau_F} = \frac{-i\tau_G}{(1-\tau_F)^2 f''(K_F)} > 0.$$

The prediction of a positive tax effect is the result of the double-dip interest deduction, because a higher foreign tax rate implies that interest deductions are even more valuable.

1.3.3 Indirect Structure (Extended)

We extend the indirect model with respect to one critical assumption. While Equation (1.2) implies that interest payments received by the conduit are tax exempt, we introduce a tax τ_C on interest payments to the conduit. Profits can then be written as

$$\begin{aligned} \pi &= (1-\tau_G)(f_G(K_G) - iB_G) + iE_F \\ &+ (1-\tau_F)(f_F(K_F) - iB_F - iE_F) - \tau_C iE_F. \end{aligned} \tag{1.3}$$

τ_C may denote withholding taxes as well as the conduit country tax rate. The marginal decision of the foreign affiliate is then determined by

$$f'(K_F) = i\frac{(1-\tau_G-(\tau_F-\tau_C))}{(1-\tau_F)}.$$

There is no longer any tax advantage compared to the direct structure if τ_F equals τ_C. If $\tau_C < \tau_F$, the tax wedge ranges somewhere between the direct and the indirect solution.

To sum up, theory suggests two different regimes with two (three) different measures for the tax-related cost of capital. Hence, tax wedges T for respective regimes follow:

$$T_1 = \frac{(1-\tau_G)}{(1-\tau_F)}, \tag{1.4}$$

$$T_2 = \frac{(1-\tau_G-\tau_F)}{(1-\tau_F)}, \tag{1.5}$$

$$T_2^* = \frac{(1-\tau_G-\tau_F+\tau_C)}{(1-\tau_F)}. \tag{1.6}$$

T_1 applies to the direct structure (Regime I); T_2 is the relevant tax measure for the indirect structure (Regime II); and T_2^* relates to the extended indirect structure where τ_C is also considered.

1.4 Investigation Approach

The purpose of the empirical investigation is to estimate how taxes affect affiliate-level investment. The theoretical analysis suggests two different regimes, depending on whether investments are direct or indirect. One way to approach this problem is to consider direct and indirect investments as two separate samples, simply split observations, and estimate two distinct equations. However, firms do not randomly choose one or the other regime, and a simple split does not fully account for this endogeneity.[11]

To address the endogeneity problem we follow the literature and estimate an endogenous switching regression model, where the switching rule is observed. (Lee, 1978) suggests a two-step procedure: first, estimate the binary variable R indicating whether the investment is directly or indirectly held. Subsequently, estimate affiliate investment in a second stage and condition on the regime choice.

[11]We can think of endogeneity in this context in many different ways. First, there are some firms switching from one regime to the other. The ultimate regression sample contains exactly 50 affiliates switching at least once over the whole time span. Second, firms' potentials to cushion shocks differ, depending on the regime. Hence, the regime is correlated with these shocks. Third, the variable of interest, affiliate-level investment, may also differ structurally with respect to all control variables. Fourth, regime choice and investment level may be simultaneously determined. Another intuitive way to think about endogeneity is to look at the decision to establish an indirect structure. The existence of preferential tax treatments, or generally differences in international taxation, presumably distort the decision to establish a conduit structure. Furthermore, if the heterogeneity in multinationals' potentials determines the regime, we have a problem of self selection, or selection into the regime. Note that any fixed-effects approach may account for time-invariant preferences (e.g., Vella, 1998). Yet the proclivity of multinationals to choose a specific regime can vary over time.

From a taxation perspective, conduit structures should generally be dominant, empirically. However, descriptive statistics show that the majority of investments are direct. The reason may be that indirect structures are also costly: while every foreign activity is associated with costs (e.g., Markusen, 1995), a conduit entity involves additional control and information problems, and hence, additional costs which reduce the probability to choose the indirect structure. We summarize the decision to establish a conduit entity (the first-stage decision) with the following equations

$$R_{ijkt} = \begin{cases} 1 & \text{if } IND_{ijkt} > 0, \\ 0 & \text{otherwise.} \end{cases}$$

$$IND_{ijkt} = h[c_{ijkt}(X_{ijkt}, \gamma_i)].$$

R_{ijkt} is a binary variable indicating whether the multinational j is investing in country k at time t in an affiliate i via a conduit entity or not. IND_{ijkt} is the corresponding unobserved propensity and c_{ijkt} represents the company-specific costs associated with the conduit firm. These costs are determined by affiliate and company-group variables and also by host-location factors such as the host country tax rate τ_{kt}. Hence, a vector X_{ijkt} of observable host-country characteristics as well as affiliate- and company-group-specific characteristics determine costs. Finally, γ_i captures unobserved preferences of affiliates, which may be important, for instance, because of affiliate-specific management strategies. First-step estimation equations are then specified as

$$R_{ijkt} = a_1 BST_{jt} + a_2 PRO_{jt} + a_4 X_{ijkt} + \xi_t + \gamma_i + u_{ijkt}. \tag{1.7}$$

The respective regime choice is identified by the company-group-specific variables BST_{jt} and PRO_{jt}, which may reflect the group-specific ability as regards establishing a conduit entity. BST_{jt} is the balance-sheet total of the multinational group; PRO_{jt} refers to the profitability of the multinational.[12] Moreover, all relevant second-stage explanatory variables are considered (including affiliate-specific effects γ_i, and aggregate time effects ξ_t). From first-stage regressions we obtain estimates for an additional selection term $\hat{\lambda}$. Including $\hat{\lambda}$ in the equations of interest allows us to consistently estimate

$$\begin{aligned} \text{Regime I:} \qquad Y_{1,ijkt} &= \alpha_1 + \alpha_2 T_{1,kt} + \alpha_3 X_{ijkt} + \hat{\lambda}_{1,ijkt} \\ &+ \psi_t + \varphi_i + \epsilon_{1,ijkt} \quad \text{iff } R_{ijkt} = 1, \end{aligned}$$

$$\begin{aligned} \text{Regime II:} \qquad Y_{2,ijkt} &= \beta_1 + \beta_2 T_{2,kt} + \beta_3 X_{ijkt} + \hat{\lambda}_{2,ijkt} \\ &+ \psi_t + \varphi_i + \epsilon_{2,ijkt} \quad \text{iff } R_{ijkt} = 0. \end{aligned}$$

Y denotes affiliate-level investment. X_{ijkt} is a vector of affiliate- and country-specific control variables. To control for selection, we include estimated selection terms, $\hat{\lambda}_1 = \frac{\phi(X\hat{a})}{\Phi(X\hat{a})}$ and $\hat{\lambda}_2 = \frac{\phi(X\hat{a})}{1-\Phi(X\hat{a})}$, as additional regressors (see Maddala, 1983).[13] Finally, T_1 and T_2 are the tax-related cost of capital for

[12] For further data and variable definitions see Section 1.5 and Appendix B. Note that empirical identification requires at least one variable that explains the regime choice. We may refer to this variable as an instrument. The nonlinearity of the probability model can already be sufficient to identify the regime. Yet this can cause collinearity among regressors since we condition on the regime choice in the second stage (Wooldridge, 2002). Note also that we do not aim to explain which countries are preferable conduit-entity locations. Rather, we are interested in the multinational's regime choice, i.e. the first-stage decision to establish a conduit structure at all, where the company can choose any potential conduit location.

[13] ϕ denotes the standard normal density function; Φ the distribution function. The ratio $(\frac{\phi(X\hat{a})}{\Phi(X\hat{a})})$ is also known as the inverse Mills ratio.

direct and indirect structures as defined in Equations (1.4) and (1.5), respectively.

The empirical implementation of this two-step approach in context of panel data and unobserved heterogeneity in both equations requires further considerations. We follow the procedure suggested by Wooldridge (1995) for panel data selection models.[14]

1.5 Data and Descriptive Statistics

The data for the empirical analysis are taken from the Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank. This is an affiliate-level database of German multinationals' foreign investments. The data provide information about the investment object's balance sheet, including further information on the type of investment and on the investor. A favorable aspect of MiDi is that the current version is available as affiliate-level panel data for the period 1996 to 2005. Moreover, data collection is enforced by German law, which sets reporting obligations for certain international transactions and positions.[15] As a crucial variable for this analysis,

[14] Appendix A contains further details concerning the Wooldridge (1995) estimator and, especially, the procedure for correcting standard errors.

[15] Außenwirtschaftsgesetz (Trade and Payments Act) in connection with Außenwirtschaftsverordnung (Foreign Trade and Payments Regulation). Each German multinational has to report its foreign assets including both direct and indirect FDI, conditional on some lower threshold level for mandatory reporting. Since 2002, investments have to be reported if the participation is 10% or more and the balance-sheet total of the foreign object is above 3 million euros. Though previous years showed lower thresholds, this level is uniformly applied for all years in the panel. For details see Lipponer (2007).

MiDi includes the information on whether the German multinational invests directly or indirectly via a conduit entity.

Below regressions analyze the determinants of affiliate-level investment. Investment is defined as the logarithmic difference in the balance-sheet item 'fixed assets'.[16] We can interpret this variable as a growth rate, but we mostly refer to 'investment' in the following. One explanatory variable is the tax wedge T as defined above. This variable is expected to be negatively related to affiliate-level investment (see Section 1.3). In order to control for country characteristics, we employ various host country variables: *GDP* to capture market size, *labor cost* in manufacturing and the local *lending rate* to capture differences in factor prices.[17] Furthermore, we control for the *present value of depreciation allowances* defined by the countries' tax code. Besides, we condition on the affiliate-specific variables *sales* and *loss carry-forward*. We expect a positive sign for sales, because this is an indicator for the affiliate's size and cash flow. The dummy variable loss carry-forward indicates whether some loss carry-forward is reported. The existence of losses in the previous periods may capture characteristics of the current decision problem of the company such as the expected performance of an affiliate. This variable is expected to be negatively related to investment.

Table 1.1 summarizes all relevant regression variables and respective mean values. The estimation sample is restricted to majority holdings. More-

[16]The dependent variable is calculated as: ln(fixed assets$_t$) - ln(fixed assets$_{t-1}$).

[17]MiDi does not provide information on affiliate-specific labor costs, or interest payments, etc.

Table 1.1: Variable Description

		Mean Values (Standard Errors) Regime I	Regime II
Tax Variables	Statutory Tax Rate	.308	.327
		(.073)	(.072)
	Tax Wedge (T_1 & T_2)	.839	.345
		(.095)	(.171)
	Tax Wedge (T_2^*)		.351
			(.173)
	Tax Wedge (T_{2a}^*)		.495
			(.159)
	Tax Wedge (T_{2b}^*)		.634[(b)]
			(.144)
	Tax Wedge (T_{2c}^*)		.695[(c)]
			(.135)
Country Level	Country GDP (in US$ bill.)	951	1,790
		(1,993)	(2,839)
	Labor Cost (in US$)	13.79	16.89
		(8.78)	(7.55)
	Lending Rate	.076	.066
		(.046)	(.034)
	Present Value of Depreciation	.806	.802
		(.052)	(.049)
Affiliate Level	Fixed Assets (in € mill.)	15.62	27.22
		(86.93)	(133.26)
	Sales (in € mill.)	55.50	91.42
		(255.17)	(434.64)
	Loss carry-forward (binary)	.304	.326
		(.460)	(.469)
	Observations	14,487	5,949

Affiliate-level data are taken from MiDi. Corporate taxation data are taken from the International Bureau of Fiscal Documentation (IBFD), and from tax surveys provided by Ernst&Young, PwC, and KPMG. The lending rates refer to credits to the private sector and are taken from the IMF International Financial Statistics Yearbook (2006) augmented with corresponding OECD figures. GDP in U.S. dollars, nominal, is taken from World Bank World Development Indicators (2006). Hourly labor costs in U.S. dollars for production workers in manufacturing are taken from the U.S. Bureau of Labor Statistics and Eurostat. T_1 and T_2 refer to Equations (1.4) and (1.5). T_2^* refers to (1.6), where τ_C corresponds to the relevant withholding tax rate for interest payments. Note that withholding tax data refers to the year 2005. τ_C is equal to 10% (T_{2a}^*), 20% (T_{2b}^*), and 25% (T_{2c}^*) for all observations. Different sample size: [(b)] 5,554 observations, [(c)] 5,030 observations.

over, financial services, partnerships, and non-manufacturing observations are excluded (see Table 1.7 in the Appendix for a detailed classification). According to theory, we remove observations if the German tax rate is below the statutory tax rate of the destination country.[18] Tax wedges are defined according to Equations (1.4), (1.5), and (1.6). Since withholding taxes are often negotiated in double tax treaties, the withholding tax rate τ_C depends on the location of the conduit entity and potential treaties of host countries with conduit countries. To check the sensitivity of the analysis, we further define T^*_{2a}, T^*_{2b}, and T^*_{2c}, where we set τ_C at 10%, 20%, and 25%, respectively, for all observations (see also Section 1.7). The consideration for this is that we change the composition of the sample, because the maximization problem in Section 1.3.3 requires that τ_C is below the host country tax rate. If this condition is not fulfilled, the observation is removed. Additionally, we change the variation of the nonlinear tax wedge.

Whereas tax wedges differ by construction, a comparison of other variables' mean values already indicate structural differences. As we would expect, the mean statutory tax rate is higher in Regime II. Market size, reflected by GDP, is on average twice as high in Regime II. Moreover, investments are much bigger in the case of the indirect structures – in terms of fixed assets and also in terms of sales. Finally, one may speculate whether the difference in average labor cost reflects the motivation for the foreign investments (vertical FDI versus horizontal FDI).

[18] The relevant German statutory tax rate is adjusted for the non-deductibility of interest expenses, because this is the relevant measure for the basic arbitrage condition.

1.6 Regression Analysis

Table 1.2 reports regression results where we simply split the sample and estimate the respective regime. As expected, we find a negative impact of the statutory tax rate and of the tax wedge T_1 on direct investments. While we partially confirm theory by finding a positive, but not significant, tax rate effect on indirect investments, in Column (4) we confirm the negative effect of the tax wedge as defined in Equation (1.5). Additional control variables such as the affiliate-specific sales, or the dummy variable for the loss carry-forward are included in all specifications. Both affiliate-specific variables show the expected sign. The fixed effects approach removes all cross-section variation between affiliates and also nests country fixed effects. In this sense, it is not surprising that country-specific variables, for example GDP or labor cost, are statistically insignificant. We find, however, a significant positive effect of the local lending rate for some specifications. The positive coefficient may reflect the comparative advantage of multinationals compared to domestic firms, because multinationals can rely on internal capital markets. Note that all regressions control for variations in German lending conditions by including a full set of time dummies. Thereby, we also capture general taxing conditions in Germany which are the same for all German parent firms.

Since we condition on affiliate-specific effects in this sample split, estimates are consistent if sample selection – the choice of the regime – depends on the constant affiliate-specific component (e.g., Vella, 1998). If this affiliate-specific effect does not fully capture selection, i.e. if the selection effect varies

Table 1.2: Regression Results (Sample Split)

	(1)	(2)	(3)	(4)	(5)
Statutory Tax Rate	-.533*	.828			
	(.285)	(.580)			
Tax Wedge (T_1)			-.448*		
			(.249)		
Tax Wedge (T_2)				-.949*	
				(.499)	
Tax Wedge (T_2^*)					-.152
					(.722)
log(Sales)	.030	.046	.030	.046	.046
	(.020)	(.050)	(.020)	(.050)	(.050)
Loss carry-forward	-.034**	-.060*	-.034**	-.059*	-.059*
	(.016)	(.035)	(.016)	(.035)	(.035)
log(GDP)	-.200	.031	-.218	.004	.056
	(.201)	(.118)	(.200)	(.120)	(.125)
log(Labor Cost)	.027	-.210	.035	-.188	-.231
	(.199)	(.197)	(.198)	(.200)	(.201)
log(Lending Rate)	.107***	.079	.108***	.083	.095
	(.042)	(.064)	(.042)	(.061)	(.061)
Present Value Depr.	-.140	.024	-.140	.007	.015
	(.229)	(.559)	(.233)	(.565)	(.546)
Regime	I	II	I	II	II
Firms	3,377	1,627	3,377	1,627	1,627
Observations	14,487	5,949	14,487	5,949	5,949
Host Countries	32	33	32	33	33

Dependent variable is investment, defined as the logarithmic difference in the balance-sheet position fixed assets (ln(fixed assets$_t$) - ln(fixed assets$_{t-1}$)). Time and affiliate-level fixed effects are included but not reported. Standard errors (in parentheses) are robust and clustered (year-country cell). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. T_1 is defined according to Equation (1.4). T_2 follows (1.5). T_2^* corresponds to Equation (1.6).

Table 1.3: Regression Results (Switching Regression)

	(1)	(2)	(3)	(4)	(5)
Statutory Tax Rate	-.450**	.900*			
	(.229)	(.530)			
Tax Wedge (T_1)			-.383*		
			(.210)		
Tax Wedge (T_2)				-.994**	
				(.484)	
Tax Wedge (T_2^*)					-.184
					(.816)
log(Sales)	.029	.044	.030	.044	.043
	(.019)	(.055)	(.019)	(.055)	(.055)
Loss carry-forward	-.035**	-.060	-.035**	-.059	-.059
	(.016)	(.038)	(.016)	(.038)	(.038)
log(GDP)	-.233*	.027	-.248*	-.001	.052
	(.133)	(.097)	(.135)	(.157)	(.146)
log(Labor Cost)	.043	-.254	.050	-.233	-.274*
	(.129)	(.163)	(.136)	(.167)	(.165)
log(Lending Rate)	.111***	.075	.112***	.080	.091
	(.029)	(.056)	(.030)	(.101)	(.097)
Present Value Depr.	-.109	.059	-.113	.042	.045
	(.187)	(.530)	(.195)	(1.21)	(1.11)
Regime	I	II	I	II	II
Firms	3,377	1,627	3,377	1,627	1,627
Observations	14,487	5,949	14,487	5,949	5,949
Host Countries	32	33	32	33	33

Dependent variable is investment, defined as the logarithmic difference in the balance-sheet position fixed assets (ln(fixed assets$_t$) - ln(fixed assets$_{t-1}$)). Time dummies and linearized affiliate-level fixed effects are included but not reported. All estimations take into account the endogeneity of the regime choice. Standard errors (in parentheses) are robust for any form of heteroscedasticity and autocorrelation, and account for the two-step estimation (see Wooldridge, 1995). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. All reported results refer to Specification (2) of the probit equation (see Appendix B, Table 1.6). T_1 is defined according to Equation (1.4). T_2 follows (1.5). T_2^* corresponds to (1.6).

over time, our estimates are not consistent. Table 1.3 presents the results from switching regressions, where we additionally condition on the selection effect $\hat{\lambda}$.[19] Basically, the results confirm findings in Table 1.2. However, the positive tax rate effect for the indirect investments is now significant. The estimated coefficient for the tax wedge T_1 in Column (3) implies that a 1 percentage point higher tax wedge is associated with -.38% less new investment in fixed assets. The regression in Column (4) suggests that a 1 percentage point higher indirect tax wedge is associated with -.99% less investment. The results confirm the double-dip structure as modeled in Section 1.3.2, because T_2 is calculated accordingly. In a further step, we consider that host countries possibly impose withholding taxes. T_2^* now refers to Equation (1.6), where τ_C corresponds to the bilateral withholding tax for interest payments between the host country and the conduit country. The insignificant coefficient in Column (5) may indicate that multinationals can avoid withholding taxes, for example, by using sophisticated conduit chains, or by benefiting from favorable tax treatment.

Table 1.4 summarizes the estimated selection effects (specifications refer to Columns (1) and (2) of Table 1.3). A test on the joint significance of the 9 selection terms confirms a bias for both samples. Selection can basically depend on the general economic environment, for example cyclical fluctuations, and how multinationals are able to cope with it. Note, though, that we do not have any well-defined expectations about the sign of the selection

[19] See Appendix B for the first-stage regression results and interpretation. Results are robust with respect to the inclusion of regime-identifying variables. However, all regressions in Table 1.3 use Specification (2) from Table 1.6 for identification.

variables. However, we estimate a significant positive effect for most years of the direct sample. This is, intuitively, what we would expect: a higher probability to invest directly implies less new investment (the selection term can be interpreted as the inverse probability to choose the direct regime). Yet the findings for the indirect sample are ambiguous.

Table 1.4: Sample Selection Bias

	Regime I		Regime II	
Selection 1997	.405*	(.249)	-1.17**	(.571)
Selection 1998	-.011	(.020)	-.030	(.055)
Selection 1999	-.001	(.019)	.005	(.042)
Selection 2000	.372*	(.209)	.410	(.550)
Selection 2001	-.085	(.130)	.227	(.165)
Selection 2002	.247*	(.133)	-.012	(.097)
Selection 2003	-.059*	(.032)	-.018	(.058)
Selection 2004	.145	(.096)	.236	(.194)
Selection 2005	.098	(.065)	.239**	(.117)
Wald-test (χ^2_9)	23.80		15.72	
p-value	.005		.073	
Observations	14,487		5,949	

Selection variables 1997 - 2005 ($\hat{\lambda}_t$) are obtained from first-stage estimates (see Appendix B, Table 1.6). Coefficients refer to Specifications (1) and (2) in Table 1.3. Standard errors (in parentheses) are robust for any form of heteroscedasticity and autocorrelation, and account for the two-step estimation (see Wooldridge, 1995). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level.

1.7 Sensitivity Analysis

Eventually, we test the robustness of the regression analysis. Table 1.5 presents estimations for both regimes. Columns (1) and (4) refer to 27 European Union (EU) member countries. Columns (2) and (5) refer to the EU 15. The reason for this sample restriction is that we possibly cannot capture relevant withholding tax rates, because conduit chains are complex and income is channeled through different conduit countries. Moreover, there is preferential tax treatment for some firms in many countries, with preferential treatment depending, for instance, on the legal form of the affiliate (see, e.g., Council of the European Union, 1999). If we restrict countries on the European Union, however, we can test the robustness of the findings, because the EU parent-subsidiary directive, the EU interest and royalties directive, and existing double-tax treaties often rule out withholding taxes. All results from above regressions are confirmed in Table 1.5. In a next step, we only analyze affiliates from the manufacturing sector (Columns (3) and (6)). Findings are also robust with respect to this sample restriction. Finally, Columns (7), (8), and (9) employ tax wedges, where the tax rate τ_C equals 10%, 20%, and 25%, for all observations. This changes the variation of the nonlinear tax term, and imposes a further restriction on the sample. Accordingly, all observations are removed if the host tax rate is above 10%, 20%, or 25% (the maximization problem in Section 1.3.3 requires that the host country tax rate is higher than taxation in the conduit country). All findings confirm the negative tax wedge effect, but the last specification is no longer significant.

Table 1.5: Sensitivity Analysis (Switching Regression)

	(EU 27)	(EU 15)	(Manufact.)	(EU 27)	(EU 15)	(Manufact.)	($\tau_C = 10\%$)	($\tau_C = 20\%$)	($\tau_C = 25\%$)
Tax Wedge (T_1)	-.513**	-.332	-.356*						
	(.210)	(.316)	(.207)						
Tax Wedge (T_2)				-.806*	-1.08**	-.788*			
				(.449)	(.489)	(.455)			
Tax Wedge (T^*_{2a})							-1.22**		
							(.620)		
Tax Wedge (T^*_{2b})								-1.25*	
								(.720)	
Tax Wedge (T^*_{2c})									-.939
									(.969)
log(Sales)	.026	.081**	-.001	.050*	.051	.033	.044	.038	.032
	(.021)	(.038)	(.020)	(.062)	(.078)	(.067)	(.055)	(.061)	(.066)
Loss carry-forward	-.034**	-.029	-.040**	-.039	-.051	-.066	-.059	-.067*	-.078*
	(.017)	(.025)	(.017)	(.032)	(.038)	(.043)	(.038)	(.040)	(.044)
log(GDP)	-.096	.212	-.172	.079	.018	.026	-.007	.066	.092
	(.149)	(.234)	(.135)	(.096)	(.126)	(.144)	(.152)	(.118)	(.120)
log(Labor Cost)	-.076	-.932***	-.014	-.225	-.365	-.151	-.236	-.416*	-.424**
	(.137)	(.254)	(.140)	(.190)	(.260)	(.174)	(.167)	(.221)	(.203)
log(Lending Rate)	.090***	.086	.100**	.095	.045	.087	.081	.115*	.111*
	(.033)	(.057)	(.030)	(.079)	(.116)	(.088)	(.085)	(.061)	(.062)
Present Value Depr.	-.186	-.545	-.060	.343	.790	.146	.047	.463	.598
	(.195)	(.538)	(.185)	(.727)	(.901)	(.948)	(1.02)	(.859)	(1.00)
Sample	1	2	3	1	2	3	4	5	6
Regime	I	I	I	II	II	II	II	II	II
Firms	2,884	1,681	2,887	1,288	1,037	1,387	1,627	1,544	1,449
Observations	12,716	6,750	12,454	4,841	3,796	5,137	5,949	5,554	5,030

Dependent variable is investment, defined as the logarithmic difference in the balance-sheet position fixed assets (ln(fixed assets$_t$) - ln(fixed assets$_{t-1}$)). Time dummies and linearized affiliate-level fixed effects are included but not reported. All estimations take into account the endogeneity of the regime choice. Standard errors (in parentheses) are robust for any form of heteroscedasticity and autocorrelation, and account for the two-step estimation (see Wooldridge, 1995). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. All reported results refer to Specification (2) of the probit equation (see Appendix B, Table 1.6). T_1 is defined according to Equation (1.4). T_2 follows (1.5). T^*_{2a} corresponds to (1.6), where τ_C corresponds to 10% for all observations. T^*_{2b} assumes $\tau_C = 20\%$, T^*_{2c} assumes $\tau_C = 25\%$ for all observations.

1.8 Conclusions

This paper has investigated the affiliate-level investment decision of German multinationals. A theoretical model yields different corporate tax effects, depending on whether the multinational follows a direct or an indirect investment strategy. Accordingly, we estimate a switching regression model with observed switching for two structurally different regimes. This approach allows us to control for the endogeneity of the regime choice. The empirical results confirm theoretical predictions: corporate tax effects are negative for direct investments, but positive for indirect observations. The tax-related cost of capital is confirmed to be negatively related to investment in both regimes. In particular, according to Specifications (3) and (4) of Table 1.3, we find a semi-elasticity of -.38 for direct and -.99 for indirect investments.

The empirical analysis supports the hypothesis that income can be transferred to the German parent without any tax deduction. This may be reasonable, given that many conditions promoting the double-dip structure are fulfilled. First, Germany is a high-tax country.[20] Second, Germany exempts dividend income almost completely. Third, the major conduit countries (see Section 1.2) are well-known conduit locations, often with preferential tax regimes.[21] Fourth, real conduit structures can be more complicated. Indeed, indirect structures often involve not only one conduit entity, but complex

[20]If Germany is not the high-tax country, the observation is removed in Section 1.6 and 1.7.

[21]Special tax regimes often apply to holding companies (e.g., in Belgium, the Netherlands, Switzerland, UK; see, e.g., Council of the European Union, 1999).

multi-country ownership chains (Weichenrieder and Mintz, 2008). This may open up more opportunities to avoid taxes.

One remarkable aspect of the findings is the implication for tax competition: the existence of conduit structures and low-tax conduit countries reduces the downward pressure on statutory tax rates. One may speculate whether this explains why some countries can stick to relatively high statutory tax rates. However, tax competition is a phenomenon which is not confined to one specific aspect. In fact, since national governments can use tax preferences as a strategic policy variable (see Bucovetsky and Haufler, 2008), tax competition for conduit entities may well be intensified.

Appendix A: Selection Correction for Panel Data Models under Conditional Mean Independence Assumption

Wooldridge (1995) suggests a flexible two-stage regression method to correct for sample selection bias in panel data models. We apply a similar estimation strategy on the above switching regression model, which allows us to perform robust statistical inference. Appendix A summarizes the main points of the estimator, with an emphasis on standard error correction. For details and consistency proofs, please consult the Wooldridge (1995) paper. The estimator allows for arbitrary correlation between the unobserved effects (γ_i, φ_i)

and observable explanatory variables.[22] Furthermore, the error distribution in the second-stage equation remains unspecified; the idiosyncratic errors can be arbitrarily serially dependent and can have any form of heterogeneity.

We proceed with a version of the above switching regression model, where we slightly change notations for simplicity and stick closer to Wooldridge (1995). We start the analysis by first estimating a probit model

$$P(R_{it} = 1|\mathbf{x}_i) = \Phi(\mathbf{x}_i\delta_t). \tag{1.8}$$

Equation (1.8) is estimated by standard probit techniques,[23] however for each time period t. Subsequently, we obtain estimates for the selection terms, $\hat{\lambda}_{1,i} = \phi(\mathbf{x}_i\hat{\delta}_t)/\Phi(\mathbf{x}_i\hat{\delta}_t)$ and $\hat{\lambda}_{2,i} = \phi(\mathbf{x}_i\hat{\delta}_t)/(1 - \Phi(\mathbf{x}_i\hat{\delta}_t))$, which are then included as control variables in the second-stage regressions (Maddala, 1983).

$$\text{Regime I:} \qquad y_{1,it} = \theta_1\hat{\mathbf{w}}_{1,it} + u_{1,it} \quad \text{iff } R = 1. \tag{1.9}$$

$$\text{Regime II:} \qquad y_{2,it} = \theta_2\hat{\mathbf{w}}_{2,it} + u_{2,it} \quad \text{iff } R = 0. \tag{1.10}$$

Here, $\hat{\mathbf{w}}$ is defined as $\hat{\mathbf{w}}_{R,it} = (1, x_{R,it}, \overline{x}_i, 0, ..., 0, \hat{\lambda}_{R,it}, 0, ..., 0)$, for $R = 1, 2$.[24] Note that we additionally include the estimated probability terms $\hat{\lambda}_R(R = 1, 2)$ from first-stage regressions and also firm-specific means to control for

[22] A significant part of the variation in the dependent variable is explained by unobserved heterogeneity between firms. This unobserved effect is likely to be correlated with other control variables. Hence, consistent coefficients require a fixed effects approach.

[23] $(\mathbf{x})$ is a vector of control variables, including all second-stage regressors and additional regime-identifying variables.

[24] The index R still denotes the Regime, but no longer refers to the binary variable.

unobserved heterogeneity.[25] Subsequently, we obtain the coefficient vector $\theta_R(R = 1, 2)$ from a pooled OLS regression:

$$\hat{\theta}_R \equiv (\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{\mathbf{w}}'_{R,it}\hat{\mathbf{w}}_{R,it})^{-1}(\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{\mathbf{w}}'_{R,it}\hat{y}_{R,it}), \quad R = 1, 2.$$

Finally, we have to account for the two-stage estimation procedure. We obtain Avar$(\hat{\theta})$ by first defining OLS residuals, $\hat{e}_{R,it} \equiv y_{it} - \hat{\mathbf{w}}_{it}\hat{\theta}$ for $R_{it} = 1, 2; i = 1, ..., N; t = 1, ..., T$. To estimate Avar$(\hat{\theta})$, we further define $\hat{\mathbf{D}}$:

$$\hat{\mathbf{D}}_R \equiv N^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T} \hat{\mathbf{w}}'_{R,it}\hat{\theta}'_R\mathbf{G}_{R,it} \text{ for R} = 1, 2, \tag{1.11}$$

$$\text{where } \mathbf{G} \text{ is} \quad \hat{\mathbf{G}}_{R,it} = \begin{pmatrix} \mathbf{0} & \mathbf{0} & \dots & \mathbf{0} & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \dots & \hat{\mathbf{Z}}_{R,it} & \mathbf{0} & \dots & \mathbf{0} \end{pmatrix}. \tag{1.12}$$

The matrix $\mathbf{Z_{it}}$ is $\mathbf{Z}_{it} = (0'0'...0'\ \hat{v}_{it}\mathbf{x}_i\ 0'...0')'$. $\hat{v}_{it}$ is the derivative of $\lambda(\cdot)$ evaluated at $\mathbf{x}_i\hat{\delta}_t$. For simplicity, we continue without the regime identifier R and estimate Avar$(\hat{\theta})$ for the respective regime. To obtain Avar$(\hat{\theta})$ as $\hat{\mathbf{A}}^{-1}\hat{\mathbf{B}}\hat{\mathbf{A}}^{-1}/N$, we further define

[25] Following Wooldridge (1995), we linearize the unobserved effects according to the Chamberlain (1980, 1982) method, who suggests to include all leads and lags of explanatory variables in order to model the relationship between the unobserved effect and the exogenous variables. To save degrees of freedom, however, we apply the Mundlak (1978) approach that imposes time-constant coefficients and include mean values of explanatory variables $(\overline{x}_i)$.

$$\hat{\mathbf{A}} \equiv N^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{\mathbf{w}}_{it}'\hat{\mathbf{w}}_{it}, \tag{1.13}$$

$$\hat{\mathbf{B}} = N^{-1}\sum_{i=1}^{N}\hat{\mathbf{p}}_i\hat{\mathbf{p}}_i', \tag{1.14}$$

$$\hat{\mathbf{p}}_i = \hat{\mathbf{q}}_i - \hat{\mathbf{D}}\hat{\mathbf{r}}_i, \;\; i = 1, ..., N, \tag{1.15}$$

$$\hat{\mathbf{q}}_i \equiv \sum_{t=1}^{T}\hat{\mathbf{w}}_{it}'\hat{e}_{it}, \;\; i = 1, ..., N, \tag{1.16}$$

$$\hat{\mathbf{D}} \equiv N^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{\mathbf{w}}_{it}'\hat{\theta}'\nabla_{\delta}\hat{\mathbf{x}}_{it}(\hat{\delta})', \tag{1.17}$$

where $\nabla_{\delta}\hat{\mathbf{x}}_{it}(\hat{\delta})'$ is the gradient of $\hat{\mathbf{x}}_{\mathbf{it}}(\hat{\delta})'$, evaluated at $\hat{\delta}$; $\hat{\mathbf{r}}_{it}$ is defined for each t as minus the inverse of the average estimated Hessian times the estimated score of the probit log-likelihood function for observation i, where we use the standard results for the first- and second derivatives for the probit model (e.g., Maddala, 1983). Finally, we estimate Avar$(\hat{\theta})$ as $\hat{\mathbf{A}}^{-1}\hat{\mathbf{B}}\hat{\mathbf{A}}^{-1}/N$ and obtain valid standard errors.

Appendix B: First-Stage Regression Results, Data Sources, Definitions, Sample Restrictions

The first-stage regression is concerned with the estimation of a probit model, where group-specific variables identify the respective regime (see Equation (1.7)). The results for pooled probit regressions are reported in Table 1.6.[26] We find that a higher balance-sheet total (BST_{jt}) of the whole company group is associated with a higher probability of establishing an indirect structure. All regression results in Tables 1.3 to 1.5, however, are reported according to Specification (2), where profitability (PRO_{jt}) is included as a second identifying variable.[27] The findings indicate that a higher profitability of the company group is associated with a higher propensity to invest indirectly.[28] Both effects may indicate that multinational enterprises need a certain level of size and sophistication to invest in an indirect structure. We may speculate whether only big and profitable companies have the required expertise to perform international tax planning. While the second-stage regressions consider affiliate-level variation, where we also control for affiliate-specific heterogeneity, balance-sheet total and profitability vary at the group level. Therefore, we argue that both the balance-sheet total and the profitability

[26]Note that the empirical model in Sections 1.6 and 1.7 follows Wooldridge (1995), who suggests to estimate probits for single years t to obtain $\hat{\lambda}$.

[27]Specification tests indicate that results are robust, irrespective of whether Specification (1) or (2) is used.

[28]Profitability is defined as total profits of the multinational (after taxes, prior to profit distribution, and offsetting of losses carried forward), relative to the balance-sheet total of the group.

on the multinational-group level are valid identifying variables. If we were considering variation between countries – we actually remove it by conditioning on affiliate-specific heterogeneity – we would also expect the local tax rate to be a crucial determinant of the regime choice. To sum up, the estimations suggest that, after conditioning on affiliate-specific heterogeneity, group-specific variables are the only relevant factors affecting the choice of the regime.

Table 1.6: Regime Identification

	(1)		(2)	
log(Balance-Sheet Total)	-.111***	(.019)	-.113***	(.019)
Profitability			-.006***	(.002)
Statutory Tax Rate	-.007	(.363)	-.009	(.363)
log(Sales)	.000	(.011)	-.000	(.011)
Loss carry-forward	.008	(.017)	.008	(.017)
log(GDP)	-.075	(.113)	-.072	(.113)
log(Labor Cost)	-.030	(.134)	-.032	(.134)
log(Lending Rate)	.002	(.034)	.002	(.034)
Present Value of Depr.	.065	(.296)	.062	(.296)
LogL.	-9,179		-9,179	
Observations	20,436		20,436	

Dependent variable is the binary indicator for direct/indirect (1/0) investment. Probit estimation including time-specific effects and linearized unobserved affiliate-specific effects. Robust standard errors (in parentheses). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. *Balance-sheet Total* is the annual aggregate at group level. *Profitability* is the profitability of the multinational group, defined as total profits of the multinational (after taxes, prior to profit distribution, and offsetting of losses carried forward), relative to the balance-sheet total of the company group.

Table 1.7: Data Sources, Definitions, and Sample Restrictions

Firm-level Data	*Source:* Microdatabase Direct Investment (MiDi). *Definition:* Investment is the logarithmic difference in the balance-sheet item fixed assets.
Corporate Tax Rates	*Source:* International Bureau of Fiscal Documentation (IBFD), Ernst&Young, PwC, and KPMG. *Definition:* Statutory Corporate Tax Rates.
Withholding Tax Rates	*Source:* Worldwide Corporate Tax Guide provided by Ernst&Young. Withholding tax rates refer to 2005. *Definition:* Withholding taxes on interest payments.
GDP	*Source:* World Bank World Development Indicators (2006). *Definition:* Gross domestic product in US$, nominal.
Labor Cost	*Source:* U.S. Bureau of Labor Statistics and Eurostat. *Definition:* Hourly compensation costs for production workers in manufacturing in US$.
Lending Rate	*Source:* IMF International Financial Statistics Yearbook (2006), augmented with corresponding OECD figures. *Definition:* Interest rate for credits to the private sector.
Present values of depreciation allowances	*Source:* Depreciation rules from above tax-data references *Definition:* Calculated for investments in machinery, discount rate 7.1 percent.
Sample Restrictions	According to the model, we drop all observations where the German statutory tax rate is below the foreign statutory tax rate, $\tau_G < \tau_F$. Tax rates account for the non-deductibility of interest expenses with respect to the German local business tax. Minority holdings and partnerships are excluded, as well as the following non-manufacturing sectors: education, health, veterinary and social care, financial services, holding companies, other services, recreational, cultural and sporting activities, retail and wholesale trade, real estate and renting, research and development, telecommunication and post, private households with employees activities of other membership organizations, nonprofit organizations serving households, general government, sewage and refuse disposal, compulsory social security, agriculture, hunting and forestry (see Lipponer, 2007). Note that restrictions do not apply on Figures 1.2 and 1.3.
Sensitivity Analysis	Table 1.5 refers to the following sample definitions: Sample 1 (2): only EU 27 (EU 15) member countries. Sample 3: only manufacturing industries. Sample 4: sets τ_C at 10% for all observations. The basic arbitrage condition then requires that host country tax rates are higher than 10%. Sample 5: sets τ_C at 20% for all observations. The basic arbitrage condition then requires that host country tax rates are higher than 20%. Sample 6: sets τ_C at 25% for all observations. The basic arbitrage condition then requires that host country tax rates are higher than 25%.

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Chapter 2

Corporate Tax Planning and Thin-Capitalization Rules – Evidence from a Quasi-Experiment

Abstract*

THIS PAPER INVESTIGATES tax-planning behavior by means of internal debt finance and the effectiveness of government countermeasures via thin-capitalization rules. A simple theoretical model which considers the financing decision of a multinational company is used to obtain empirical implications. The empirical analysis, based on German inbound investment data from 1996 to 2004, confirms the significant impact tax-rate differentials have on the use of internal debt. The effectiveness of the German thin-capitalization rule is tested by using legal amendments as natural experiments. The results suggest that thin-capitalization rules induce significantly lower internal borrowing. Hence, tax planning via internal finance is effectively limited by thin-capitalization rules.

2.1 Introduction

It is a well established fact, both from the theoretical and empirical points of view, that taxes play an important role in determining the capital structure of companies (e.g., Modigliani and Miller, 1958, 1963; Desai et al., 2004). To minimize the tax burden of the whole company group, a multinational enterprise in particular can choose its capital structure according to differences in international taxation. Borrowing from affiliates located in low-tax countries and lending to affiliates in high-tax countries will allow a deduction of interest payments from profits at high-tax locations and a reduction of the overall tax payments. Typically, to limit adverse tax revenue consequences, high-tax countries attempt to restrict the use of internal debt by

*This chapter is based on joint work with Michael Overesch. The corresponding paper "Corporate Tax Planning and Thin-Capitalization Rules – Evidence from a Quasi-Experiment" is forthcoming in *Applied Economics*.

imposing so-called thin-capitalization or earning stripping rules. In recent years, increased attention has been given to multinationals' profit shifting via internal loans. For example, the number of EU member countries that rely on some form of debt-to-equity restriction has increased from 8 in 1996 to 17 in 2005. From a theoretical perspective, these rules are suitable for limiting profit shifting (e.g., Fuest and Hemmelgarn, 2005; Panteghini, 2006). Yet empirical evidence as to whether governments have been successful is still rare. Indeed, this is crucial for policymakers who want to defend tax revenues against cross-country tax planning on the part of multinationals. However, effective thin-capitalization rules possibly imply less financial flexibility for some firms and adversely affect investment. In order to evaluate this trade-off, it is important to find out more about the impact of thin-capitalization rules on financial decisions and about the associated tax-revenue effects.

In providing evidence on the tax sensitivity of companies' capital structure choices, previous empirical studies have usually not taken into account thin-capitalization rules. For a sample of US controlled affiliates, Desai et al. (2004) show that higher local tax rates are associated with higher debt-to-asset ratios. Their analysis points out that internal borrowing, in particular, reacts sensitively to taxation. This result is confirmed by Buettner et al. (2006) and by Mintz and Weichenrieder (2005) for German multinationals. So far, evidence for the effects of thin-capitalization rules on companies' decisions has only been provided by Buettner et al. (2008). They find that thin-capitalization rules effectively restrict debt finance but also affect investment of German multinationals.

The question we address in this paper is whether thin-capitalization rules effectively restrict the tax-planning behavior of multinationals. For the empirical analysis, we use German inbound investment data. We expect German multinationals to engage in tax-planning activities, because hardly any other country has higher statutory corporate tax rates than Germany. We exploit legal amendments made to the German thin-capitalization rule in 2001 and 2004, where only some legal forms were treated. This quasi-experimental setting enables us to use a difference-in-differences approach to identify whether thin-capitalization rules are successfully imposed. The empirical results suggest that both tax-rate differentials and thin-capitalization rules are crucial for multinationals' capital structures. In particular, our findings indicate that some companies, which were affected by a stricter thin-capitalization rule, subsequently adjusted their capital structure. Hence, governments in high-tax countries are, to some extent, able to restrict multinationals' profit shifting.

The paper is structured as follows. We begin with some institutional details about the German thin-capitalization rule. Thereafter, we set up a theoretical model which considers the financing decision of a multinational and takes into account a thin-capitalization rule. In Sections 2.4 and 2.5, we present the empirical investigation approach and the data. The empirical results are presented in Section 2.6. Section 2.7 briefly concludes.

2.2 Some Institutional Details

The high level of German company taxation and also the comparatively low corporate tax revenues are well documented (European Communities, 2005). Firms are burdened with a very high statutory tax rate comprising a corporate income tax and, additionally, a local trade income tax. It is reasonable to assume that a multinational company allocates internal debt optimally with respect to differences in international taxation. Thereby, taxable profits are reduced by means of interest deduction. As a result, jurisdictions lose corporate tax revenue and consequently try to defend their tax base by imposing some form of restriction, for example, thin-capitalization rules. These rules, such as Section 8(a) of the German corporate income tax law (KStG), typically limit interest deduction up to a fixed relation between equity and internal debt, i.e. the interest paid for an excess leverage cannot be deducted from the tax base.

The German thin-capitalization rule only applies to foreign affiliates that are incorporated.[1] First-tier foreign partnerships are not affected by the restriction and constitute a suitable non-treatment group when looking at legal amendments of this rule as natural experiments. The rule classifies two different types of incorporated companies. The first group of companies comprises ordinary corporations, which are not classified as holdings. For the purposes of this law, a holding is defined as a firm where more than 75% of

[1]One exemption would be the German rule introduced in 2004, which applies to cases in which a second-tier partnership is held by incorporated foreign affiliates. We do not consider these cases in our analysis.

total assets consist of shares in other corporations. For ordinary corporations, the allowed internal-debt-to-equity ratio, called safe haven, was accepted at 3:1 before 2001. Yet the safe haven internal-debt-to-equity ratio was 9:1 in the case of a holding corporation, and therefore, holdings could still be used as loopholes. In 2001 and 2004, two important amendments of the German thin-capitalization rule were introduced. In 2001, the allowed internal-debt-to-equity ratios were significantly reduced to 1.5:1 in the case of an ordinary corporation and to 3:1 in the case of a holding corporation. Nevertheless, a possible loophole in terms of holding corporations remained. In 2004, this special rule for holding corporations was also abolished, and the safe haven was generally constituted at 1.5:1 for every corporation. However, first-tier partnerships were not affected by these amendments.

To illustrate the change in the thin-capitalization rule, let us consider the following example. A German holding corporation has used internal debt as a source of finance, with an internal-debt-to-equity ratio of 4:1 in 2000. This corporation was allowed to deduct interest payments without restriction. Following the 2001 tax reform, the accepted ratio was reduced to 3:1. As a consequence, the corporation was no longer able to deduct interest payments for 5 percentage points of its debt-to-equity share. Nevertheless, the corporation was not prohibited from maintaining its internal-debt-to-equity ratio. It is important to bear in mind, however, that not every corporation (irrespective of its legal form) is affected by a stricter thin-capitalization rule. It is highly possible that many firms fall below the accepted internal-debt-to-equity relation anyway. We will come back to this point in Section 2.6, discussing the implications for the estimated coefficients.

2.3 A Model

We explain the impact of company taxation on the choice of debt or equity as a subsidiary's source of finance by the following simple model. We consider a firm with two separate entities, of which the parent company is denoted by 1 and the subsidiary by 2. If the parent company and the subsidiary are completely financed with equity, profits are determined by

$$\pi = f(k_1)(1 - t_1) + f(k_2)(1 - t_2) - r(k_1 + k_2).$$

k_1 and k_2 denote invested capital, $f(k_j)$ output at location j, t_1 and t_2 the statutory tax rates at the respective locations. The opportunity costs of own capital are $r(k_1 + k_2)$. Note that an exemption system of repatriated foreign profits is assumed.[2] The parent company can decide on the type of capital that is used to finance the subsidiary. Instead of equity, the parent company can provide capital by means of an internal loan. We denote the share of capital that is financed by such an internal loan as μ_2 and the internal interest rate as i_2. Interest payments $i_2\mu_2$ can be deducted for tax purposes by the borrowing subsidiary 2. Simultaneously, interest payments are taxed at the lending company. The tax consequences of an internal credit are then $i_2\mu_2k_2(t_2^i - t_1)$, where t_2^i is the tax rate avoided because of interest deduction. This tax rate can differ from the statutory company tax rate if interest payments are not fully deductible from corporate income. For

[2]This is true for most European countries and Canada. The effect of a credit system equals an exemption system if $t_2 > t_1$. Otherwise, the affiliate's tax rate increases to t_1, depending on the time of retention. Yet the general incentives remain if foreign profits are not distributed immediately.

instance, in Germany only half of all interest payments can be deducted for local income tax purposes, and thus, $t_2^i < t_2$.

Moreover, we assume that internal loans are associated with additional costs, for example agency costs, because of asymmetric information (Jensen and Meckling, 1976; Myers, 1977). Furthermore, there are non-tax reasons to use internal debt such as short-term cash management between parent and affiliate or the opportunity to control the local management through fixed annual interest payments (Jensen, 1986). We consider cost and utility of internal debt and introduce a convex cost function $c_2(\mu_2)$,[3] as well as a concave utility function $g_2(\mu_2)$.[4] Subsequently, the profit function of the firm can be described as

$$\begin{aligned} \pi &= f(k_1)(1-t_1) + f(k_2)(1-t_2) - r(k_1+k_2) \\ &+ [i_2\mu_2(t_2^i - t_1) - c_2(\mu_2) + g_2(\mu_2)]k_2. \end{aligned} \tag{2.1}$$

Obviously, the transition of equity into internal debt implies a direct profit shift from the borrowing affiliate 2 to the lending parent company 1 if the tax rate of the borrowing affiliate is higher than the tax rate of the lender. The tax-rate differential between both locations creates incentives to use equity refinanced internal debt as a source of finance. This implies that profits are shifted to the lending affiliate. Jurisdictions attempt to counteract these activities by imposing restrictions, for example thin-capitalization rules, which typically limit interest deduction. Consequently, interest paid for an

[3] $dc_2/d\mu_2 > 0,\ d^2c_2/d\mu_2^2 > 0.$

[4] $dg_2/d\mu_2 > 0,\ d^2g_2/d\mu_2^2 < 0.$

excess leverage cannot be deducted from the tax base if μ_j is above a certain fixed $\overline{\mu}_j$. We now assume that country 2 introduces such a rule, denoted by φ_2, where $\varphi_2 = 1$ if the rule is effectively binding and 0 otherwise. Whether the rule is binding for an affiliate depends on the difference between the actual internal-debt ratio and the maximum accepted, i.e. whether a company is above the threshold level or not, and how the type of internal debt is classified for tax purposes. Note that φ_2 is always 0 if $\mu_2 < \overline{\mu}_2$. We extend the profit function by the additional tax payments arising from excess leverage above the thin-capitalization rule limit:

$$-i_2(\mu_2 - \overline{\mu}_2)t_2^i\varphi_2 k_2.$$

The profit function becomes

$$\begin{aligned} \pi &= f(k_1)(1-t_1) + f(k_2)(1-t_2) - r(k_1+k_2) \\ &+ [i_2\mu_2(t_2^i - t_1) - i_2(\mu_2 - \overline{\mu}_2)t_2^i\varphi_2 - c_2(\mu_2) + g_2(\mu_2)]k_2. \end{aligned} \tag{2.2}$$

The optimal share of internal debt of subsidiary 2 financed by parent equity is obtained by the following first-order condition

$$i_2(t_2^i - t_1 - t_2^i\varphi_2) + g_{2,\mu}(\mu_2) - c_{2,\mu}(\mu_2) \stackrel{!}{=} 0. \tag{2.3}$$

First, we consider the case without application of a thin-capitalization rule. Accordingly, the share of internal debt is determined by the tax-rate difference between the borrowing affiliate and the parent company $(t_2^i - t_1)$. The internal lending rate can be used to leverage the tax effect. Yet the interest

rate is not likely to constitute an important degree of freedom, as the arm's length principle easily applies.

Secondly, we consider cases where the thin-capitalization rule is applied. If φ_2 becomes 1, any tax incentive to use internal debt is effectively stopped. In this case, only the tax-rate level at the location of the lending parent has an impact. Additionally, internal debt used for non-tax reasons becomes more expensive, because internal interest payments are taxed twice. Assuming a binding case, this is an incentive to reduce μ_2 in order to avoid enforcement of the thin-capitalization rule.

We can derive comparative static properties by differentiating the first-order condition:

$$- \quad i_2 dt_1 + [i_2 - i_2\varphi_2]dt_2^i + [t_2^i - t_1 - t_2^i\varphi_2]di_2 = [c_{2,\mu\mu}(\mu_2) - g_{2,\mu\mu}(\mu_2)]d\mu_2.$$

First, let us consider the effect of an increasing tax rate at the lending company's location on the share of internal debt used by its affiliate.[5] The derivative equals

$$\frac{d\mu_2}{dt_1} = \frac{-i_2}{c_{2,\mu\mu}(\mu_2) - g_{2,\mu\mu}(\mu_2)} < 0. \tag{2.4}$$

This expression is always negative: internal debt used by an affiliate decreases with an increasing tax rate at the parent's location. With regard to the

[5]We assume a zero marginal tax-rate effect on the internal interest rate i_2. This is a reasonable assumption, because the arm's length principle is easily applied to interest rates.

marginal effect of an increasing tax rate at the affiliate's location we obtain

$$\frac{d\mu_2}{dt_2^i} = \frac{i_2 - i_2\varphi_2}{c_{2,\mu\mu}(\mu_2) - g_{2,\mu\mu}(\mu_2)} \geq 0. \tag{2.5}$$

This expression is positive when the thin-capitalization rule is not enforced ($\varphi = 0$). Otherwise, if the share of internal debt is above the limits ($\varphi = 1$), a tax rate increase has no effect on the optimal share of internal debt. This can be explained by the fact that interest payments for the excessive debt cannot be deducted for tax purposes. Higher internal borrowing must be due to non-tax reasons, e.g. short-term cash management. Accordingly, a tax-rate variation does not matter for the optimal μ_2 in this case. To sum up, the following proposition can be set up:

Proposition 1: *The optimal share of internal debt should increase with an increasing tax rate at the subsidiary's location and decrease with an increasing tax rate at the parent's location. Hence, if the share of internal debt is tax driven, it should increase with an increasing tax-rate difference* ($t_2^i - t_1$).

Finally, let us consider a reform of the thin-capitalization rule. Germany significantly reduced the safe haven in 2001 and 2004, respectively. We exploit these reforms to obtain exogenous variation in one crucial explanatory variable. Given any distribution of μ, a stricter thin-capitalization rule is associated with more companies above the lower threshold level. A reduction of $\overline{\mu}_2$ increases the number of cases for which φ_2 becomes one because the rule is binding and enforced. Equation (2.3) implies that tax incentives to use internal debt decrease. In this case, the firm reduces its debt share below

the new threshold level and prefers equity as the marginal source of finance. Proposition 2 follows:

Proposition 2: *If internal debt is a channel for shifting taxable profits, and thin-capitalization rules can limit tax-planning behavior, a reduction of the allowed debt-to-equity ratio implies smaller shares of internal borrowing. Non-incorporated companies, which are not treated by the German thin-capitalization rule and its amendments, do not reduce their share of internal debt.*

2.4 Empirical Implications

We test the above propositions empirically by using German inbound FDI data. A simple estimation approach to test Proposition 1 could be a regression of the internal-debt ratio ID of an investment in country G (Germany) taken by firm k located in country j in period t on the tax-rate differential $(STR_{G,t} - STR_{j,t})$ and on some company-specific characteristics $x_{k,j,t}$. A simple regression equation would be

$$ID_{k,j,t} = a_0 + a_1(STR_{G,t} - STR_{j,t}) + a_2 x_{k,j,t} + a_k + a_t + \epsilon^{ID}_{k,j,t}, \qquad (2.6)$$

where a_k is a company-specific effect to control for heterogeneity between company groups. Furthermore, we control for German capital market constraints or aggregate shocks by a time-specific effect a_t. Note that we are

able to identify tax-rate effects because of cross-country and time variation in $STR_{j,t}$. Following Proposition 1, we expect a positive sign of the tax differential coefficient a_1 on ID. For internal debt, which is refinanced by equity, the local interest rate at the lending parent location should be irrelevant. Only the German lending rate could be of importance, as it is used as the arm's length benchmark by the German tax authority. We implicitly control for the German lending rate by time effects a_t, because every inbound investor faces the same lending rate. The two reforms in 2001 and 2004 constitute exogenous sources of variation, unambiguously affecting the average value of our dependent variable for some groups. We can therefore test Proposition 2 by using a difference-in-differences approach (see, e.g., Meyer, 1995).

Different amendments of the German thin-capitalization rule have constituted three groups with different degrees of treatment. We use a dummy variable D_{TGROUP} to denote the respective treatment group, i.e. the corporations which were treated by a specific amendment of the thin-capitalization rule in 2001 or 2004. Additionally, we use a dummy variable D_{post} to indicate the post-amendment observations from 2001 to 2004. Thus, an estimation equation for the 2001 reform effect can be described as

$$\begin{aligned} ID_{k,j,t} &= b_0 + b_1(STR_{G,t} - STR_{j,t}) + b_2 x_{k,j,t} \\ &+ b_3 D_{TGROUP} + b_4 D_{DTGROUP} D_{post} \\ &+ b_k + b_t + \epsilon^{ID}_{k,j,t}. \end{aligned} \tag{2.7}$$

The treatment group consists of both ordinary corporations and holding corporations. It is important to bear in mind that partnerships were not

treated by the German thin-capitalization rule and constitute a suitable non-treatment group of the reform in 2001. Group-independent time trends are absorbed by b_t. Therefore, we implicitly control for yearly variations in German tax rates. The treatment effect is measured by b_4, where we expect a negative sign. Furthermore, for the 2004 reform effect, we propose the following equation

$$\begin{aligned} ID_{k,j,t} &= c_0 + c_1(STR_{G,t} - STR_{j,t}) + c_2 x_{k,j,t} \\ &+ c_3 D_{TGROUP} + c_4 D_{DTGROUP} D_{2004} \\ &+ c_k + c_t + \epsilon^{ID}_{k,j,t}, \end{aligned} \tag{2.8}$$

where only holding corporations were treated by the reform of the thin-capitalization rule. Therefore, all other companies, incorporated and non-incorporated, constitute the non-treatment group. We also expect a negative sign of the treatment effect c_4.

To sum up, the legal reforms enable us to test whether a thin-capitalization rule is effectively imposed. The tax reform of 2001 only hit ordinary incorporated firms as well as holding companies. Partnerships, however, were not affected. In 2004, only holding corporations were affected. We argue that groups are comparable, because we observe only affiliates of multinationals. In other words, we look at firms which have the same opportunities with respect to internal finance, for example. Furthermore, we control for differences across single investments, for instance, by using the affiliate-specific sales as a control variable. We additionally assume that there are no systematic changes in within- and between-group compositions. In fact, the group

sizes are almost stable over time. To identify the effect on the treated companies, a further critical assumption is that all groups are equally affected by aggregate shocks.

2.5 Data and Descriptive Statistics

The empirical analysis uses the MiDi database for multinationals provided by the Deutsche Bundesbank. This is a comprehensive annual micro database of investment positions of German enterprises held abroad as well as of investment positions held in Germany by foreign companies. The data provide information about the investment object's balance sheet, including further information on the type of investment and on the investor. A favorable characteristic of the data is that it provides the possibility of tracing observations of individual firms over time. The current version provides affiliate-level panel data for the period 1996 to 2004. The collection of the data is enforced by German law, which sets reporting obligations for certain international transactions and positions.[6]

The database comprises direct and indirect FDI positions above a certain threshold level. Given that the model deals with a simple two-tier com-

[6]Sec. 26 Außenwirtschaftsgesetz (Trade and Payments Act) in connection with Außenwirtschaftsverordnung (Foreign Trade and Payments Regulation). Since 2002, FDI has to be reported if the participation is 10% or more and the balance-sheet total of the foreign investment in Germany is above 3 million Euro. For details, see Lipponer (2006). Though previous years showed lower thresholds, we apply this level uniformly for all years in the panel.

pany structure, indirectly held investments are excluded. Moreover, we only keep observations with a nonzero internal-debt ratio. Table 2.1 displays the number of observations in our sample, the country-specific mean values of the share of non-German internal debt, the average country-specific tax-rate differentials, and the average number of investment objects. Investors are mainly from Germany's neighboring countries, e.g., from Switzerland, the Netherlands, or from France. Of course, investors from other big economies such as Japan or the USA are also strongly represented. According to the model, we define the dependent variable ID as internal debt borrowed from the foreign parent company relative to total capital. To control for company-specific variation in the accession to external debt, we employ the affiliate's sales as an indicator for size and cash flow in our regression analysis (see, e.g., Panno, 2003). We expect a negative effect of higher sales when external and internal debt serve as substitutes (see Buettner et al., 2006). As agency costs and the utility of internal debt may also vary across industries, we control for further heterogeneity by including dummies for 56 industries at the level of the affiliate.

The statutory tax-rate differential constitutes the relevant measure for investigating the tax impact on the use of internal debt. The variable STR_G contains German statutory profit tax rates;[7] foreign statutory tax rates are denoted by STR_F. We use these two tax measures to construct bilateral tax-rate differences. Since the effective tax reduction from using debt

[7]Our measure takes into account that only half of all interest payments can be deducted from the tax base of the German trade income tax. Furthermore, we consider the national average of the local trade income tax.

Table 2.1: German Inbound FDI (1996 – 2004)

Home Country	Number of Observations	Internal Debt Ratio	Tax Rate Difference	Number of Investments
Australia	33	.358	.021	4
Austria	1,245	.240	.019	139
Belgium	564	.284	-.033	64
Canada	162	.280	-.063	19
Cyprus	21	.215	.130	3
Czech Republic	40	.340	.019	5
Denmark	745	.284	.040	83
Finland	189	.345	.077	22
France	1,988	.249	-.014	223
Great Britain	1,276	.270	.051	144
Greece	a)	a)	a)	a)
Hungary	39	.367	.158	5
Iceland	a)	a)	a)	a)
Ireland	63	.488	.251	8
Italy	905	.281	-.069	101
Japan	2,257	.339	-.100	252
Korea (South)	165	.393	.056	21
Lithuania	a)	a)	a)	a)
Luxembourg	388	.235	.001	44
Mexico	12	.138	.014	a)
Netherlands	2,429	.281	.010	273
Norway	177	.279	.078	21
Poland	30	.212	.042	3
Portugal	25	.281	.038	3
Slovakia	a)	a)	a)	a)
Slovenia	75	.221	.109	9
Spain	300	.211	-.043	35
Sweden	565	.249	.076	64
Switzerland	2,725	.276	.112	306
Turkey	51	.316	-.013	6
USA	2,880	.280	-.051	330
Total	*19,379*	*.280*	*.003*	*2,195*

Source: MiDi. The table shows the per-country apportionment of parent companies for German inward FDI from 1996 until 2004. Internal-debt ratios are country-specific mean values, determined by the level of balance-sheet liabilities divided by total capital. The table also shows average statutory tax-rate differences between Germany and respective foreign locations, as well as the yearly average number of investments.
a) Not reported due to data protection (because the number of observations is too small).

might be zero if a subsidiary carries forward any losses for tax purposes (MacKie-Mason, 1990; Francois, 2006), we include a dummy variable indicating whether some loss carry-forward is reported. Of course, the existence of losses in the previous periods may capture other characteristics of the current decision problem of the company such as the expected performance of an affiliate. Thus, the overall effect on internal leverage is ambiguous. Table 2.2 displays basic information about the regression variables.

Table 2.2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
ID (share of internal debt from foreign parent company)	.280	.262	.001	.992
STR_G - STR_F (tax-rate difference)	.003	.072	-.152	.281
STR_F (foreign tax rate)	.354	.071	.100	.532
Loss carry-forward (binary variable)	.431	.495	0	1
Sales (sales in €1,000)	65,088	247,678	1,000	11,000,000

Source: MiDi. Observations: 19,379. Minimum and maximum values are averages of the 3 smallest (highest) values, reported as average values for confidentiality reasons.

2.6 Empirical Results

The empirical analysis involves panel data regressions that include company fixed effects. Thereby, we generally control for all time-constant heterogeneity between company groups. First of all, it is worth mentioning that all regressions show the expected tax rate effect. Specification (2) in Table 2.3 indicates, for example, that a 10 percentage point increase in the tax-rate

differential between Germany and any other country is associated with a 1.9 percentage point higher internal-debt ratio. The magnitude of the tax effect is in line with earlier findings (see, e.g., Desai et al., 2004, or Buettner et al., 2006). With regard to the effect of the German thin-capitalization reform in 2001, we control for systematic differences in the control and treatment group by introducing a treatment-group dummy variable D_{TGROUP}. First, we do not distinguish between different treatment groups in Specifications (3)-(5) of Table 2.3. While we interact the treatment group with a post-reform dummy D_{post} for the whole period of 2001 until 2004 in Column (3), we control for each single year in Columns (4) and (5). In Column (3), we observe that the treated group (holdings and incorporated firms) responds to the tighter thin-capitalization rule, and internal debt is reduced in the post-reform period. Columns (4) and (5) show that the reform was by no means anticipated. Rather, it took the companies 1 year to reduce their internal-debt ratios. This is possibly the result of a restructuring process which started in 2001.

A company is only affected if the thin-capitalization rule is binding (the firm's internal-debt-to-equity ratio is above the maximally accepted ratio). In this case, the tax-planning firm should re-optimize its capital structure after the reform if the construction so far has been optimal. Nevertheless, given the continuum of internal-debt-to-equity ratios, not all corporations are affected. Consequently, the treatment effect would be much stronger if all treated corporations were noticeably affected. In Table 2.4, we split the sample into different treatment groups. As already mentioned, we have two treatment groups for the 2001 reform (holdings and ordinary incorporated

Table 2.3: Thin-Capitalization Reform in 2001 (I)

	(1)	(2)	(3)	(4)	(5)
$STR_G - STR_F$	.188**	.192**	.206**	.207***	.214***
	(.088)	(.088)	(.087)	(.087)	(.088)
D_{TGROUP}			.001	.002	.018
			(.019)	(.019)	(.020)
$D_{TGROUP} \times D_{POST}$			-.025**		
			(.010)		
$D_{TGROUP} \times 1997$					-.006
					(.018)
$D_{TGROUP} \times 1998$					-.016
					(.019)
$D_{TGROUP} \times 1999$					-.025
					(.017)
$D_{TGROUP} \times 2000$					-.024
					(.018)
$D_{TGROUP} \times 2001$				-.004	-.021
				(.012)	(.020)
$D_{TGROUP} \times 2002$				-.036**	-.052**
				(.015)	(.023)
$D_{TGROUP} \times 2003$				-.032**	-.049**
				(.011)	(.020)
$D_{TGROUP} \times 2004$				-.038**	-.054**
				(.016)	(.023)
1997	-.003	-.003	-.003	-.003	.003
	(.005)	(.005)	(.005)	(.005)	(.017)
1998	-.002	-.002	-.002	-.002	.013
	(.006)	(.006)	(.006)	(.006)	(.017)
1999	-.001	-.001	-.002	-.002	.022
	(.005)	(.005)	(.005)	(.005)	(.016)
2000	-.000	-.000	-.000	-.000	.022
	(.006)	(.006)	(.006)	(.006)	(.017)
2001	.002	.002	.025***	.006	.022
	(.005)	(.005)	(.011)	(.012)	(.019)
2002	-.011	-.010	.013	.023	.038
	(.006)	(.007)	(.011)	(.015)	(.021)
2003	-.024***	-.024***	-.001	.006	.020
	(.006)	(.006)	(.010)	(.011)	(.018)
2004	-.022***	-.022***	.001	.013	.028
	(.007)	(.007)	(.007)	(.016)	(.021)
ln(Sales)	-.016***	-.015***	-.015***	-.015***	-.015***
	(.004)	(.004)	(.004)	(.004)	(.004)
Loss carry-forward		.009	.009	.009	.009
		(.005)	(.005)	(.005)	(.005)
Observations	19,379	19,379	19,379	19,379	19,379
Adj. R^2	.711	.711	.711	.711	.711

Source: MiDi. The dependent variable is the share of internal loans borrowed from the foreign parent company. Robust and clustered (country/year clusters) standard errors are in parentheses. Two stars denote significance at 5% and three stars at the 1% level. All estimates include a full set of 5,257 company and 56 industry fixed effects.

Table 2.4: Thin-Capitalization Reform in 2001 (II)

	(1)	(2)	(3)	(4)	(5)	(6)
$STR_G - STR_F$	.201**	.216**	.224**	.783***	.750***	.737***
	(.089)	(.088)	(.090)	(.287)	(.288)	(.294)
D_{TGROUP}		.003	.019		.019	.100
		(.019)	(.020)		(.074)	(.084)
$D_{TGROUP} \times D_{POST}$		-.025**			-.101***	
		(.010)			(.018)	
$D_{TGROUP} \times 1997$			-.006			-.044
			(.018)			(.028)
$D_{TGROUP} \times 1998$			-.017			-.017
			(.019)			(.035)
$D_{TGROUP} \times 1999$			-.026			-.036
			(.017)			(.032)
$D_{TGROUP} \times 2000$			-.024			-.085**
			(.018)			(.034)
$D_{TGROUP} \times 2001$			-.020			-.125**
			(.020)			(.038)
$D_{TGROUP} \times 2002$			-.053**			-.151**
			(.023)			(.041)
$D_{TGROUP} \times 2003$			-.050**			-.193**
			(.020)			(.042)
$D_{TGROUP} \times 2004$			-.052**			-.221**
			(.023)			(.046)
1997	-.002	-.002	.003	-.006	-.006	.003
	(.006)	(.006)	(.017)	(.014)	(.015)	(.019)
1998	-.002	-.002	.013	.007	.006	.009
	(.006)	(.006)	(.017)	(.013)	(.014)	(.018)
1999	-.002	-.002	.022	.019	.015	.020
	(.005)	(.005)	(.016)	(.013)	(.014)	(.018)
2000	-.000	-.000	.022	.008	.000	.016
	(.006)	(.006)	(.017)	(.015)	(.015)	(.019)
2001	.003	.026**	.022	.026	.040	.040
	(.006)	(.011)	(.019)	(.020)	(.020)	(.023)
2002	-.010	.013	.039	.034	.046**	.051**
	(.007)	(.011)	(.021)	(.020)	(.021)	(.024)
2003	-.024***	-.002	.021	.006	.018	.031
	(.006)	(.011)	(.018)	(.017)	(.018)	(.021)
2004	.019***	.003	.028	.018	.029***	.048
	(.007)	(.012)	(.021)	(.020)	(.020)	(.025)
ln(Sales)	-.014***	-.014***	-.014***	-.019***	-.017**	-.018**
	(.004)	(.004)	(.004)	(.007)	(.007)	(.007)
Loss carry-forward	.009	.009	.009	-.011	-.013	-.014
	(.006)	(.005)	(.005)	(.015)	(.014)	(.014)
Observations	18,787	18,787	18,787	2,196	2,196	2,196
Adj. R^2	.714	.714	.714	.806	.810	.811

Source: MiDi. The dependent variable is the share of internal loans borrowed from the foreign parent company. Specifications (1) - (3) are based on a sample of ordinary corporations and partnerships. Specifications (4) - (6) are based on a sample which consists of holding corporations and partnerships. Robust and clustered (country/year clusters) standard errors are in parentheses. Two stars denote significance at 5% and three stars at the 1% level. All estimates include a full set of 5,105/738 company and 56 industry fixed effects.

Table 2.5: Thin-Capitalization Reform in 2004

	(1)	(2)	(3)	(4)
$STR_G - STR_F$	.192**	.193**	.406**	.410**
	(.088)	(.088)	(.201)	(.200)
D_{TGROUP}		.050**		.026
		(.020)		(.024)
$D_{TGROUP} \times D_{2004}$		-.068**		-.042**
		(.021)		(.019)
1997	-.003	-.003		
	(.005)	(.005)		
1998	-.002	-.002		
	(.006)	(.006)		
1999	-.001	-.001		
	(.005)	(.005)		
2000	-.000	-.000		
	(.006)	(.006)		
2001	.002	.002		
	(.005)	(.006)		
2002	-.010	-.011	-.014***	-.014***
	(.007)	(.007)	(.004)	(.004)
2003	-.024***	-.024***	-.034***	-.035***
	(.006)	(.006)	(.005)	(.005)
2004	-.022***	-.020***	-.029***	-.028***
	(.007)	(.007)	(.005)	(.005)
ln(Sales)	-.015***	-.015***	-.009	-.009
	(.004)	(.004)	(.007)	(.007)
Loss carry-forward	.009	.009	.026**	.026**
	(.005)	(.005)	(.010)	(.010)
Observations	19,379	19,379	7,980	7,980
Adj. R^2	.711	.712	.773	.773

Source: MiDi. The dependent variable is the share of internal loans borrowed from the foreign parent company. Specifications (1) - (2) are based on the whole sample, (3) and (4) are based on a sample in which only observations from 2001 until 2004 are considered. Robust and clustered (country/year clusters) standard errors are in parentheses. Two stars denote significance at 5% and three stars at the 1% level. All estimates include a full set of 5,257/3,196 company and 56 industry fixed effects.

companies). The results are generally comparable, apart from the fact that the number of observations is reduced.[8] Specifications (1) to (3) consider ordinary corporations as the treatment group and partnerships as the control group. Specifications (4) to (6) investigate the tax effects on internal debt of holding corporations (partnerships again constitute the control group). One major insight from Table 2.4 is that holdings adapt their capital structure much faster than ordinary incorporated companies. The restructuring process is possibly easier, and therefore faster for some reason. Moreover, the threshold level was reduced more severely for holding corporations. Another reason might be the potential role of holding corporations as special tax-planning entities. The magnitude of the treatment effect can be interpreted as follows. For holding corporations, the 2001 thin-capitalization reform induced a decline in the share of internal debt borrowed from the foreign parent company of about 10 percentage points. This equals a reduction of approx. one-third, considering a pre-reform mean of 31.7% internal debt to total capital.

Finally, we focus on the effect of the German thin-capitalization reform in 2004. This reform applied to holding corporations only. The control group consists of all other legal forms. The results in Table 2.5 show once more that some companies restructure, basically those which were affected by the stricter rule, and reduce their share of internal debt. Specifications (1) and (2) are based on observations from 1996 to 2004. Regressions in Columns (3) and (4) are only based on observations from 2001 to 2004, in order to

[8]Note that the group sizes are relatively constant for the 9 years in the sample.

avoid confounding effects of the first thin-capitalization reform in 2001. The magnitude of the 2004 reform effect is much lower compared to the 2001 reform. Here, the share of internal debt is reduced by approx. 4.2 percentage points. This equals a reduction of about one-sixth, given the pre-reform level of 26% internal debt to total capital.

2.7 Conclusions and Implications

We find that international tax-rate differentials play an important role in determining the share of internal lending to German affiliates. This confirms earlier results provided by other studies. The important insight provided by our empirical analysis is that German thin-capitalization rules are effectively imposed. A reduction of the allowed debt-to-equity ratios, enforced by reforms in 2001 and 2004, respectively, induced significantly smaller shares of internal debt from incorporated companies.

Finally, we focus on revenue effects. Although we cannot estimate how much revenue Germany would lose in the absence of a thin-capitalization rule, rough estimations of the reform effects can be provided. First of all, we consider Specifications (3) and (6) from Table 2.4. In 2002, the 2001 reform is associated with lower internal-debt-to-capital ratios of approx. 0.053 for ordinary corporations and approx. 0.151 for holding corporations. Given the respective mean values, Germany was able to retain additional tax revenue averaging €71,700 per ordinary corporation and €1,807,000 per holding cor-

poration in additional tax revenue by tightening the thin-capitalization rule.[9] Considering the number of treated corporations, we estimate an amount of approx. €260 million in additional tax revenue. Secondly, using Specification (4) of Table 2.5, we estimate the additional tax revenue to be up to approx. €30 million for the reform in 2004. The total amount might be higher due to the treatment of indirectly held foreign affiliates or because other debt types are also treated. Moreover, the internal lending rate is not necessarily equivalent to the local lending rate. All estimated magnitudes can only be rough estimates, and we cannot take into account that multinationals – in event of restrictions on their capital structure choice – are able to shift profits through other channels, for instance, by transfer-price setting.

With respect to the effectiveness of thin-capitalization rules, our results suggest that governments are able to restrict tax-planning activities. Restricting corporations in shifting profits, however, can raise costs of finance, and hence, cause adverse investment effects. This trade-off presents new challenges and opportunities for future research.

[9]We assume as price for the internal credit a German lending rate for credits to the private sector of 9.7% in 2002 (IMF, 2005), and the 2002 statutory tax rate of 32.88%.

Data Sources and Definitions

Affiliate-level data are taken from the micro-level dataset of the Bundesbank (see Lipponer, 2006, for an overview). The share of internal debt from the foreign parent company is determined by the level of balance-sheet liabilities in the respective category divided by total capital consisting of registered capital, capital reserves and profit reserves, as well as internal and external debt. Corporate taxation data are taken from the IBFD and from tax surveys provided by the tax advisory companies Ernst&Young, PwC and KPMG.

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Chapter 3

The Impact of Thin-Capitalization Rules on External Debt Usage – A Propensity Score Matching Approach

Abstract

THIS PAPER ANALYZES how multinational enterprises respond to a restriction on interest deductions incurred for internal borrowing. The emphasis of the study is on a firm's response with respect to external borrowing. The empirical investigation applies propensity score matching techniques and exploits the 2001 reform of the German thin-capitalization rule to solve endogeneity problems. The results suggest that restrictions on internal debt are associated with expansions in external debt finance, indicating a substitutional relationship. Since multinational enterprises can use internal debt to shift profits from high- to low-tax countries, this finding implies that policies aimed at securing corporate tax revenue possibly fail and should be subject to careful scrutiny by policymakers.

3.1 Introduction

Once corporate income taxation is introduced in models of capital structure choice, a firm can increase its value by using debt instead of equity finance, making use of interest deductions. This is one essential finding of the corporate finance literature (for surveys, see Graham, 2003; Myers, 2001). A firm's capital structure choice, however, involves not only the debt-equity decision. Some companies also have the choice between internal and external debt finance. In the context of multinational firms, for instance, this choice entails complex issues of international tax planning.

Several existing empirical research papers consider both internal and external debt and find that corporate debt policy reflects differences in international taxation (e.g., Desai et al., 2004a; Mintz and Weichenrieder, 2005; Ramb

and Weichenrieder, 2005). If multinational enterprises use internal loans to shift profits from high- to low-tax countries, high-tax countries lose corporate tax revenue. As a consequence, many governments have focused attention on countermeasures such as thin-capitalization rules which restrict the deductibility of interest expenses associated with internal debt. For example, from 1996 to 2005, the number of EU member countries that relied on some form of debt-equity restriction increased from 8 to 17. Only recently, the issue has appeared on the agenda of the European Commission, as "[...] there is clearly a perceived need for the introduction of a common thin capitalization rule." (Dourado and de la Feria, 2008, p.1). It is questionable, however, whether European countries will agree on harmonizing thin-capitalization rules in the near future, because a common rule may reduce welfare in some countries (see Haufler and Runkel, 2008).

In a recent study, Buettner et al. (2008) find that thin-capitalization rules are effective in restricting internal borrowing. Overesch and Wamser (2008) confirm this result by investigating a reform of the German thin-capitalization rule. However, whether corporate tax revenue simultaneously goes up remains unclear. In fact, the analyses of Desai et al. (2004a) and Ruf (2008) suggest that internal and external debt are substitutes, and thus, tax revenue may be unaffected. If firms are able to substitute external for internal debt, they still make use of interest deduction, because external debt is usually not affected by thin-capitalization rules. While consequences for corporate tax revenues ultimately depend on the elasticity of substitution between external and internal debt, on interest costs for external debt and, in the medium term, on firms' investment response, the goal of securing the domestic corporate tax base possibly fails in the first place.

This paper investigates how a firm's external debt usage responds to restrictions on internal borrowing. Thereby, the analysis also reveals how internal debt generally relates to external debt. Any investigation of this relationship is challenging, because firms simultaneously decide on both internal and external debt. To obtain reliable estimates, we therefore make use of a more sophisticated identification strategy, where we first exploit a reform of the German thin-capitalization rule. Second, we adopt a counterfactual perspective and apply propensity score matching methods. The analysis is based on an affiliate-level database on foreign direct investment in Germany (inbound FDI), provided by the Deutsche Bundesbank (the German Central Bank). The findings support the hypothesis that affiliates of foreign multinationals partially substitute external for internal borrowing if they are affected by a tighter thin-capitalization rule. The estimations imply that affected firms increase their external-debt-to-capital ratio by approx. 2.5 percentage points compared to the counterfactual outcome. With regard to the external debt level, we estimate an average treatment effect on the treated (ATT) that suggests that treated firms expand their external debt usage by 8%. These findings imply a limited effectiveness of thin-capitalization rules in terms of shielding tax revenue.

The study proceeds as follows. Section 3.2 provides institutional details about the German thin-capitalization rule. Some theoretical considerations are presented in Section 3.3. The empirical investigation approach is developed in Section 3.4. Section 3.5 describes the data. Section 3.6 reports and interprets the results. Section 3.7 concludes.

3.2 The German Thin-Capitalization Rule

While multinational firms can use their internal capital markets for a number of reasons – for instance to overcome shortcomings associated with external credit markets (e.g., Desai et al., 2004a) – internal financial policies can also support multinationals' efforts in reducing their overall tax liabilities. In a very simple scenario, in which a multinational firm is active in a low- and a high-tax country, we would expect the subsidiary in the high-tax country to borrow from the subsidiary in the low-tax country. Since interest payments are usually deductible from the corporate tax base, the difference in national statutory tax rates determines the potential gain (see, e.g., Buettner and Wamser, 2007).

To secure their corporate tax bases, many countries have introduced some form of debt-equity restriction. Referring to excessive debt-to-equity ratios, i.e. companies are thinly capitalized, such restrictions are commonly known as thin-capitalization rules. In Germany, a thin-capitalization rule was first introduced in 1994. After having been subject to amendments in 2001 and 2004, it was replaced by a so-called earnings-stripping rule in 2008 (see also Section 3.7). Up to and including 2007, Section 8(a) of the German corporate income tax law (KStG) limited interest deduction if a firm's internal-debt-to-equity ratio exceeded a certain threshold level. The rule applied to two different types of incorporated affiliates. The first group of affiliates included ordinary corporations that were not classified as holding companies. For these corporations, interest deduction was allowed up to an internal-debt-

to-equity ratio (equity inclusive of internal debt) of 3:1 before 2001. The threshold level for holdings – defined as a firm where more than 75% of total assets consist of shares in other corporations – was even less restrictive at an internal-debt-to-equity ratio of 9:1. In 2001, the thresholds were significantly reduced to 1.5:1 in the case of an ordinary corporation and to 3:1 in the case of a holding corporation. Note that if the internal-debt-to-equity ratio of a firm was in excess of the threshold defined by the thin-capitalization rule, only interest expenses for the internal borrowing above the allowed threshold were non-deductible.

3.3 Theoretical Framework

Corporate financial decisions are a relevant aspect of firm policy affecting the value of a company (for surveys, see Auerbach, 2002; Graham, 2003). Nevertheless, investigations on capital structures typically start from the Modigliani-Miller irrelevance theorem. Assuming a frictionless capital market, Modigliani and Miller's (1958) result states that the capital structure is irrelevant for the company value. In the presence of taxes, however, companies would generally favor debt, because the debt tax shield generated by debt interest deductions increases the company value (Modigliani and Miller, 1963).[1]

[1]The irrelevance theorem is no longer valid in the presence of various capital market imperfections (see Fama, 1978, for a discussion of the Modigliani-Miller assumptions). Kemsley and Nissim (2002) estimate the value of the debt tax shield. Their findings suggest that the debt tax shield is equal to approx. 40% of debt balances, or 10% of total

The following model considers two multinational enterprises (A and B). Each multinational has a subsidiary in Germany. The subsidiaries are identical, except that one is affected by the reform of the German thin-capitalization rule (subsidiary of multinational B), the other is not (subsidiary of multinational A).

3.3.1 Multinational Firm A

Consider a multinational firm A which is active in a parent country (country 1) and in Germany (country 2). The multinational's after-tax profits are given by

$$\begin{aligned} \pi^A &= f\left(k_1^A\right)(1-t_1) + f\left(k_2^A\right)(1-t_2) \\ &- \left[i_1 \lambda_1^A k_1^A\right](1-t_1) \\ &- \left[i_2 \lambda_2^A k_2^A\right](1-t_2) \\ &+ \left[i_2 \mu_2^A k_2^A\right](t_2-t_1) \\ &- \left[\left(1-\lambda_1^A\right) k_1^A + \left(1-\lambda_2^A\right) k_2^A\right] r^A \\ &- \left[c\left(\lambda_1^A\right) k_1^A + c\left(\lambda_2^A, \mu_2^A\right) k_2^A\right]. \end{aligned} \tag{3.1}$$

Output is given by the production functions $f\left(k_1^A\right)$ and $f\left(k_2^A\right)$, where k_1^A units of capital are employed at the parent's location, and k_2^A units of capital in Germany. The firm is subject to the corporate tax rates t_1 and t_2. The

firm value. Graham (2000) estimates that the tax benefit of debt equals 9.7% of firm value.

relevant interest rates are given by i_1 and i_2. The second and the third line capture the net-of-tax interest costs related to external debt, where λ_1^A and λ_2^A denote the respective shares of capital financed with external debt.[2] Moreover, let μ_2^A be the share of internal debt provided by the parent firm. If we assume that Germany is always the high-tax country ($t_2 > t_1$), the multinational can increase π^A by shifting profits from the high-tax affiliate to the low-tax parent firm. Note that internal loans are equity refinanced and do not increase external debt. The fourth line captures the multinational's cost of equity, where the rate of return on equity is denoted by r^A. Finally, $c(\lambda_1^A)$ and $c(\lambda_2^A, \mu_2^A)$ are the cost of borrowing.[3] The cost function is assumed to be convex in both types of debt.[4] Furthermore, if the cross-partial derivative is positive, external and internal debt are substitutes.[5] The firm chooses λ_2^A and μ_2^A to maximize profits, which yields the following optimality conditions

$$c_\lambda\left(\lambda_2^A, \mu_2^A\right) = r^A - i_2\left(1 - t_2\right), \tag{3.2}$$

$$c_\mu\left(\lambda_2^A, \mu_2^A\right) = i_2\left(t_2 - t_1\right). \tag{3.3}$$

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[2]Note that Equation (3.1) implicitly assumes that the firm is not experiencing losses and that debt interest expenses are fully deductible.

[3]On the one hand, these costs may be associated with financial distress (Kraus and Litzenberger, 1973; Scott, 1976). Agency cost models, on the other hand, introduce costs which relate to conflicting interests between debt and equity owners (Jensen and Meckling, 1976; Myers, 1977).

[4]$c_{\lambda_1^A} \equiv \frac{\partial c}{\partial \lambda_1^A} > 0$, $c_{\lambda_2^A} \equiv \frac{\partial c}{\partial \lambda_2^A} > 0$, $c_{\mu_2^A} \equiv \frac{\partial c}{\partial \mu_2^A} > 0$, $c_{\lambda_1^A \lambda_1^A} \equiv \frac{\partial^2 c}{\partial \lambda_1^{A2}} > 0$, $c_{\lambda_2^A \lambda_2^A} \equiv \frac{\partial^2 c}{\partial \lambda_2^{A2}} > 0$, $c_{\mu_2^A \mu_2^A} \equiv \frac{\partial^2 c}{\partial \mu_2^{A2}} > 0$.

[5]$c_{\lambda_2^A \mu_2^A} \equiv \frac{\partial^2 c}{\partial \lambda_2^A \partial \mu_2^A} > 0$.

The convexity of the cost function implies that λ_2^A is positive if $r^A > i_2\,(1-t_2)$.[6] While external debt is determined by the local tax rate, the optimal μ_2^A is determined by the tax-rate differential between Germany and the parent country $(t_2 - t_1)$.

3.3.2 Multinational Firm B

We observe a second multinational with a subsidiary in Germany. Multinational B is identical to firm A, except that the German subsidiary of firm B is affected by the reform of the thin-capitalization rule. Thus, it is restricted in the use of internal debt.[7] In fact, thin-capitalization rules imply that interest expenses above a certain threshold of the internal-debt-to-equity ratio are no longer deductible for tax purposes (see Section 3.2). The profit function for B can then be written as

$$\begin{aligned}
\pi^B &= f\left(k_1^B\right)(1-t_1) + f\left(k_2^B\right)(1-t_2) \\
&- \left[i_1\lambda_1^B k_1^B\right](1-t_1) \\
&- \left[i_2\lambda_2^B k_2^B\right](1-t_2) \\
&+ \left[i_2\mu_2^B k_2^B\right](t_2 - t_1 - \phi t_2) \\
&- \left[\left(1-\lambda_1^B\right)k_1^B + \left(1-\lambda_2^B\right)k_2^B\right] r^B \\
&- \left[c\left(\lambda_1^B\right)k_1^B + c\left(\lambda_2^B, \mu_2^B\right)k_2^B\right].
\end{aligned} \tag{3.4}$$

[6] For notational simplicity, c_λ and c_μ refer to the first derivatives of the cost function with respect to λ_2^A and μ_2^A.

[7] Note that all notations and assumptions from above apply also for multinational B.

The share ϕ of interest expenses associated with internal debt is not deductible and therefore does not add value to the debt tax shield of the multinational (see line four).[8] Although Equation (3.4) implies that there is a reduced benefit from using internal debt, interest expenses for external debt remain fully deductible. The multinational's first-order conditions are then given by

$$c_\lambda\left(\lambda_2^B, \mu_2^B\right) = r^B - i_2\left(1 - t_2\right), \tag{3.5}$$

$$c_\mu\left(\lambda_2^B, \mu_2^B\right) = i_2\left(t_2 - t_1 - \phi t_2\right). \tag{3.6}$$

Equation (3.6) suggests that the incentive to use internal debt is partially offset, because the marginal benefit of using internal debt is reduced by the thin-capitalization rule. As long as the tax-rate difference is sufficiently large, however, there is an incentive to use internal debt to shift profits.

Recall that the German subsidiaries of the multinationals A and B are identical, except that the subsidiary of B is affected by the reform of the thin-capitalization rule. If the subsidiaries choose μ and λ simultaneously, and if r^A is similar to r^B, the assumptions about the functional form of $c(\lambda, \mu)$ imply that $\lambda_2^{A*} < \lambda_2^{B*}$, because $\mu_2^{A*} > \mu_2^{B*}$. This means that, as a consequence of a tighter thin-capitalization rule, subsidiary B is inclined to use additional external debt, whereas subsidiary A is not.

Prediction: *A subsidiary that is affected by a tighter thin-capitalization rule increases external debt usage compared to a non-affected subsidiary.*

[8] The non-deductibility is captured by $\phi\left(i_2 \mu_2^B k_2^B t_2\right)$, where we assume $0 < \phi < 1$. The actual ϕ depends on the thin-capitalization threshold and on the firm's internal-debt-to-equity ratio. The empirical analysis exploits the exogenous variation of the threshold.

3.4 Empirical Investigation Approach

This section describes the empirical identification strategy. As noted previously, the basic goal of this study is to investigate how firms respond to a change in the thin-capitalization threshold with respect to their external debt usage. Thereby, the analysis also reveals how internal debt generally relates to external debt.

To address the research issue, we do not use standard regression techniques, because external and internal debt are determined simultaneously. Hence, we cannot consider exogenous variation of one variable and simply regress external on internal debt or vice versa. Since exclusion restrictions are also difficult to justify, even instrumental variable techniques are not convincing and may result in biased estimates and misleading inference. We shall choose a research design that sufficiently takes into account endogeneity issues by using both a policy reform (the 2001 reform of the thin-capitalization rule) as a quasi-experimental setting and propensity score matching techniques.

Our data contains information on the capital structure of foreign subsidiaries in Germany, including information on internal borrowing. We can use this data in combination with information about the German thin-capitalization threshold level $\bar{\theta}$ to identify firms for which interest deduction is denied because the thin-capitalization rule is binding. According to the evaluation literature we refer to these firms as the treatment group (see, e.g., Blundell and Costa Dias, 2002). The change in the outcome variable due to the

treatment is called the treatment effect. If subsidiaries are not subject to treatment, they are assigned to the control group. The treatment status of firm j is indicated by the binary variable T_j, defined as

$$\begin{aligned} T_j &= 1 \qquad \text{if } \theta_{j,t} < \bar{\theta}_{t-1} \text{ and } \theta_{j,t} > \bar{\theta}_t, \\ T_j &= 0 \qquad \text{if } \theta_{j,t} < \bar{\theta}_{t-1} \text{ and } \theta_{j,t} < \bar{\theta}_t. \end{aligned}$$

The year t refers to the reform year 2001. We look at a single firm j that can be affected by the legal thin-capitalization rule $\bar{\theta}$. $\bar{\theta}$ corresponds to the allowed internal-debt-to-equity ratio (equity inclusive of internal debt), and $\theta_{j,t}$ is the internal-debt-to-equity ratio of the firm.[9] Note that above definition implies that, although a treated firm would have been below the pre-reform threshold ($\bar{\theta}_{t-1}$) level in t, it is above the post-reform threshold. Using this definition, we ensure that a firm is affected by an exogenous reform. We allow $\bar{\theta}$, the German thin-capitalization rule, to differ according to the legal form of the firm, because different threshold levels apply (see Section 3.2; note, though, that we abstract from using an index for the legal form, for the sake of simplicity). With respect to the theoretical model, Equation (3.4) refers to cases where $T = 1$. If θ_j is sufficiently low, then Equation (3.1) applies and $T = 0$.

We define the outcome variable as the change in the share of external debt $\Delta\lambda$, calculated as $\lambda_{t+1} - \lambda_t$.[10] We expect that affected subsidiaries are adjust-

[9] A thin-capitalization rule of 3:1 translates into an internal-debt-to-equity ratio $\bar{\theta}$ of 0.75. The post-reform ratio of 1.5:1, hence, corresponds to $\bar{\theta} = 0.6$.

[10] Since the empirical analysis is concerned with the 2001 reform, $\Delta\lambda$ refers to $\lambda_{2002} - \lambda_{2001}$. The intuition for this definition is that the exogenous shock is at the beginning

ing their capital structure during the period after the shock. In particular, we expect a positive treatment effect, indicating that treated firms increase external debt usage compared to non-treated firms.

The optimal setting to investigate the effect of the reform is described by the counterfactual framework (Heckman, 2005, 2008). A real counterfactual would require observing each subsidiary in both states (with and without treatment). Since this is not possible, the aim is to choose the control group such that control units are as similar as possible to the treatment group. A perfect control group would only differ in terms of the treatment status. Whether a company is affected by a stricter thin-capitalization rule, however, is not random. Since both groups presumably differ also without treatment, comparing the mean values of the change in external debt between treated and non-treated firms would bias the results. For instance, financially constrained or financially distressed firms may have a higher probability to be treated, because they potentially depend on internal loans from the parent company (Gopalan et al., 2007) and may only have limited access to external debt. A strategy for overcoming this problem is to find a group of non-affected companies that is similar to the treated firms in relevant pre-treatment characteristics X.

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of 2001; from 2001 to 2002, the firms may adjust their capital structure. The share of external debt λ is defined as external liabilities relative to total capital. The latter consists of nominal capital, capital reserves, profit reserves, and total debt.

3.4.1 Propensity Score Matching

Rosenbaum and Rubin (1983, 1984) describe how one can bundle firm characteristics in a single-index variable, the propensity score. On the basis of this propensity score we can match treated and non-treated firms such that they are comparable with respect to relevant observable characteristics. One advantage of this non-parametric approach is that it is a very intuitive way to estimate treatment effects, because we determine treated firms by a set of observable variables, and then compare firms to appropriate matches (firms which are not affected, but similar in other respects). Formally, the propensity score can be described as the probability of receiving a treatment given pre-treatment characteristics

$$p(X) \equiv Pr\{T = 1|X\} = E\{T|X\}.$$

$T = \{0, 1\}$ is the treatment variable as defined above and X is the multidimensional vector of pre-treatment characteristics. If the exposure to treatment is random within cells defined by X, it is also random within cells defined by the values of the mono-dimensional variable $p(X)$. Then, the Average effect of Treatment on the Treated (ATT) can be estimated as

$$\begin{aligned} \text{ATT} &\equiv E\{\Delta\lambda_{1j} - \Delta\lambda_{0j}|T_j = 1\} \\ &= E\{E\{\Delta\lambda_{1j} - \Delta\lambda_{0j}|T_j = 1, p(X_j)\}\} \\ &= E\{E\{\Delta\lambda_{1j}|T_j = 1, p(X_j)\} - E\{\Delta\lambda_{0j}|T_j = 0, p(X_j)\}|T_j = 1\}, \end{aligned}$$

where the variable $\Delta\lambda_{0j}$ denotes the counterfactual outcome. Note that the real counterfactual outcome for treated firms is not observed; we do not know how the firms would have chosen their financial structure without treatment. Yet we can use the control group as a substitute and condition on the propensity score. However, we need two additional assumptions to obtain the result for the ATT. First, pre-treatment variables of the two groups have the same distribution given the propensity score (balancing property). If this assumption holds, the treatment is considered to be random. The second assumption is called the unconfoundedness assumption. It requires that, given the propensity score, potential outcomes are independent of treatment assignment (see the Appendix, Lemma 1 and Lemma 2, for more details on the assumptions).

Estimating the ATT using propensity score matching involves a two-step procedure, where we predict the probability of being affected by the 2001 reform of the thin-capitalization rule in a first step (using a probit or logit regression). The binary dependent variable corresponds to T_j as defined above. In a second step, we match treated and control units and estimate the treatment effect. If we were observing exactly the same propensity score for two firms, we could simply compare these two observations. However, the propensity score is a continuous variable and the probability of observing the same value for two firms is infinitely small. For this reason, we do need methods to match comparable firms.

3.4.2 Matching Methods

We make use of four different matching methods: nearest neighbor matching, radius matching, stratification matching, and kernel matching.[11] *Nearest neighbor matching* matches to each treated company the control unit with the closest propensity score. Untreated firms can be used more than once as a match. Subsequently, the difference in the outcome variable between matched units is computed to obtain the ATT. Note that one match is assigned to every treated firm, no matter how close propensity scores actually are. This can result in a rather unsatisfying matching quality. We can overcome this problem, to some extent, when we use *radius matching*. This method matches treatment units with control units only if the propensity score falls into a certain range. The smaller we define the radius – the tolerable distance within which units are matched – the better is the quality of the matches. The *stratification method* splits the sample according to the value of the propensity score into intervals. Within each interval, treated and control units have on average the same propensity score. We obtain the ATT by calculating the difference between average outcomes of the treated and the controls within each interval. However, we possibly lose observations if we do not find comparable firms within one interval. *Kernel matching*, finally, does not only use some of the control observations. Rather, this matching estimator constructs the counterfactual outcome by using weighted averages of all controls. The weights proportionally decrease with an increasing distance between the propensity scores of treated firms and controls.

[11] For more details about matching algorithms, consult, for example, Morgan and Harding (2006), Dehejia and Wahba (2002).

To evaluate different matching methods, we need to take into account the trade-off between quantity and quality of matches. Whereas more information can improve the efficiency of the estimates, a higher matching quality can reduce the bias. Radius matching, for example, rather avoids bad matches compared to nearest neighbor matching.

3.5 Data and Descriptive Statistics

The empirical investigation relies on the MiDi (Microdatabase Direct Investment) database collected by the Deutsche Bundesbank. Two aspects of MiDi are particularly noteworthy: first, according to the German Trade and Payments Act (Außenwirtschaftsgesetz) in connection with the Foreign Trade and Payments Regulation (Außenwirtschaftsverordnung), a German affiliate held by a foreign investor is obliged to provide balance-sheet information. Hence, above a minimum reporting threshold, we observe all foreign affiliates in Germany. Second, MiDi does not only provide information about the affiliates' total debt, it also includes information about internal borrowing. The corresponding question in the FDI stock survey asks the participants to report *liabilities to affiliated enterprises linked with the party required to report through participating interests* (Lipponer, 2007).

Table 3.1 provides a list of the investor countries, including means of affiliate characteristics as well as the total number of subsidiaries in a country. All statistics refer to the year 2001. Due to data protection, we only report

Table 3.1: Country and Firm Characteristics

Investor Country	Fixed Assets (€1.000)	Employees (#)	Leverage (Ratio)	Subsidiaries (#)	Investor Country	Fixed Assets (€1.000)	Employees (#)	Leverage (Ratio)	Subsidiaries (#)
Australia	2,929.13	74.38	0.827	8	Italy	6,956.89	132.69	0.689	217
Austria	7,767.44	123.66	0.687	431	Japan	7,835.79	105.98	0.658	350
Belgium	16,826.55	173.68	0.682	263	Korea (South)	7,659.33	121.91	0.742	33
Bermuda (GB)	3,757.93	83.21	0.687	14	Liechtenstein	9,922.08	95.63	0.669	52
Brazil	1,909.40	114.40	0.793	5	Luxembourg	11,311.81	137.53	0.631	360
British Virgin Isl.	3,188.75	40.94	0.746	16	Malaysia	4,522.00	186.95	0.576	5
Canada	15,670.40	325.43	0.626	60	Netherlands	13,574.94	210.88	0.652	2,143
Cayman Islands	5,447.15	86.00	0.660	26	Netherlands Anti.	4,865.75	204.38	0.610	8
China	732.36	14.43	0.838	14	Norway	6,904.67	112.74	0.721	57
Croatia	271.40	394.00	0.969	5	Panama	4,125.00	231.54	0.750	13
Cyprus	30,049.44	49.67	0.779	9	Poland	344.88	190.04	0.828	24
Czech Republic	10,99	32.91	0.581	11	Portugal	11,662.25	126.63	0.725	8
Denmark	5,391.76	156.88	0.668	273	Russia	1,104.09	12.91	0.722	11
Finland	13,618.07	189.52	0.622	95	Singapore	8,036.00	77.89	0.707	9
France	12,452.87	243.65	0.643	883	Slovenia	3,149.33	21.83	0.906	12
Great Britain	11,972.90	172.68	0.641	763	South Africa	14,041.82	115.55	0.604	11
Greece	894.42	25.17	0.781	12	Spain	115,335.30	142.13	0.681	83
Hong Kong	3,465.29	62.43	0.764	7	Sweden	11,764.04	195.51	0.628	307
Hungary	2,338.14	65.14	0.710	7	Switzerland	9,108.19	172.85	0.689	1,086
Iran	3,283.82	20.18	0.894	17	Taiwan	692.20	23.07	0.702	15
Ireland	10,527.44	146.97	0.669	36	Turkey	3,741.86	116.29	0.797	21
Israel	8,979.62	20.18	0.601	21	USA	16,696.46	288.87	0.603	1,476

Source: MiDi. Descriptive statistics refer to the year 2001. Fixed Assets, Employees, and Leverage are sample means. All minority holdings are excluded, but no further restrictions are imposed. The country of the foreign investor may not always be the ultimate parent country. Subsidiaries is the number of majority holdings. Confidential information: investor countries with less than 5 observations in 2001 are excluded.

countries with at least 5 investments. To avoid any conflicting participation interests (e.g., Desai et al., 2004b), we exclude all minority holdings. The Netherlands, Switzerland, and the United States are the most important investor countries. However, the country of the foreign investor may not always be the ultimate parent country. This explains the large number of observations from the Netherlands and also from Switzerland, because both countries are frequently used to establish intermediate holding companies (see Weichenrieder and Mintz, 2008).

Table 3.2 reports summary statistics. The treatment variable T, which is analyzed in a first-step binary model (see Section 3.6 and the Appendix for further details), indicates that approx. 15% of all subsidiaries in the estimation sample are affected by the reform of the thin-capitalization rule. T is determined by several explanatory variables: first of all, we expect that tax-rate differentials have a positive impact on the propensity to be treated.[12] Moreover, we expect that the subsidiary's sales positively relate to the probability of being treated, because sales capture the size of a firm (e.g., Graham and Harvey, 2001). Another helpful variable to predict treatment is the binary variable loss carry-forward. The variable is one if the firm carries forward any losses, and zero otherwise. If firms are in a loss situation, the incentive to engage in tax planning is reduced (see MacKie-Mason, 1990). Therefore, we expect firms with losses to be less frequently treated by the reform of the thin-capitalization rule. Finally, we control for the tangible-to-total assets ratio of firms (tangibility). Higher tangibility may be associated

[12]Equation (3.3) motivates the inclusion of the tax-rate differential $(t_2 - t_1)$.

with better access to external credits, because tangible assets can be used as collateral. Since a high level of external liabilities implies that the probability to be treated is low, we may expect a negative coefficient for tangibility.

Table 3.2: Descriptive Statistics

Variable	Mean	Std. Error	Min.	Max.
Tax-Rate Differential ($t_2 - t_1$)	.050	.057	-.029	.392
ln(Sales)	10.33	1.42	c)	c)
Loss carry-forward	.333	.471	0	1
Tangibility	.363	2.16	c)	c)
Treatment (T)	.151	.358	0	1
Share of Internal Debt	.240	.228	c)	c)
Share of External Debt	.362	.277	c)	c)

Source: MiDi. 3,309 observations. c) confidential information. Treatment (T) defined as described in Section 3.4. Tax-rate differential defined as ($t_{\text{Germany}} - t_{\text{Foreign}}$). For further variable definitions, see the Appendix.

3.6 Results

We use a binary choice model to obtain the propensity score. Corresponding first-step estimation results and also tests for the balancing property are reported in the Appendix (Tables 3.6 and 3.7). Concerning the inclusion of control variables in the binary model, we closely follow the existing literature on the capital structure choice of multinational enterprises (see, e.g., Overesch and Wamser, 2008). Note that we implicitly control for macroeconomic factors in Germany, because all foreign investors are exposed to the

same economic situation in the destination country. According to the results of the binary-choice models, a higher tax-rate differential is associated with a higher propensity to be treated, because the incentive for the German subsidiary to use internal debt finance is higher if the tax-rate difference is higher. Note that the variation in the foreign statutory tax rate is crucial to identifying an effect of the tax-rate differential. While the coefficient shows the expected sign, the effect is not statistically significant. The subsidiaries' sales relate positively to the propensity to be above the threshold level. The existence of a loss carry-forward reduces the incentives for tax-planning activities, and therefore reduces the probability of a treatment. We do not find a significant impact of the tangibility variable.

3.6.1 Results for External Debt

Table 3.3 presents the results for the change in the external-debt-to-capital ratio. Since different matching algorithms imply a trade-off between bias and efficiency, we report the results for the different procedures. As expected, standard errors are higher in the case of the nearest neighbor matching. However, the findings are robust and treatment is significantly related to the change in the share of external debt in all specifications. The findings confirm theoretical expectations: there is evidence for a positive average treatment effect on the treated. Estimates are in the range of .023 to .027, depending on the matching method. A coefficient of .027 implies that a treated subsidiary increases its external-debt-to-capital ratio by 2.7 percentage points.

Table 3.3: Propensity Score Matching, Share of External Debt
Outcome Variable: Change in the Share of External Debt

Nearest Neighbor Matching		
Average Effect of Treatment (Std. Err.)	.027	(.010)***
(Bootstrapped Standard Errors)		(.011)**
Number of Treated Firms: 500		
Number of Control Firms: 438		
Radius Matching (radius=.1)		
Average Effect of Treatment (Std. Err.)	.023	(.006)***
(Bootstrapped Standard Errors)		(.006)***
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Radius Matching (radius=.001)		
Average Effect of Treatment (Std. Err.)	.023	(.006)***
(Bootstrapped Standard Errors)		(.007)***
Number of Treated Firms: 489		
Number of Control Firms: 2,648		
Stratification Matching		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	.026	(.006)***
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Kernel Matching (Epanechnikov kernel, bandwidth=0.06)		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	.024	(.005)***
Number of Treated Firms: 500		
Number of Control Firms: 2,809		

Coefficient (Std. Dev.). Propensity score based on probit estimation (see Appendix, Table 3.6). Calculations are based on the statistical software provided by Becker and Ichino (2002). Standard errors (in parentheses). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. Outcome variable: change in the share of external debt, defined as $\lambda_{t+1} - \lambda_t$, where λ is defined as external liabilities relative to total capital. The latter consists of nominal capital, capital reserves, profit reserves, and total debt.

Table 3.4: Propensity Score Matching, Level of External Debt
Outcome Variable: Change in the Level of External Debt

Nearest Neighbor Matching		
Average Effect of Treatment (Std. Err.)	.084	(.050)*
(Bootstrapped Standard Errors)		(.062)
Number of Treated Firms: 500		
Number of Control Firms: 438		
Radius Matching (radius=.1)		
Average Effect of Treatment (Std. Err.)	.074	(.033)**
(Bootstrapped Standard Errors)		(.031)**
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Radius Matching (radius=.001)		
Average Effect of Treatment (Std. Err.)	.078	(.035)**
(Bootstrapped Standard Errors)		(.036)**
Number of Treated Firms: 489		
Number of Control Firms: 2,648		
Stratification Matching		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	.078	(.037)**
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Kernel Matching (Epanechnikov kernel, bandwidth=0.06)		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	.076	(.029)***
Number of Treated Firms: 500		
Number of Control Firms: 2,809		

Coefficient (Std. Dev.). Propensity score based on probit estimation (see Appendix, Table 3.6). Calculations are based on the statistical software provided by Becker and Ichino (2002). Standard errors (in parentheses). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. Outcome variable: change in the level of external debt, defined as the change in the natural logarithm of the liabilities to external creditors, ln(external liabilities$_{t+1}$) - ln(external liabilities$_t$).

Table 3.5: Propensity Score Matching, Share of Internal Debt
Outcome Variable: Change in the Share of Internal Debt

Nearest Neighbor Matching		
Average Effect of Treatment (Std. Err.)	-.050	(.011)***
(Bootstrapped Standard Errors)		(.011)***
Number of Treated Firms: 500		
Number of Control Firms: 438		
Radius Matching (radius=.1)		
Average Effect of Treatment (Std. Err.)	-.043	(.008)***
(Bootstrapped Standard Errors)		(.009)***
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Radius Matching (radius=.001)		
Average Effect of Treatment (Std. Err.)	-.042	(.008)***
(Bootstrapped Standard Errors)		(.008)***
Number of Treated Firms: 489		
Number of Control Firms: 2,648		
Stratification Matching		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	-.045	(.008)***
Number of Treated Firms: 500		
Number of Control Firms: 2,725		
Kernel Matching (Epanechnikov kernel, bandwidth=0.06)		
Average Effect of Treatment (Std. Err.)		
(Bootstrapped Standard Errors)	-.043	(.007)***
Number of Treated Firms: 500		
Number of Control Firms: 2,809		

Coefficient (Std. Dev.). Propensity score based on probit estimation (see Appendix, Table 3.6). Calculations are based on the statistical software provided by Becker and Ichino (2002). Standard errors (in parentheses). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. Outcome variable: change in the share of internal debt, defined as $\mu_{t+1} - \mu_t$, where μ is defined as internal liabilities relative to total capital. The latter consists of nominal capital, capital reserves, profit reserves, and total debt.

Findings in Table 3.3 confirm that firms substitute external for internal debt if we consider the debt-to-capital ratios. The analysis presented in Table 3.4 investigates whether the positive treatment effect is still identified if we define the outcome variable as the level of external debt. To be specific, the outcome variable is calculated as the change in the natural logarithm of the liabilities to external creditors (ln(external liabilities$_{t+1}$) - ln(external liabilities$_t$)). The results show that treatment by the 2001 reform of the thin-capitalization rule is related to more external debt. Except for the nearest neighbor matching with bootstrapped standard errors, the coefficient is always significant. The ATT of .078 implies that an affected subsidiary expands its external liabilities by approx. 8%.

3.6.2 Results for Internal Debt

In addition to the analysis concerning the share of external debt, we examine the effectiveness of the thin-capitalization reform with respect to internal debt. Table 3.5 contains results where the outcome variable is defined as the change in the share of internal debt.[13] If firms are affected by the thin-capitalization reform, we expect a negative treatment effect. In other words, treated affiliates reduce their internal-debt-to-capital ratios, because interest deduction is no longer possible. A coefficient of -.05 implies that treatment by the reform of the thin-capitalization rule is associated with a 5 percentage point lower internal-debt-to-capital ratio. If we consider both the treatment

[13]The analysis confirms empirical findings of earlier research (see Buettner et al., 2008; Overesch and Wamser, 2008; Weichenrieder and Windischbauer, 2008).

effect for the change in the share of internal debt and the change in the share of external debt, we find that the affected firm can substitute external debt for approx. 55% of the reduction in its internal-debt-to-capital ratio (using the averages of the estimated ATTs in Tables 3.3 and 3.5 for this evaluation).

3.7 Conclusion

The empirical literature on corporate taxation and multinational companies provides extensive evidence that multinationals are mobile in various aspects and can avoid taxes (see, e.g., Devereux and Maffini, 2007). Policymakers who value adequate tax revenue, therefore, feel inclined to restrict tax-planning opportunities. In recent decades, for instance, various forms of debt-equity restrictions have been imposed in several countries. Germany and many other countries apply so-called thin-capitalization rules which limit the amount of deductible interest payments to affiliated companies.

This paper has exploited a reform of the German thin-capitalization rule in order to examine how subsidiaries of multinational firms adjust their capital structure after being affected by a stricter rule. The findings suggest that firms, to some extent, are able to substitute external for internal debt. In particular, a treated subsidiary increases its external-debt-to-capital ratio by approx. 2.5 percentage points relative to the counterfactual outcome. In terms of the stock of external borrowing, treatment is associated with approx. 8% more external debt.

Governments presumably pursue a twofold aim when introducing thin-capitalization rules: to defend the domestic corporate tax base and to reduce discrimination against purely domestic companies (because domestic firms are not able to shift profits).[14] Concerning the first goal, the results imply that thin-capitalization restrictions aimed at avoiding adverse consequences for corporate tax revenue are not necessarily rewarding. With respect to the second goal, thin-capitalization rules may be considered as being appropriate, because excessive thin capitalization no longer provides an opportunity to shift profits. Yet, though both domestic and multinational firms are unrestricted in the use of external debt, multinational firms may also have better access to external debt finance (and interest payments to external lenders are usually deductible).

In 2004, Germany responded to the Lankhorst-Hohorst judgment of the European Court of Justice by extending the scope of application of its thin-capitalization rule to loans from resident companies (see Körner, 2004). More recently, the 2008 corporate tax reform replaced the thin-capitalization rule by a so-called earnings-stripping rule.[15] In view of the findings of this investigation, this recent reform of the rule seems to be sensible. And yet, to evaluate the medium- and long-term impact on the economy, policymakers should consider the effect of the new earnings-stripping rule on firms' cost

[14]By contrast, some countries may strategically remove thin-capitalization restrictions to attract FDI (see Haufler and Runkel, 2008).

[15]Under the new interest barrier (Zinsschranke), interest deductions are limited to 30% of earnings (EBITDA). The new interest barrier rule includes several exceptions and additional requirements (escape clause, single business exception, exemption limit; see, e.g., Müller-Duttiné and Scheunemann, 2007).

of capital and therefore on real investment: a general non-deductibility of interest expenses is comparable to an additional tax that would risk driving productive capital, rather than tax bases, out of high-tax countries.

The central insight of this analysis is that any policy that urges multinationals to report income locally rather than shifting it to low-tax countries requires careful consideration. As to future research, additional work is needed to understand the role of internal debt which is not related to profit shifting. This is probably a significant share and must not be affected by thin-capitalization rules. Moreover, to develop a deeper understanding of substitution possibilities in a dynamic context, future research should aim at testing how costly it is for companies to adjust their capital structure.

Appendix

The estimation of the average treatment effect relies on two assumptions. First, the balancing property has to hold. This assumption is testable. Results are displayed in Table 3.7. Second, unconfoundedness given the pre-treatment characteristics X and given the propensity score $p(X)$ has to be satisfied. The unconfoundedness assumption refers to the assignment to the treatment. Rosenbaum and Rubin (1983) formulate Lemma 1 and Lemma 2, where $p(X)$ is the propensity score, T the treatment and X is the vector of pre-treatment characteristics:

Lemma 1 (Balancing Property): $$T \perp X \quad | \quad p(X).$$

Lemma 2 (Unconfoundedness): $$Y_1, Y_0 \perp T \quad | \quad X,$$
$$Y_1, Y_0 \perp T \quad | \quad p(X).$$

Table 3.6: Probability of Treatment

	Probit		Logit	
Tax-Rate Difference	.016	(.584)	.048	(1.02)
ln(Sales)	.040	(.020)**	.074	(.036)**
Loss carry-forward	-.163	(.059)***	-.302	(.110)***
Tangibility	-.029	(.044)	-.063	(.094)
Sector 2	-.521	(.417)	-.907	(.779)
Sector 3	-.082	(.228)	-.145	(.388)
Sector 4	-.376	(.156)**	-.677	(.265)**
Sector 5	-.502	(.217)**	-.927	(.393)**
Sector 6	-.598	(.267)**	-1.11	(.503)**
Sector 7	-.171	(.157)	-.308	(.267)
Sector 8	-.359	(.327)	-.647	(.598)
Sector 9	-.637	(.208)***	-1.17	(.386)***
Sector 10	-.572	(.192)***	-1.05	(.346)***
Sector 11	-.699	(.274)**	-1.28	(.531)**
Sector 12	-.789	(.516)	-1.45	(1.06)
Europe	-.553	(.262)**	-.962	(.426)**
America	-.679	(.275)**	-1.19	(.453)***
Asia	-.452	(.283)	-.766	(.466)*
Observations	3,309		3,309	
Log-likelihood	-1,372.92		-1,372.71	
Pseudo R-sq	.023		.023	

Source: MiDi. Considered are only majority-owned affiliates. Robust standard errors (in parentheses). (***) (**) (*) indicate significance at the (1%) (5%) (10%) level. Sector dummies are defined according to Table 3.8. Dependent variable: Treatment (T). Regarding the regional dummies, 'Rest of the World' is the reference group.

Table 3.7: Balancing Property

Variable	Mean (Treated)	Mean (Control)	Bias in %	Bias reduction in %	t-value	p-value
Tax-Rate Diff.	.052	.050	2.9	9.1	.46	.645
ln(Sales)	10.519	10.597	-5.6	65.0	-.92	.359
Loss carry-f.	.28	.288	-1.7	87.1	-.28	.779
Tangibility	.292	.289	.1	97.0	.14	.888
Sector 2	.004	.012	-11.7	-497.0	-1.42	.156
Sector 3	.03	.032	-1.3	83.1	-.18	.855
Sector 4	.42	.402	3.6	47.5	.58	.563
Sector 5	.026	.018	4.6	19.6	.86	.389
Sector 6	.012	.016	-3.2	51.8	-.54	.591
Sector 7	.378	.374	.9	95.9	.13	.896
Sector 8	.008	.012	-4.3	-218.5	-.64	.525
Sector 9	.028	.034	-2.9	81.1	-.55	.585
Sector 10	.042	.052	-4.4	59.9	-.75	.456
Sector 11	.01	.008	1.6	82.9	.33	.738
Sector 12	.002	0	3.4	33.0	1.00	.318
Europe	.778	.776	.5	46.0	.08	.940
America	.13	.134	-1.1	88.7	-.19	.852
Asia	.076	.07	2.4	72.1	.36	.716

Source: MiDi. 3,309 observations, 500 treated observations, 2,809 untreated observations. The balancing property is tested by using the software *pstest* provided by Leuven and Sianesi (2003).

Table 3.8: Variable Definitions

Internal-debt ratio (μ)	*Definition:*	Liabilities to shareholders/affiliated enterprises linked with the party required to report through participating interests divided by total capital consisting of nominal capital, capital reserves, profit reserves, and total debt.
	Source:	MiDi
External-debt ratio (λ)	*Definition:*	Borrowing from external creditors divided by total capital consisting of nominal capital, capital reserves, profit reserves, and total debt.
	Source:	MiDi
Sales	*Definition:*	Affiliate-specific sales.
	Source:	MiDi
Loss carry-forward	*Definition:*	Binary variable. If a firm carries forward any losses, the dummy variable is 1.
	Source:	MiDi
Tangibility	*Definition:*	Ratio of fixed assets to balance-sheet total.
	Source:	MiDi
Tax-Rate Differential	*Definition:*	Difference in statutory tax rates between Germany and investors' home countries ($t_{\text{Germany}} - t_{\text{Foreign}}$).
	Source:	Statutory tax rates are taken from the International Bureau of Fiscal Documentation (IBFD) and from tax surveys provided by Ernst&Young, PricewaterhouseCoopers (PwC), and KPMG. Tax rates take into account restrictions on interest deductibility.
Sector Definition		Sectors are defined according to the following classification: Agriculture (Sector 1); Mining (Sector 2); Metal Working Industry (Sector 3); Manufacturing (Sector 4); Electricity and Water Supply, Sewage Disposal, Telecommunication, Transport and Post (Sector 5); Construction (Sector 6); Retail and Wholesale Trade (Sector 7); Hotels and Restaurants (Sector 8); Other Services (Sector 9); Financial Intermediation and Financial Services (Sector 10); Computer, Research and Development (Sector 11); Government, Social Security, Social Care, Private Households, and Nonprofit Organizations (Sector 12).

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Chapter 4

Internal Debt and Multinationals' Tax Planning: Empirical Evidence from Panel Data

Abstract*

THIS PAPER INVESTIGATES the determinants of internal debt issued by foreign affiliates of multinational corporations. A theoretical analysis discusses the choice of the capital structure in a setting where internal debt can be used to shift taxable profits to low-tax countries and derives testable predictions. Empirical evidence on the tax sensitivity of internal debt is provided using micro-level panel data of virtually all German multinationals made available by the German Central Bank (Bundesbank). This comprehensive dataset allows us to exploit differences in taxing conditions of 175 countries over a period of ten years. The empirical results confirm a robust impact of tax-rate differences within the multinational group on the use of internal debt, supporting the profit-shifting hypothesis. However, the tax effects are rather small, suggesting that costs related to adjusting the capital structure are substantial.

4.1 Introduction

Due to the rising importance of foreign direct investment (FDI) and the emergence of multinational firms, international tax issues are of increasing importance for corporate financing decisions. As is well noted in the literature (e.g., Gresik, 2001), a multinational corporation has several ways to structure its activities in order to minimize the burden of taxation. This tax planning also involves the capital structure since multinationals can use external as well as internal funds to adjust their capital structure. In particular, multinationals can exploit opportunities for tax planning by means

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of internal debt. Borrowing from affiliates located in low-tax countries and lending to affiliates at high-tax locations will allow the latter to deduct interest payments and shift taxable profits into the low-tax countries. Yet there are more strategies to shift taxable profits to low-tax countries, for instance, by means of transfer pricing (e.g., Haufler and Schjelderup, 2000; Swenson, 2001; Clausing, 2003).

While several papers document that tax-planning activities have significant effects on the distribution of taxable profits of multinationals (e.g., Grubert and Mutti, 1991; Hines and Rice, 1994; Huizinga and Laeven, 2008), so far, the empirical literature has not provided evidence about the extent to which internal debt is involved. Some papers show that the capital structure of multinationals' affiliates is sensitive to the tax rate in the host country (e.g., Jog and Tang, 2001; Desai, Foley, and Hines, 2004a; Mintz and Weichenrieder, 2005; Buettner et al., 2006). But similar results have also been obtained for domestic corporations (e.g., Gordon and Lee, 2001). Moreover, as noted by Graham (2003) and Mintz and Smart (2004), tax planning by means of internal debt should respond not only to the local tax rate but also to the *tax-rate difference* between the lending and the borrowing affiliate within the multinational group. This view is supported by Huizinga, Laeven, and Nicodème (2008), who show that the debt-to-asset ratio of European multinationals is significantly affected by the host country tax rate as well as by the tax-rate differences relative to other affiliates in the group. However, quantitatively, their results point at rather small effects.

Against this background, the contribution of this paper is to provide direct

evidence on whether and to what extent internal debt is used for tax-planning purposes. The paper employs a large micro-level panel database of virtually all German multinationals made available for research by the German Central Bank (Bundesbank). This unique dataset allows us to consider the capital structure and, in particular, the determinants of internal debt of German multinationals in 175 countries over a period of 10 years.

The empirical results strongly support a significant impact of the tax-rate difference on internal debt, suggesting that internal debt is indeed used to shift profits from high- to low-tax countries. The host country tax, however, is insignificant suggesting that internal debt is not used to minimize the cost of capital. These results prove robust if we take account of the potential effects of *Controlled Foreign Corporation* (CFC) rules. However, even if we focus on majority-owned subsidiaries, the implied tax effects are rather small. This finding is indicative of substantial costs of adjusting the capital structure for tax-planning purposes.

The paper is organized as follows. In Section 4.2 we model a corporation which is active at different locations, including low-tax countries. The corporation is assumed to maximize profits by optimally using debt, exploiting also differences in international taxation. From the optimality conditions we obtain testable empirical implications, which are discussed in Section 4.3. Section 4.4 gives a short description of the dataset and discusses the investigation approach. Section 4.5 provides descriptive statistics. The basic results are presented in Section 4.6. In Subsection 4.6.1 our analysis additionally takes account of the German *Controlled Foreign Corporation* (CFC) rules.

Some further evidence showing how the results change when only majority-owned subsidiaries are considered is presented in Subsection 4.6.2. Section 4.7 provides the conclusions.

4.2 Theoretical Considerations

Consider a multinational group with affiliates in N countries. For simplicity, let us assume that each country hosts just one affiliate such that the tax system varies between affiliates. The profit function of the group is given by

$$\begin{aligned}
\pi &= \sum_{i=1}^{N} f(k_i)(1-\tau_i) \\
&- \sum_{j=1}^{N}\sum_{i=1}^{N} [i_j \lambda_{ji} k_i](1-\tau_i) \\
&- \sum_{j=1}^{N}\sum_{i=1,i\neq j}^{N} [i_j \mu_{ji} k_i](1-\tau_i) \quad + \quad \sum_{j=1,i\neq j}^{N}\sum_{i=1}^{N} [i_j \mu_{ji} k_i](1-\tau_j) \\
&- r\sum_{i=1}^{N}\left(1-\sum_{j}\lambda_{ji}\right)k_i \\
&- \sum_{i=1}^{N} c_i(\lambda_{1i},...,\lambda_{ji},...,\lambda_{N,i},\mu_{1i},...,\mu_{ji},...,\mu_{Ni})\,k_i, \quad \text{with} \quad \mu_{ii}=0.
\end{aligned}$$

Let us briefly discuss the components of this profit function. The first line captures the contribution of output, $f(k_i)$, taking account of the fact that a part of the corresponding profit is taxed away. The host country statutory tax rate is denoted with τ_i. The second line shows the interest costs

for external debt which, similarly, enter profits only after tax deduction. i_j is the corresponding lending rate at location j. Note that this term captures also the interest costs related to internal debt if the corporation issues some external debt in country j in order to finance the loan to an affiliate in country i. The third line is also concerned with internal debt but reports the contribution of pure profit shifting where a loan is given to the affiliate without increasing external debt.[1] The fourth line reports the cost of capital financed with equity where r is the company-specific rate of return on equity. The fifth line, finally, captures cost of borrowing in addition to the market lending rate such as agency cost, for instance.[2] The additional cost of borrowing is assumed to increase with the various types of debt in the model.[3] Note that we assume that the additional cost of borrowing of affiliate i is increasing not only in the share of capital financed with external debt λ_{ji}. In fact, similar to Mintz and Smart (2004) where internal borrowing involves

[1]Note that the interest rate for the internal loan is set equal to the external lending rate. This amounts to the assumption that the arm's length principle applies to the remuneration of internal loans.

[2]The corporate finance literature (see Tirole, 2006, for an overview) justifies the existence of those additional cost of debt on several grounds. A first set of arguments refers to the possible cost of financial distress including bankruptcy (Kraus and Litzenberger, 1973; Scott, 1976) as well as agency costs related to the conflict between debtors and creditors (Jensen and Meckling, 1976; Myers, 1977). Another strand of the literature (e.g., Aghion and Bolton, 1989; Hart, 1988), emphasizes the role of agency costs between shareholders and management. From this perspective, some debt might be useful to ensure control rights of investors in bad states, for instance, if a firm goes bankrupt. But, since equity allows the manager to control the corporation in good states, a tax-induced increase in the debt-to-asset ratio relative to the optimal level would imply an inefficiency which contributes to the additional cost of borrowing.

[3]The additional cost of borrowing function is assumed to be convex. More specifically, we assume: $\frac{\partial c_i}{\partial \lambda_{ji}} > 0$, $\frac{\partial c_i}{\partial \mu_{ji}} > 0$, $\frac{\partial^2 c_i}{\partial \lambda_{ji}^2} > 0$, $\frac{\partial^2 c_i}{\partial \mu_{ji}^2} > 0$.

deadweight costs, we assume that the additional cost of borrowing will also increase in the share of internal debt μ_{ji} as this also implies a decline in the equity share of the affiliate, *ceteris paribus*. The first-order conditions are

$$\frac{\partial \pi}{\partial \lambda_{ji}} = -i_j \left(1 - \tau_i\right) k_i + r k_i - \frac{\partial c_i}{\partial \lambda_{ji}} k_i \stackrel{!}{=} 0$$

$$\frac{\partial \pi}{\partial \mu_{ji}} = -i_j \left(1 - \tau_i\right) k_i + i_j \left(1 - \tau_j\right) k_i - \frac{\partial c_i}{\partial \mu_{ji}} k_i \stackrel{!}{=} 0.$$

The first of these conditions implies that a loan from affiliate j to affiliate i – financed with an external credit raised in country j – is a function of the corresponding after-tax rate of interest

$$\begin{aligned} \lambda_{ji} &= g_i \left(\quad r - i_j \left(1 - \tau_i\right), \ldots \quad \right), \text{where} \\ \frac{\partial g_i}{\partial i_j \left(1 - \tau_i\right)} &< 0 \quad \text{for} \quad r > i_j \left(1 - \tau_i\right). \end{aligned} \tag{4.1}$$

According to the second condition, a loan from affiliate j to affiliate i – without an increase of external debt – depends on the tax-rate difference

$$\begin{aligned} \mu_{ji} &= h_i \left(\quad i_j \left(\tau_i - \tau_j\right), \ldots \quad \right), \text{where} \\ \frac{\partial h_i}{\partial i_j \left(\tau_i - \tau_j\right)} &> 0 \quad \text{for} \quad \tau_i > \tau_j. \end{aligned} \tag{4.2}$$

By imposing somewhat more structure onto the analysis, we can generate more specific predictions. Consider a simplified cost function where we distinguish three different kinds of debt

$$c_i = c_i \left(\lambda_{ii}, \sum_{j \neq i} \lambda_{ji}, \sum_{j \neq i} \mu_{ji} \right). \tag{4.3}$$

λ_{ii} refers to external debt issued by the affiliate and $\sum_{j \neq i} \lambda_{ji}$ refers to the amount of internal debt refinanced with external debt issued by the lending part of the multinational. $\sum_{j \neq i} \mu_{ji}$ is the amount of internal debt used simply to shift taxable profits.

With this cost function, if lending rates differ, $\sum_{j \neq i} \lambda_{ji}$ is determined by the local tax rate and the lowest lending rate among all locations

$$\lambda_{ji} > 0, \quad \text{where} \quad j = \arg\min_k i_k, \quad \text{and zero otherwise.} \tag{4.4}$$

With this condition, λ_{ji} follows from Equation (4.1).

In contrast, $\sum_{j \neq i} \mu_{ji}$ is determined by the largest tax-rate difference evaluated with the lending rate

$$\mu_{ji} > 0, \quad \text{where} \quad j = \arg\max_k i_k \left(\tau_i - \tau_k\right), \quad \text{and zero otherwise.} \tag{4.5}$$

With this condition, the optimal level of μ_{ji} is determined by Equation (4.2).

4.3 Empirical Implications

The analysis below aims at testing the empirical implications of the model. Basically, our analysis is concerned with the implications of the first-order conditions and considers the empirical determinants of internal debt. Let us

decompose the debt-to-asset ratio D_i of each affiliate i into three components

$$D_i \quad \equiv \quad \lambda_{ii} \quad + \quad \underbrace{\sum_{j \neq i} \lambda_{ji} \; + \sum_{j \neq i} \mu_{ji}}_{ID_i}, \tag{4.6}$$

where the first component is the amount of debt directly raised from external creditors, the second and third components together make up the amount of internal debt (ID_i). Note that our theoretical model – in contrast to most of the existing literature – makes a distinction between internal debt, which is used to minimize cost of capital across capital markets (λ_{ji}), and internal debt (μ_{ji}) which is only used to shift taxable profits. Yet this distinction is generally not observed empirically. Instead, balance-sheet data, like those used in the current study, usually provide figures for D_i and ID_i. However, since the determinants for λ_{ji} and μ_{ji} differ, whether internal debt is driven by the shifting of taxable profits or by the minimization of the cost of capital becomes an empirical question that can be answered by an analysis of the predictive power of the respective determinants.

Abstracting from possible differences in the lending rate, the share of capital of an affiliate i held by corporation k financed with internal debt $ID_{i,k}$ should be a function of the local tax rate τ_i and the maximal tax-rate difference $(\tau_i - \tau_k^{min})$ with regard to all other affiliates in the multinational group (τ_k^{min} is the lowest host country tax rate among all affiliates of the group as implied by Equation (4.5)). In other words, the theory suggests not only to take account of the local tax rate faced by an affiliate in order to capture the standard tax shelter of debt finance. Instead, we should also take account of the tax-rate

difference to the lowest tax rate among all affiliates of a multinational group as this determines the potential tax savings from profit shifting.[4]

4.4 Data and Investigation Approach

A basic problem in the empirical analysis of the tax effects on the capital structure is to find a setting with sufficient empirical variation in the incentives generated by the tax system. In the current study we utilize a micro-level panel dataset of German multinationals that offers substantial variation in three dimensions:

1. A first dimension relates to the international perspective, as the dataset reports the capital structure of each of the foreign affiliates of a multinational that operates in various countries. While the database considers the multinationals' activities globally, the empirical analysis is based on a sample of 175 countries for which reliable information with regard to corporate income taxation is available.

2. Another dimension that offers variation in the taxing conditions is the time dimension. The panel data covers the multinationals' activities as well as the taxing conditions on an annual basis in the period from 1996 until 2005.

[4]Similarly, but based on a specific additional cost of debt function that does not distinguish between internal and external debt, Huizinga et al. (2008) suggest to use a weighted average of all tax-rate differences within the group.

3. The third dimension is related to the heterogeneity of the affiliates that vary in the tax-rate difference relative to the lowest level of the tax rate observed among all affiliates in the group. Note that this type of variation refers to each individual affiliate in the dataset.

In order to test the empirical implications as outlined in the previous section, we employ a micro-level dataset for German multinationals that is taken from a comprehensive annual database of foreign direct investment positions of German enterprises (MiDi) provided by the Deutsche Bundesbank. The data provide information about each foreign affiliate's balance sheet and some further information about the ownership and about the German investor. Each German multinational has to report its foreign assets, including both directly and indirectly held FDI, if it is above some lower threshold level.[5] Basically, the estimation sample comprises balance-sheet information of virtually all German outbound investments from 1996 to 2005, regardless of the degree of ownership.

With regard to the lending part of internal debt, the dataset distinguishes internal debt received from the parent as well as internal debt received from

[5]Data collection is enforced by German law, which determines reporting mandates for international transactions as part of the Foreign Trade and Payments Regulation. Since 2002 FDI has to be reported if the participation is 10% or more and the balance-sheet total of the foreign object is above 3 million euro. For details see Lipponer (2007). Though previous years showed lower threshold levels, we apply this threshold level uniformly for all years in the panel.

other foreign affiliates.[6] This allows us to restrict the focus of the empirical analysis even more closely to internal loans granted as well as received by foreign affiliates and to exclude internal loans by the German parent. This is important, since, given the high German tax rates, under standard conditions there is little reason to expect that German parents use internal loans to foreign affiliates in order to shift foreign profits into Germany.[7]

As we focus on internal loans issued and received by foreign affiliates, we implicitly assume that the taxing conditions for these foreign affiliates are decisive for the multinational. This might be questioned in a context where the parent company would have to pay taxes on worldwide profits, as in a regime of foreign tax credit. However, note that for German multinationals as well as for most other European multinationals the exemption principle applies. Moreover, no interest allocation rules apply in Germany. Hence, the German case might be much more straightforward as compared to the U.S. case, where foreign earnings are taxed subject to a foreign tax credit and, furthermore, interest allocation rules apply (see Altshuler and Mintz, 1995). Yet the exemption principle might not be fully effective in the German case, for instance, due to Controlled Foreign Corporation (CFC) rules; we will come back to this issue below.

[6]The corresponding position is "...liabilities to affiliated enterprises ... outside of Germany" (see Lipponer, 2007).

[7]The German parent instead might borrow internally from foreign low-tax affiliates. However, this information is not available in the dataset.

Since taxing conditions vary in more than one dimension, we can further exploit the micro-level structure of the dataset and explore the capital structure of multinationals using panel-data techniques. Following our discussion of the empirical implications, the analysis is based on regressions of the following type

$$ID_{i,k,t} = a_1(\tau_{i,t} - \tau_{k,t}^{min}) + a_2\tau_{i,t} + a_3 x_{i,k,t} + \varphi_t + \gamma_k + \varepsilon_{i,k,t}, \tag{4.7}$$

where $(\tau_{i,t} - \tau_{k,t}^{min})$ is the affiliate-specific tax-rate difference with regard to the lowest tax rate within the group, and $\tau_{i,t}$ is the statutory tax rate applicable to affiliate i. The dependent variable, ID, is defined by the amount of internal loans received by a foreign affiliate i from other foreign affiliates within the multinational group k divided by total capital.

Note that the basic specification includes time effects, φ_t, possibly capturing differences in the treatment of foreign earnings in the home country (Germany) of the multinational and other aggregate shocks. The specification also takes account of a specific effect for each multinational group, γ_k. This is important in the current context since group-specific risk would affect the lending rate and the additional cost of borrowing (Desai et al., 2004a). Using group-specific fixed effects also allows us to condition on the international structure of each group. This is crucial since we exploit the differences in the group structure in order to identify tax incentives but do not model the choice of the group structure. We also employ affiliate-specific control variables, $x_{k,i,t}$, which capture some heterogeneity in the borrowing costs across affiliates. Since borrowing costs may vary across industries, we also provide results of specifications that employ industry-specific effects. Finally,

borrowing costs might also be related to country-specific conditions in the lending market such as bankruptcy laws, creditor rights, etc. This would suggest to further include country-specific effects. However, the empirical literature (Desai et al., 2004; Huizinga et al., 2008) usually does not employ those effects, as they entirely remove the cross-sectional distribution.

4.5 Descriptive Statistics

Table 4.1 provides some information about the sample of multinationals. The basic sample includes FDI in 175 countries held by German multinationals, excluding all bi-national corporations with only one foreign affiliate where no internal loans from non-German affiliates can be observed. Nevertheless, this sample covers more than 90% of the total foreign FDI position of Germany. Note that this basic sample is used to describe the profit-shifting incentives for the multinationals. The distribution of internal debt that is empirically investigated, however, is taken from the reduced sample excluding affiliates with zero sales. While this restriction implies a reduction in the number of observations, the idea is to focus on the capital structure of productive affiliates as in the above theoretical model.[8] Nevertheless, since the tax-rate difference with regard to the lowest tax rate observed among all foreign affiliates is determined using the basic sample, we take the tax incentives for internal debt into account in a rather comprehensive way including purely non-productive tax-haven affiliates.

[8]The estimation results proved to be robust against the inclusion of zero-sales affiliates.

Table 4.1: Sample Characteristics

Sample	Observations	Countries	Capital (in bn. €)
(1) Basic sample excl. bi-national corp.	157,184	123.06	4,054
(2) Reduced sample excl. zero sales	128,892	119.01	1,472

Capital consists of registered capital, capital reserves, profit reserves, as well as internal and external debt. The total capital figure is an unweighted annual average for the period from 1996 to 2005. Sample 1 excludes bi-national corporations and comprises all foreign direct investment observations (outbound investment) where corporate tax rate information is available; Sample 2 further excludes all observations reporting no sales. Countries is the average number of countries in the sample where at least one German investment is reported.

As has been discussed above, we employ affiliate- and group-specific indicators of the tax incentives for profit shifting. More specifically, we proceed in two steps. First, we determine for each multinational the lowest corporate income tax rate observed among all of its foreign affiliates; for ease of exposition we will refer to the corresponding affiliate as the *lowest-tax affiliate*. In a second step, we use this group-specific minimum tax rate as the benchmark for the group and compute the tax-rate difference of the host country tax rate with regard to this benchmark for each of the affiliates. As a consequence, high-tax affiliates of a multinational will show large positive tax-rate differences, whereas the tax-rate difference for the lowest-tax affiliate is zero.

Table 4.2 provides some information about which countries typically host the lowest-tax affiliates. The second column lists the number of all affiliates reported in each of the countries. The third column, denoted with $\Delta\tau = 0$, lists

Table 4.2: Geographical Distribution of Affiliates

Country	obs.	$\Delta\tau = 0$	τ	Country	obs.	$\Delta\tau = 0$	τ
Albania	11	0	0.273	Egypt	274	0	0.400
Algeria	47	12	0.324	El Salvador	48	9	0.250
Angola	c)	c)	0.375	Equitorial Guinea	0	0	0.250
Antigua & Barbuda	c)	c)	0.390	Estonia	160	28	0.258
Argentina	938	62	0.341	Ethiopia	4	0	0.425
Armenia	c)	c)	0.240	Faroe Islands	0	0	0.210
Aruba	0	0	0.350	Fiji	0	0	0.335
Australia	2,769	215	0.334	Finland	885	114	0.283
Austria	8,387	1,568	0.331	France	12,928	808	0.369
Azerbaijan	16	4	0.280	French Polynesia	0	0	0.450
Bahamas	18	18	0.000	Gabon	16	0	0.370
Bahrain	40	40	0.000	Gambia	c)	c)	0.350
Bangladesh	55	0	0.350	Georgia	10	7	0.200
Barbados	38	0	0.380	Ghana	23	7	0.333
Belarus	17	5	0.278	Gibraltar	37	0	0.350
Belgium	4,588	232	0.383	Greece	951	64	0.347
Belize	c)	c)	0.290	Greenland	0	0	0.350
Bermuda	210	210	0.000	Grenada	0	0	0.300
Bolivia	26	5	0.250	Guatemala	110	0	0.298
Botswana	0	0	0.250	Guernsey	36	6	0.200
Brazil	3,138	614	0.323	Guinea	0	0	0.350
British Virgin Isl.	94	43	0.135	Guyana	0	0	0.450
Brunei	13	0	0.300	Haiti	c)	c)	0.350
Bulgaria	309	83	0.293	Honduras	28	8	0.296
Cambodia	c)	c)	0.200	Hong Kong	2,117	1,339	0.165
Cameroon	19	0	0.385	Hungary	3,635	2,478	0.193
Canada	2,467	75	0.413	Iceland	16	0	0.258
Canary Isl.	10	7	0.350	India	1219	46	0.369
Cayman Isl.	589	589	0.000	Indonesia	548	72	0.300
Ceuta and Melilla	0	0	0.350	Iran	78	7	0.453
Chile	572	325	0.156	Ireland	1,760	1,475	0.108
China	3,703	286	0.330	Isle of Man	43	40	0.100
Columbia	341	0	0.350	Israel	179	7	0.358
Congo	10	0	0.440	Italy	7,752	107	0.423
Costa Rica	75	6	0.300	Jamaica	9	0	0.333
Côte d'Ivoire	43	0	0.350	Japan	2,667	14	0.453
Croatia	414	89	0.265	Jersey	75	7	0.200
Cyprus	358	80	0.215	Jordan	8	0	0.370
Czech Republic	4,792	1,055	0.326	Kazakhstan	44	5	0.300
Democra. Rep. of Congo	14	0	0.425	Kenya	83	0	0.318
Denmark	2,092	313	0.312	Korea (South)	1,056	178	0.299
Dominica	c)	c)	0.300	Kuwait	17	0	0.550
Dominican Republic	59	7	0.250	Kyrgyzstan	9	0	0.275
Ecuador	124	10	0.315	Latvia	153	76	0.221

obs.: total number of affiliates (pooled in the period from 1996 until 2005); $\Delta\tau = 0$: number of affiliates with a tax-rate difference equal to zero, *i.e* number of observations identified as low-tax affiliates; τ: average host country statutory tax rate; c) confidential data.

Table 4.2: Geographical Distribution of Affiliates, cont.

Country	obs.	$\Delta\tau = 0$	τ	Country	obs.	$\Delta\tau = 0$	τ
Lebanon	28	18	0.125	Senegal	11	0	0.344
Lesotho	0	0	0.360	Seychelles	0	0	0.400
Libya	50	0	0.460	Sierra Leone	0	0	0.429
Liechtenstein	68	43	0.200	Singapore	2,191	619	0.245
Lithuania	163	124	0.224	Slovak Rep.	1,164	365	0.306
Luxembourg	2,234	386	0.351	Slovenia	388	117	0.250
Macau	6	0	0.147	Solomon Isl.	0	0	0.320
Macedonia	33	26	0.150	South Africa	1,649	39	0.393
Malawi	7	0	0.363	Spain	7,478	554	0.350
Malaysia	1,094	225	0.284	Sri Lanka	59	11	0.355
Maldives	4	4	0.000	St Kitts & Nevis	[c])	[c])	0.381
Malta	96	11	0.350	St Lucia	0	0	0.332
Morocco	211	16	0.350	St Vincent	[c])	[c])	0.400
Mauritania	0	0	0.200	Sudan	0	0	0.494
Mauritius	52	4	0.300	Surinam	0	0	0.379
Mexico	1,849	107	0.339	Svalbard	0	0	0.280
Moldova	28	9	0.226	Swaziland	9	0	0.345
Mozambique	5	0	0.371	Sweden	2,784	716	0.280
Myanmar	6	6	0.300	Switzerland	7,851	4,750	0.245
Namibia	12	8	0.350	Syria	0	0	0.470
Nepal	[c])	[c])	0.250	Taiwan	620	84	0.250
Netherlands	8,661	1,114	0.345	Tanzania	22	0	0.310
Netherlands Antilles	121	5	0.363	Thailand	735	105	0.300
New Caledonia	5	0	0.300	Trinidad & Tobago	34	0	0.335
New Zealand	449	11	0.330	Tunisia	103	15	0.346
Nicaragua	23	0	0.285	Turkey	1,245	94	0.360
Nigeria	91	16	0.300	Turks & Caicos Isl.	0	0	0.000
Northern Mariana Isl.	0	0	0.350	Uganda	18	0	0.300
Norway	1,190	298	0.280	Ukraine	246	22	0.290
Oman	23	15	0.250	United Arab. Emir.	103	8	0.333
Pakistan	160	7	0.356	United Kingdom	13,145	3,834	0.307
Panama	97	0	0.342	Uruguay	167	39	0.310
Papua New Guinea	0	0	0.265	US Virgin Isl.	0	0	0.385
Paraguay	41	17	0.300	USA	16,775	1,636	0.412
Peru	196	13	0.294	Uzbekistan	4	0	0.275
Philippines	364	16	0.329	Vanuatu	0	0	0.000
Poland	5,198	2,165	0.299	Venezuela	312	22	0.340
Portugal	1,922	370	0.319	Vietnam	79	0	0.310
Qatar	4	0	0.350	West Bank/Gaza	[c])	[c])	0.200
Romania	645	215	0.293	Yemen	[c])	[c])	0.345
Russia	1,165	305	0.301	Yugoslavia	96	39	0.203
Rwanda	0	0	0.350	Zambia	6	0	0.350
Samoa	0	0	0.346	Zimbabwe	21	0	0.338
Saudi Arabia	165	13	0.355	*All Countries*	*157,155*	*31,491*	*.302*

obs.: total number of affiliates (pooled in the period from 1996 until 2005); $\Delta\tau = 0$: number of affiliates with a tax-rate difference equal to zero, *i.e* number of observations identified as low-tax affiliates; τ: average host country statutory tax rate. [c]) confidential data.

the number of observations where the respective country hosts the lowest-tax affiliate. Reflecting the importance of these countries' export markets for the German multinationals, most affiliates are reported in the U.S., in the U.K., in France, and in the Netherlands. But, the table also shows that if an affiliate is located in a tax haven such as Cayman Islands, Bermuda, Bahrain, or Bahamas, it is always the lowest-tax affiliate in the group.

Table 4.3: Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Statutory tax rate	.330	.073	0	.600
Tax-rate difference	.121	.102	0	.550
Tax-rate difference with CFC rules[a])	.055	.050	0	.300
Total leverage	.586	.274	0	1
Internal debt				
– total	.241	.260	0	1
– excluding loans				
from German parent (ID)	.106	.196	0	1
Loss carry-forward	.309	.462	0	1
Tangibility	.261	.254	0	1
ln(Sales)	9.82	1.43	[b])	[b])

Panel comprises 10 years, 128,892 ([a]) 107,238) observations. The tax-rate difference is the difference between the statutory tax rate at the affiliate's location and the minimum tax rate within the multinational group. [a]) additionally takes the German CFC rules into account (see Section 4.6.1). [b]) confidential data.

Table 4.3 displays descriptive statistics for the variables used in the empirical analysis. While the tax-rate variable is measured at the level of the host country, all other variables including the tax-rate difference vary by affiliate. A first impression of the relative importance of internal debt as a means of shifting taxable profits, as compared to the standard tax shelter from debt,

is given by the three different borrowing variables. While the total leverage is almost 60%, internal debt makes up only a capital share of 24.1%. This figure still includes internal loans from the German parent to foreign affiliates. Given Germany's high tax rate, it is quite unlikely that these loans are related to profit shifting. Internal loans received from other foreign affiliates amount only to an average capital share of 10.6%. Yet this share is possibly highly sensitive to taxing conditions.

Table 4.4: Leverage and Internal debt

	basic sample	multinationals with an affiliate in a low-tax country		lowest-tax affiliates
		10%-percentile	5%-percentile	$\Delta\tau = 0$
Variable	(1)	(2)	(3)	(4)
Total leverage	.586	.551	.547	.548
External debt	.344	.301	.307	.342
Internal debt				
– total	.241	.250	.240	.205
– excluding loans from German parent	.106	.149	.162	.078
Observations	*128,892*	*57,049*	*31,919*	*31,521*

10 % percentile (5%-percentile): all groups with an affiliate located in one of the low-tax countries, where a low-tax country is defined as a country with a statutory tax rate below the 10% (5%) percentile; $\Delta\tau = 0$ refers to all those foreign affiliates with the lowest tax rate within the group.

4.6 Results

Table 4.4 provides some first descriptive evidence for the impact of taxes on internal debt. It displays the share of capital financed with different kinds of debt for the basic sample as well as for various sub-samples. For ease of comparison, Column (1) repeats the mean figures reported above. Columns (2) and (3) report the share of internal debt observed among the affiliates of those multinational corporations that hold at least one affiliate in a low-tax country. Column (2) defines the low-tax country as a country with a tax rate below the 10% percentile of the tax-rate distribution among the countries, Column (3) uses the even stricter definition based on the 5% percentile of the tax-rate distribution. If corporations use internal debt for profit shifting, we should expect the mean to be higher for the affiliates of these multinational corporations. Indeed, the capital share of internal debt (excluding loans obtained from the German parent) is higher by a factor of 1.4 to 1.5, indicating that the use of internal debt is much more prevalent among multinationals with affiliates in low-tax countries. Conversely, the affiliate experiencing the lowest tax rate within the group should display a much lower capital share of internal debt. As reported in Column (4), the mean capital share for those affiliates is only three quarters of the overall mean. This further confirms the theoretical view, which predicts that internal debt is small as there are few incentives to shift profits out of low-tax countries.

Table 4.5 reports regression results for a basic specification following Equation (4.7). In order to control for the group structure and group-specific

risks, all estimations employ fixed effects for the company group. Moreover, time dummies are included in order to capture differences in the taxation of the parent. The standard errors are computed taking account of a potential problem with grouped error terms. Following Bertrand et al. (2004) we cluster at the level of the year-country cells, since the statutory tax rate only varies across these cells. Given the limited information in the balance sheet of the affiliates, only three affiliate-level control variables are included. Since the effective tax reduction from using debt might be zero if an affiliate carries forward any losses for tax purposes (see MacKie-Mason, 1990), we include a variable indicating whether a loss carry-forward is reported. We also include the sales of the affiliate, because a larger cash flow might be associated with less credit-market constraints, and hence, might facilitate access to external credit that replaces internal debt. Finally, tangibility, defined as the ratio of fixed assets to total assets, is used as a further determinant of the financial structure.[9]

Throughout most specifications, the tax-rate difference shows a significant positive effect, whereas the host country tax rate proves insignificant. This confirms the theoretical prediction in the sense that corporations use internal debt to shift taxable profits. At the same time, the insignificance of the tax rate indicates that internal loans between foreign affiliates do not play an important role in minimizing the cost of capital. Given the magnitude of the

[9]Higher tangibility, on the one hand, is associated with an easier access to additional debt because firms can easily borrow against fixed assets. Agency costs of debt are then reduced by the value of collateral. On the other hand, the value of interest deduction may be crowded out by the non-debt tax shields generated by depreciation and investment tax credits related to tangible assets (DeAngelo and Masulis, 1980).

other types of debt (cf. Table 4.3), this function might well be carried out by loans from the German parent or by external debt.

Qualitatively, there is not much difference between specifications. Column (4) includes a control for a loss carry-forward as the incentive to save taxes is reduced in this case. The positive sign might reflect the support of financially weaker firms by means of internal loans (Gopalan et al., 2007). According to Columns (5) and (6), the results prove robust also against the inclusion of controls for sales and tangibility. The specification in Column (7) additionally employs industry-level dummies using a classification of affiliates according to 71 industries. This might help to further control for differences in the financial risk related to an affiliate's activities. Column (8) uses controls for the host country in order to make sure that no country-specific characteristics are driving the results. While the results prove to be robust, one might, however, be concerned that some part of the variation is swallowed up by the country-specific dummies.

Quantitatively, we see from the preferred Specification (7) that a ten percentage point increase in the tax-rate difference with regard to the group-specific lowest-tax affiliate leads to an approximately 0.73 percentage point higher internal-debt ratio. Expressed as a semi-elasticity, an increase of the tax-rate difference by ten percentage points triggers a response in the corresponding capital share by 6.9%. This figure is within the range of existing estimates of the tax sensitivity of multinationals' debt. Corresponding calculations based on the estimates by Desai et al. (2004a) yield a semi-elasticity of 10.2% (5.5%) for the sensitivity of an affiliate's capital share of internal (external)

Table 4.5: Basic Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax-rate diff. within comp. group	.073 **		.082 **	.081 **	.082 **	.081 **	.073 **	.066 **
	(.018)		(.019)	(.020)	(.020)	(.020)	(.019)	(.018)
Statutory tax rate		.067 **	-.011	-.020	-.012	-.014	-.009	-.052 **
		(.020)	(.026)	(.025)	(.025)	(.025)	(.024)	(.026)
Loss carry-forward				.032 **	.031 **	.032 **	.034 **	.033 **
				(.002)	(.003)	(.002)	(.002)	(.002)
ln(Sales)					-.004 **	-.004 **	-.001	-.005 **
					(.001)	(.001)	(.001)	(.001)
Tangibility						-.021 **	-.002	-.0001
						(.005)	(.005)	(.004)
Industry effects	no	no	no	no	no	no	yes	yes
Host-country effects	no	no	no	no	no	no	no	yes
R-squared	.231	.231	.231	.236	.236	.236	.255	.269

Dependent variable: internal-debt ratio related to loans from other, non-German affiliates. Robust standard errors allowing for country-year cluster effects in parentheses. An asterisk denotes significance at 10% level, two asterisks denote 5%. 128,892 observations, 4,479 firms. All estimates include a full set of group-level and time fixed effects.

debt with regard to the tax rate. Huizinga et al. (2007), employing a tax-rate difference variable in order to predict the total debt-to-asset ratio of foreign affiliates, report weaker effects that point at semi-elasticities of approx. 2.1% or lower, depending on the size of the affiliate.[10]

The rather small tax effects suggest that there are some important costs or restrictions which prevent corporations from heavily using internal debt for profit shifting. For instance, host countries may enact specific policies that restrict the use of internal debt for tax-planning purposes. In particular, withholding taxes on interest payments or thin-capitalization rules come to mind. While it proved impossible to augment the current analysis based on 175 countries with information about those rules, Huizinga et al. (2008) note that withholding taxes on interest payments are mainly zero within Europe, where most of the foreign direct investment of German multinationals is located. Therefore, it seems unlikely that withholding taxes can explain the low tax sensitivity. With regard to thin-capitalization rules, we should note that the current analysis is only concerned with internal loans received from other foreign affiliates. Thin-capitalization rules would, however, also refer to related-party debt that is issued by the parent. Given that the share of internal debt owed to the parent is 13.5% as compared to 10.6% for the share of debt related to other foreign affiliates, in many cases foreign affiliates could lower the amount of debt owed to the parent in order to avoid the denial of interest deduction. If foreign affiliates are hesitant to do so, we are back to the question of what prevents foreign affiliates to rearrange the capital

[10]Since Huizinga et al. (2008) use a weighted average of bilateral tax-rate differences, one obtains even smaller effects when taking into account a weighting factor smaller than 1.

structure accordingly. However, not only host countries' tax policies but also the tax policy in the parent country might affect the tax incentive for the shifting of taxable profits within the multinational if the exemption of foreign profits is limited.

4.6.1 Taking Account of CFC Rules

While we have focused on internal debt of firms where we observe positive sales, some affiliates' income may be defined as passive income according to Germany's controlled foreign corporation (CFC) rules.[11] Passive income comprises, for example, royalties, dividends, or interest earnings. Indeed, our model implies that low-tax affiliates earn interest income. German tax authorities, however, grant full tax exemption of an affiliate's earnings only if they stem from active business operations. In particular, if interest income of the low-tax affiliate is not reinvested it might be classified as passive income under this rule.[12] If the affiliate's income is defined as passive income and the host country tax level is below 30% (since 2001, 25%), income is immediately taxable in Germany; even if it is not repatriated (*Hinzurechnungsbesteuerung*, see 10, AStG). To take account of a possible impact of the CFC rules, we change the computation of the tax-rate difference with regard to the lowest-tax affiliate within the group and consider only tax-rate

[11]Sec.7–Sec.14 Außensteuergesetz (AStG, International Transactions Tax Act). Accordingly, the US legislation refers to Subpart F rules.

[12]The German legislation explicitly defines income which is accepted as active income (8 AStG).

differences with regard to host countries with a tax rate above 30% (25%). The resulting tax-rate difference is, as expected, much smaller, and shows a mean of 5.5% – compared with the previous figure of 12.1% (see Table 4.3). The empirical results obtained with this modified tax–rate difference are depicted in Table 4.6.

While the number of observations is reduced slightly, the results are qualitatively quite similar to the basic results presented above. Again, the statutory tax rate does not prove significant. Only the tax-rate difference exerts a positive impact, with a coefficient that is quite similar to the basic findings (0.08 instead of 0.073). Also the semi-elasticity is only 7.4% compared to 6.9%. This indicates that the low tax sensitivity of internal debt cannot be attributed to CFC rules.[13]

Besides CFC rules, another possible tax issue is the taxation of repatriated foreign profits. As noted above, Germany generally follows the exemption principle: as of 1996, at the beginning of the period analyzed, this is documented by 72 double-taxation treaties covering all the major host countries for German FDI (Bundesfinanzministerium, 2008). These treaties apply to about 80% of the observations in the basic sample and to an even larger share of the affiliates with positive sales that constitute the estimation sample. Nevertheless, a significant share of low-tax countries do not have double-taxation treaties with Germany such that the German parent does not enjoy tax exemption. However, this group of countries largely overlaps with the

[13]This fits with some recent literature arguing that the US's anti-abuse controlled foreign corporation (CFC) provisions are not effective (e.g., Mutti and Grubert, 2006).

Table 4.6: CFC Rules

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax-rate diff. (CFC)	.108 **	.093 **	.087 **	.090 **	.090 **	.080 **	.078 **
	(.040)	(.037)	(.037)	(.037)	(.037)	(.037)	(.036)
Statutory tax rate		.017	.017	.024	.019	.014	-.003
		(.050)	(.049)	(.049)	(.050)	(.047)	(.042)
Loss carry-forward			.032 **	.032 **	.032 **	.034 **	.033 **
			(.003)	(.003)	(.003)	(.003)	(.002)
ln(Sales)				-.003 **	-.003 **	.0001	-.005 **
				(.001)	(.001)	(.001)	(.001)
Tangibility					-.017 **	.002	.002
					(.006)	(.006)	(.005)
Industry effects	no	no	no	no	no	yes	yes
Host-country effects	no	no	no	no	no	no	yes
R-Square	.245	.231	.250	.250	.250	.268	.283

Dependent variable: internal-debt ratio related to loans from other, non-German affiliates. Robust standard errors allowing for country-year cluster effects in parentheses. An asterisk denotes significance at 10% level, two asterisks denote 5%. 107,238 observations, 4,304 firms. All estimates include a full set of group-level and time fixed effects.

countries that are subject to the above CFC rules. Therefore, also the lack of double-taxation treaties cannot explain the low tax sensitivity.

4.6.2 Majority-Owned Subsidiaries

Another possible explanation of why firms experience high costs when adjusting the capital structure is related to the additional cost of using internal debt. While additional costs of debt are not directly observed in the dataset, some of their potential determinants are. Desai et al. (2004b) argue that shared ownership of foreign affiliates is associated with coordination costs which impede tax-efficient structuring of worldwide operations. This view is supported by Mintz and Weichenrieder (2005), who find a higher tax-rate sensitivity of internal debt for wholly-owned subsidiaries. In terms of the above theoretical framework, this would imply that the additional costs of borrowing related to internal debt are lower and exhibit a smaller gradient when the ownership share is higher. Hence, we might expect an affiliate to use more internal debt and to display a higher tax sensitivity of internal debt if the ownership share of the parent is higher.

Since not only the level of internal debt will be different with a higher degree of ownership but also the sensitivity with regard to the tax-rate differential and all other determinants of internal debt, Table 4.7 reports results for a sample where only majority-owned subsidiaries are included. In fact, the tax sensitivity is positive and larger as compared to the results in Tables 4.5 and 4.6. Taking the results from Specification (6), we find that the coefficient of

Table 4.7: Majority-Owned Subsidiaries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax-rate diff. (CFC)	.129 **	.105 **	.099 **	.104 **	.104 **	.095 **	.086 **
	(.041)	(.042)	(.041)	(.041)	(.041)	(.041)	(.041)
Statutory tax rate		.027	.024	.033	.032	.023	-.008
		(.053)	(.052)	(.052)	(.053)	(.050)	(.047)
Loss carry-forward			.034 **	.033 **	.033 **	.035 **	.035 **
			(.003)	(.003)	(.003)	(.003)	(.003)
ln(Sales)				-.004 **	-.004 **	-.001	-.006 **
				(.001)	(.001)	(.001)	(.001)
Tangibility					-.004	.011	.010
					(.007)	(.007)	(.006)
Industry effects	no	no	no	no	no	yes	yes
Host-country effects	no	no	no	no	no	no	yes
R-Square	.258	.258	.263	.264	.264	.281	.295

Dependent variable: internal-debt ratio related to loans from other, non-German affiliates. All minority owned-affiliates are excluded. Robust standard errors allowing for country-year cluster effects in parentheses. An asterisk denotes significance at 10% level, two asterisks denote 5%. 94,314 observations, 4,050 firms. All estimates include a full set of group-level and time fixed effects.

the tax-rate differential is about 0.095 for majority-owned subsidiaries. This indicates that a ten percentage point increase in the tax-rate difference with regard to the lowest-tax affiliate leads to an approximately 0.95 percentage point higher internal-debt ratio. Expressed as a semi-elasticity evaluated at the mean for majority-owned subsidiaries, a tax-rate change by ten percentage points triggers a response in the corresponding debt ratio by about 8.3% – which is only slightly higher than the basic result above (6.9%).

4.7 Conclusions

We have set up a model of a multinational corporation that uses internal debt for two purposes. The first is to minimize cost of capital by issuing external debt in countries where financial conditions are favorable and transferring the funds via internal loans. The second is to shift taxable profits to low-tax jurisdictions. The theoretical analysis suggests that – due to the first purpose – the use of internal debt will be affected by the host country's statutory corporation tax rate. The second purpose, however, causes internal debt to depend on the tax-rate differential between the lending and the borrowing firms within the multinational group. Only this latter relationship is indicative of profit shifting. Therefore, existing empirical evidence on the tax-rate sensitivity of the multinational capital structure even if related to internal debt does not reveal its role for the shifting of taxable profits.

Our empirical investigation provides direct evidence on whether and to what

extent internal debt is used for tax-planning purposes. The analysis makes use of a large micro-level panel dataset of virtually all German multinationals made available for research by the German Central Bank. A special feature of this dataset is that it includes information about the actual amounts of internal debt used by the foreign affiliates, distinguished into loans from the parent and loans received from other foreign affiliates. This comprehensive dataset allows us to exploit differences in the taxing conditions in 175 countries, including many low-tax countries, over a period of ten years. For each affiliate within the multinational group, we calculate the appropriate tax-rate difference relative to the lowest tax rate observed among all foreign affiliates and use this to predict the amount of internal debt.

The empirical results confirm a robust and significant positive impact of tax-rate differences within the multinational group on the use of internal debt, supporting the view that internal debt is used to shift taxable profits to low-tax countries. The host country tax rate proves insignificant, however, suggesting that internal debt is not used to minimize the cost of capital. Nevertheless, our findings indicate that the magnitude of tax effects is rather small. Further analysis shows that the low tax sensitivity is not caused by the German CFC rules. While an analysis focusing on majority-owned subsidiaries points at slightly larger effects, the tax sensitivity remains modest.

To conclude, our findings are indicative of substantial costs of adjusting the multinational's capital structure for means of profit shifting. As a consequence, if profit shifting is important, as the literature indicates, multinationals seem to take resort to alternative strategies of tax planning. Moreover, the

results suggest that restrictions imposed by tax policy on the capital structure of multinationals would not substantially curb the shifting of taxable profits but would rather result in higher cost of capital.

Datasources and Definitions

Firm-level data are taken from the micro-level dataset of the Bundesbank, see Lipponer (2007), for an overview. The dependent variable, ID, is determined by a balance-sheet position capturing liabilities of foreign affiliates to other foreign affiliates within the multinational group divided by the affiliate's total stock of capital. The latter is defined as the sum of registered capital, capital reserves, profit reserves, as well as internal and external debt.

Corporate taxation data are taken from the International Bureau of Fiscal Documentation, and from surveys provided by the tax advisory companies Ernst&Young, PwC, and KPMG. The statutory tax rate variable contains statutory profit tax rates modified by applicable restrictions on interest deductions. The data covers a group of 175 countries in a period of ten years from 1996 until 2005.

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Eidesstattliche Versicherung

Ich versichere hiermit eidesstattlich, dass ich die vorliegende Arbeit selbständig und ohne fremde Hilfe verfasst habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sowie mir gegebene Anregungen sind als solche kenntlich gemacht. Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

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