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**Working Paper**

## Who Cares about Corporate Taxation? Asymmetric Tax Effects on Outbound FDI

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# Working Papers

## Who Cares about Corporate Taxation? Asymmetric Tax Effects on Outbound FDI

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Ifo Working Paper No. 59

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## Who Cares about Corporate Taxation? Asymmetric Tax Effects on Outbound FDI\*

### Abstract

This paper investigates whether different types of FDI are asymmetrically affected by corporate taxation. We classify investment projects according to several characteristics such as the general motivation for FDI, the type of business activity, or the degree of internationalization of the multinational. Subsequently, we analyze how local taxes influence the number of German outbound investments in European countries. The analysis reveals significant asymmetries with regard to tax effects: vertically integrated investments are more sensitive to host-country taxation than horizontal FDI; larger tax-rate elasticities are estimated if business activities are considered highly mobile; in accordance with profit-shifting arguments, subsidiaries of more internationalized companies are less tax responsive to host taxation.

JEL Code: F21, F23, H25, H32.

Keywords: FDI, corporate taxation, multinational company, count data.

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# 1 Introduction

Taxes are an important determinant of foreign direct investment (FDI) decisions of multinational firms. De Mooij and Ederveen (2006) survey numerous research papers on FDI and taxes and find in a meta analysis, based on 31 empirical studies, a typical tax-rate semi-elasticity of about -2.1. Yet the estimated elasticities vary significantly between considered studies. This may be explained by different empirical specifications and different data (for surveys, see Hines, 1999; De Mooij and Ederveen, 2003, 2006). However, asymmetric tax effects are presumably an inherent characteristic of heterogeneous FDI. Therefore, this investigation classifies FDI according to different criteria. It contributes to the understanding of asymmetric tax effects by separately analyzing and comparing behavioral responses of different types of FDI.

Previous research indicates that tax effects differ according to FDI characteristics. Mutti and Grubert (2004), for example, find higher tax elasticities for export-oriented foreign affiliates of US multinationals, compared to foreign affiliates serving mainly the host market. Stöwhase (2005) examines the tax-rate sensitivity of bilateral foreign direct investment flows in the EU and finds a higher tax-rate sensitivity for the service sector compared to the manufacturing sector and the primary sector, which is not affected at all.

The tax competition literature generally suggests that countries compete for firms, capital, and paper profits. This paper's analysis considers the first aspect. In particular, we analyze on the basis of a count data model, how the number of German outbound investments in European countries is affected by corporate tax levels of the host countries. For this purpose, we use the MiDi (Microdatabase Direct Investment) database provided by the German central bank (*Deutsche Bundesbank*). Since MiDi is an affiliate-level database of German FDI positions, we can exploit micro-level information to classify foreign direct investments accordingly. We identify three major aspects which can cause significant asymmetries in the tax elasticity of FDI: first, the motivation for FDI; second, the type of the underlying business activity; third, the degree of internationalization within

a multinational group. For each category, we analyze the determinants of the number of German wholly-owned outbound FDI positions per country and year in 30 European countries during the period 1989 to 2005. Moreover, we employ different tax measures, which may or may not be relevant for respective types of FDI.

The analysis of all FDI observations suggests a tax-rate elasticity of  $-.68$  (a corresponding semi-elasticity of  $-2.17$ ). This finding is remarkably close to results provided by previous literature.<sup>1</sup> Considering the heterogeneity of FDI, however, the empirical results confirm theoretical expectations and reveal significant differences in tax-rate sensitivities. First of all, our analysis suggests that vertically-integrated FDI projects in manufacturing are more responsive to corporate taxation than horizontal FDI. Secondly, we find asymmetric tax effects between different business activities. For instance, financial service subsidiaries, which are expected to be highly mobile, are significantly more sensitive compared to other industries. In addition, we only find an impact of depreciation allowances for industries associated with a comparatively high fraction of fixed assets. Finally, in accordance with profit-shifting arguments, an increasing level of internationalization is associated with a decreasing tax sensitivity. Our results emphasize how tax policy can influence not only the quantity of foreign investments but also the composition of FDI. The findings may also contribute to an understanding of governments' behavioral responses to tax competition, depending on countries' existing FDI composition.

The paper is organized as follows: in Section 2, we examine the sources of tax asymmetries. Section 3 provides an overview on the empirical estimation strategy and offers information about the data and the FDI classifications. Section 4 presents the regression results. Finally, Section 5 concludes.

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<sup>1</sup>Analyzing existing FDI papers, Hines (1999) identifies an average tax-rate elasticity of  $-.60$ . De Mooij and Ederveen (2006) identify a typical semi-elasticity of about  $-2.1$ .

## 2 Theoretical Considerations and Existing Literature

Several studies find asymmetric tax effects related to differences in systems of international cross-border taxation (e.g., Hines, 1996; Egger, Loretz, Pfaffermayr, and Winner, 2006).<sup>2</sup> Other studies consider bilateral tax treaties, which are set up to reduce cross-border withholding taxes and double taxation (e.g., Blonigen and Davies, 2004; Egger, Larch, Pfaffermayr, and Winner, 2006).

We agree that institutional differences between countries are important. Our paper, however, emphasizes inherent characteristics of FDI that determine asymmetries. We divide FDI into groups according to three attributes: the motivation of FDI, the type of business activity, and the degree of internationalization. Our classification may specifically depend on several underlying questions: are corporate taxes of different importance in firm's weighting schemes? Do other location factors asymmetrically outweigh corporate taxation? Do firms have different profit-shifting opportunities to avoid taxation? Are firms asymmetrically mobile? Do relocation costs differ?

**Motivation:** Economic theory distinguishes between vertically and horizontally motivated FDI. A vertically integrated multinational divides the production process and locates parts of its value chain in different countries (Helpman, 1984, 1985). Horizontal FDI is motivated by an additional or more favorable market access (Markusen, 1984, 2002). Since the motivation for horizontal FDI is market seeking rather than differences in factor prices, we expect corporate taxes to be of secondary importance. We do, however, expect tax levels to unambiguously affect the decision on whether the multinational serves the respective market at all, i.e. the location versus export decision. In contrast, the motivation for vertical FDI lies mainly in factor-price differences. Therefore, we expect vertically motivated FDI to be more responsive to local taxes than horizontal FDI.

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<sup>2</sup>Home countries of parent companies either tax repatriated foreign profits—whereas taxes paid abroad can be credited (*credit system*), or exempt repatriated foreign profits from taxation (*exemption system*).

Mutti and Grubert (2004) confirm that tax effects differ, depending on the motivation for FDI. If the production is intended to export, they interpret investments as vertical FDI, whereas production for the domestic market is an indication for horizontal FDI. They find higher tax elasticities if the production of US foreign affiliates is export-oriented.

**Business Activity:** Some business activities are possibly less responsive to local taxes than others. The degree of mobility associated with the respective business may be an obvious source of asymmetries. Mobility generally depends on costs associated with relocation. In particular, the share of physical production factors, specific constructions, or generally the size of the plant ultimately determine the degree of mobility. However, not only the mobility of the business itself is relevant. In fact, profits are assumed to be more mobile than real capital (e.g., Hines and Rice, 1994; Huizinga and Laeven, 2007). The heterogeneity in tax-base elasticities, therefore, determines the tax responsiveness of firms, too. We expect investments in mobile business activities to be more sensitive compared to investments in immobile activities. However, another aspect of mobility—the mobility of paper profits—can imply higher, but also lower tax elasticities.

Previous studies support this hypothesis. Grubert and Slemrod (1998), for example, find that the low-tax country Puerto Rico is particularly attractive to businesses whose profits are presumably highly mobile. Grubert (2003) shows that US multinationals with higher-than-average activities in R&D or advertising choose locations with extreme tax levels. The comparative advantage of these businesses due to enhanced cross-border profit shifting explains the preference for high-tax countries. At the same time, multinationals demand tax-shelter subsidiaries in low-tax countries. Stöwhase (2005) classifies FDI according to economic sectors and finds a higher tax elasticity for the service sector. One may speculate whether this reflects enhanced mobility, or opportunities to shift profits towards these firms. Asymmetric tax response of FDI from different industries may also be induced by industry-specific tax provisions from host countries. For example, Swenson (1994) analyzes the response of US inward FDI after the 1986 US tax reform. Her identification strategy

relies on a tax reform, which affected different industries asymmetrically.

**Degree of Internationalization:** The degree of internationalization of the multinational company may cause further tax asymmetries. As already mentioned, tax elasticities depend on the multinationals' opportunities to shift profits. If the multinationals are able to shift profits, local tax rates may be less relevant because effective tax payments are small or even zero. The opportunity to shift profits, however, is only available for multinationals with several locations. In case of a German parent company, profit shifting is hardly available for multinationals with only one foreign affiliate. Indeed, it makes no sense for a company that is active in Germany and in one foreign country to shift profits to the parent, since Germany's tax level is among the highest worldwide. In contrast, the host tax rate may become especially important if profits of the German parent are shifted towards the foreign subsidiary; for instance, because the multinational can manipulate transfer prices. Hence, we expect higher tax effects for single foreign subsidiaries, compared to subsidiaries which are able to shift profits to other foreign subsidiaries.

## 3 Empirical Methodology and Data Description

### 3.1 Econometric Framework

We are interested in the determinants of the number of German outbound investments during one year in different destination countries. Hence, the dependent variable, the number of German subsidiaries at respective locations, is a count variable which takes on only nonnegative integer values and is often zero, in particular when analyzing subsamples consisting of specific FDI types. A natural starting point for count data is a Poisson regression model.<sup>3</sup> Papke (1991), for example, uses a Poisson model and analyzes

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<sup>3</sup>Tomlin (2000) shows how misspecification of discrete data models can bias empirical results.



how tax differentials within the United States affect the location decisions of companies. Our approach is comparable to Stöwhase (2003) who analyzes tax effects on the number of investments at the country level.

We model the number of German investments  $n_j$  in a foreign country  $j$ . We are interested in the expected value of  $n_j$  conditional on some control variables  $x_j$ ,  $E(n_j|x_j)$ , where  $x_j$  contains, for instance, the country-specific tax rate. One way to express this is to use the exponential function as a functional form,  $E(n|x_j) = \exp(x'_j\beta)$ . To determine the probability of some  $n_j$  given  $x_j$ , we further assume a Poisson distribution with expectation  $\lambda_j \equiv \exp(x'_j\beta)$ . This implies the following probability function:

$$f(n_j|x_j) = \frac{\exp(-\lambda_j)\lambda_j^n}{n!}, \quad n = 0, 1, 2, \dots$$

In order to obtain the Poisson regression model, we use the above functional form for the intensity parameter  $\lambda_j$  to construct the loglikelihood function. Subsequently, we can estimate the vector  $\beta$  using maximum likelihood methods (Cameron and Trivedi, 1998).

The Poisson distribution implies the so-called *equidispersion* or *Poisson variance assumption*. It imposes the equality of conditional variance and mean:  $Var(n_j|x_j) = E(n_j|x_j)$ . However, the Poisson model is robust to distributional misspecifications, provided that the conditional mean,  $\lambda_j = \exp(x'_j\beta)$ , is correctly specified. We can use a quasi-maximum likelihood approach to consistently estimate  $\beta$ . If the equidispersion assumption is not valid, however, this regression is not efficient (Cameron and Trivedi, 1998).

To anticipate later results, specification tests reveal that the equidispersion assumption does not hold empirically, because  $Var(n_j|x_j) > E(n_j|x_j)$ . Therefore, we alternatively estimate a negative binomial model which nests the Poisson model. This approach differs in the specification of the conditional variance and introduces more flexibility. In particular, the negative binomial model allows for overdispersion as a general form of heteroscedasticity

(Cameron and Trivedi, 1998).<sup>4</sup>

### 3.2 Data Description and FDI Classification

For the empirical analysis we use data on German outbound FDI. The data are taken from the MiDi database provided by the German central bank (*Deutsche Bundesbank*). This is a comprehensive annual micro database of direct investment positions of German investors held abroad. Basically, the dataset provides information about the investment object's balance sheet, including further information on the type of investment and on the investor. This allows us to precisely separate investments according to micro-level information. The collection of the data is enforced by German law, which requires reporting obligations for certain international transactions and positions.<sup>5</sup> This last aspect of MiDi is worth emphasizing: we are able to observe virtually all German outbound investments. Descriptive statistics, therefore, provide some impressive insights into the structure of German outbound FDI. The database comprises direct and indirect FDI positions above certain threshold levels.<sup>6</sup> We consider all wholly-owned affiliates in 30 European countries, which are directly or indirectly held by a German parent company. However, we exclude observations which may have unclear or special taxing conditions.<sup>7</sup> The data are available for the period from 1989 until 2005 on an annual basis.

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<sup>4</sup>Specification tests indicate overdispersion (see Section 4). Therefore, we apply a generalized form of the Poisson, the negative binomial model. While the so-called Negbin I model allows for overdispersion but imposes a constant variance-mean ratio,  $V(n_j|x_j) = (1 + \delta^2)\exp(x'_j\beta)$ , the Negbin II model allows for overdispersion that increases with the conditional mean,  $V(n_j|x_j) = (1 + \alpha^2\exp(x'_j\beta))\exp(x'_j\beta)$  (Winkelmann, 2003). Ultimately, we apply the Negbin II model.

<sup>5</sup>Sec. 26 of Foreign Trade and Payments Act (*Aussenwirtschaftsgesetz*) in connection with Foreign Trade and Payments Regulations (*Aussenwirtschaftsverordnung*).

<sup>6</sup>Since 2002, FDI has to be reported if the participation is 10% or more and the balance-sheet total of the foreign investment is above 3 million Euro. For details, see Lipponer (2007). Though previous years showed lower threshold levels, we apply this threshold uniformly for all years in the sample.

<sup>7</sup>We exclude observations from mining, agriculture, non-profit organizations, and finally, membership organizations, because special tax regimes may be available. Furthermore, we exclude observations whose German parent is not an incorporated and legally independent entity, as well as subsidiaries which are not legally independent enterprises.

Table 1: Classification of FDI Projects

All German Wholly-Owned Outbound FDI Projects							
<i>Business Activity:</i>							
Manufacturing Sector		Non-Manufacturing Sector					
Heavy Industry	Non-Heavy Industry	Business Services	Wholesale Trade	Financial Services	Holdings	R&D	Residual Group
<i>Motivation for FDI:</i>							
Horizontal				Vertical			
<i>Degree of Internationalization:</i>							
Single Foreign Investment		Multiple Foreign Investments					

In Section 4, we analyze the number of German affiliates per country and per year for different categories. According to our discussion in Section 2, we classify German controlled FDI positions on the basis of different criteria. Table 1 summarizes this classification. Note that we mainly focus on the characteristics of the FDI projects rather than on those of the parent companies. In a first step, we use the industry classification as an indicator for differences in business activities. We distinguish, for example, between manufacturing and non-manufacturing subsidiaries. Table 2 shows significantly higher average values of fixed assets, sales and employees for manufacturing affiliates. Total assets are on average higher for non-manufacturing firms. Furthermore, we use the detailed industry code to distinguish between heavy and non-heavy industry.<sup>8</sup> Descriptive statistics show that the

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<sup>8</sup>We define the following industries as heavy manufacturing: Manufacture of iron and steel, ferrous metal foundries, drawing plants, cold rolling mills, secondary transformation of metals, manufacture of

average stock of fixed assets is higher for heavy-industry subsidiaries, whereas the mean number of employees is higher for the non-heavy-industry affiliates. We further differentiate the non-manufacturing sector and consider six separate industries: business services, wholesale trade, financial services, holding companies, research and development (R&D), and a residual group of other non-manufacturing subsidiaries. Table 2 reveals further remarkable aspects: affiliates classified as financial services, and also holding companies, have very small stocks of fixed assets, but at the same time very high amounts of total assets. Furthermore, the mean number of employees is very small in comparison to affiliates from other industries.

In a next step, we separate vertical FDI projects from horizontal investments. Unfortunately, MiDi does not provide direct information about whether the project is vertical or horizontal. However, we exploit a balance-sheet position that reflects internal transactions. The amount of intra-company deliveries is typically high for vertical FDI, because this type of foreign affiliates is part of a worldwide intra-company supply chain. MiDi contains the balance-sheet position *current assets of which claims on affiliated enterprises*, which reflects unpaid inter-company bills at the balance-sheet date.<sup>9</sup> Note that this indicator refers to outgoing deliveries, but not to received goods and services.<sup>10</sup> We take this proxy for intra-firm deliveries and normalize it with total sales. We argue that a high ratio indicates that affiliates are vertically integrated. We define the upper 25% percentile of this ratio's distribution as vertical FDI.<sup>11</sup> Although this is no well-defined threshold level, the results are qualitatively robust if we vary the definition of the threshold. The remaining

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non-ferrous metals, non-ferrous metal foundries, manufacture of structural metal products, manufacture of railway and tramway locomotives and rolling stock, manufacture of railed vehicles, manufacture of aircraft and spacecraft, manufacture of basic metals, manufacture of coke, refined petroleum and nuclear fuel, building and repairing of ships, manufacture of chemicals and chemical products, manufacture of pharmaceutical products, manufacture of refined petroleum products, manufacture of plastic products.

<sup>9</sup>The financial accounting literature may refer to this position as *accounts receivable from affiliated parties*. Note that financial transactions are presumably of secondary relevance for this balance-sheet position, because financial assets in affiliated companies such as inter-company loans are reported separately.

<sup>10</sup>The definition, therefore, also classifies subsidiaries used as export platforms (cf., Ekholm et al., 2007) as horizontal FDI.

<sup>11</sup>We always condition on the distribution of all observations.

Table 2: Mean Values for Different Types of FDI in 2005

	Fixed Assets (in 1,000€)	Total Assets (in 1,000€)	Sales (in 1,000€)	Employees (Number)
All Observations	14,670.41	270,227.20	62,409.60	186.42
<i>Business Activity:</i>				
Manufacturing	17,655.54	54,972.09	73,341.51	304.43
Non-Manufacturing	13,474.02	356,497.50	58,028.29	139.12
Heavy Manufacturing	20,948.13	78,135.43	82,558.62	226.94
Non-Heavy Manufacturing	16,858.17	49,362.60	71,109.39	323.19
Business Services	26,738.76	56,599.17	50,354.61	244.41
Wholesale Trade	3,413.76	21,716.02	47,809.33	86.93
Financial Services	8,427.68	2,451,893.00	62,901.25	69.55
Holding Companies	1,904.62	258,348.10	3,784.14	5.55
Research & Development	13,268.74	72,188.65	26,086.96	183.35
Residual Non-Manufact.	38,935.07	98,611.52	157,750.60	318.45
<i>Motivation:</i>				
Vertical FDI	17,865.46	809,835.20	75,484.79	196.54
Horizontal FDI	14,936.91	62,131.41	68,158.59	213.02
Vertical FDI & Manufact.	24,786.18	92,013.82	95,199.05	337.94
Horizontal FDI & Manufact.	14,895.47	40,593.48	65,337.27	293.67
Vertical FDI & Non-Manufact.	14,294.44	1,180,224.00	65,312.42	123.59
Horizontal FDI & Non-Manufact.	14,955.68	71,886.61	69,436.46	176.49
Parent Manufact. and Vertical	22,929.25	150,411.90	88,834.25	241.68
Parent Manufact. and Horizontal	11,724.80	41,949.43	80,674.32	202.69
<i>Internationalization:</i>				
Single Foreign Investment	11,702.58	60,503.82	24,602.00	142.21
Multiple Foreign Investments	14,884.95	285,388.20	65,142.72	189.61

Source: MiDi. All numbers refer to variable means. All wholly-owned German outbound FDI projects in 2005 in 30 European countries are considered. See Table 3 for a list of all considered countries.

observations are classified as horizontal FDI. Table 2 shows that there are no significant differences between both types of FDI in terms of the stock of fixed assets and also annual sales. Subsequently, we distinguish between vertical and horizontal FDI of manufacturing affiliates. Furthermore, we consider subsidiaries where the parent is in the manufacturing sector. These sub-classifications reveal differences, especially with respect to total assets and the number of employees.

Finally, we classify all observations with respect to different degrees of internationalization. On the one hand, we only consider binational corporations—German parent firms which

only have one foreign affiliate. On the other hand, we consider the foreign affiliates whose German parent holds at least a second foreign affiliate in Europe or elsewhere in the world. Table 2 reveals that single foreign affiliates of German multinationals are smaller compared to subsidiaries belonging to a more internationalized company.

For the regression analysis, we count the number of affiliates for each country and each year during the period 1989 to 2005. For each of the different FDI types, in accordance with above classification, we generate the number of affiliates as the dependent variable. Table 3 depicts the distribution of German outbound investments among 30 European locations in 2005. If we consider all affiliates, we find that France and the United Kingdom are the most important destination countries for German outbound FDI. Neighboring countries—the Netherlands, Austria and Switzerland—are also strongly represented, as well as big European economies such as Spain and Italy.

If we consider only certain types of FDI, we find very different distributions. Some findings are worth emphasizing: the UK and the Netherlands are the most important locations for vertical FDI. Several countries in Eastern Europe, especially Poland and the Czech Republic, become important if we consider only the manufacturing sector. Table 3 also suggests that financial services are highly concentrated in some countries. Luxembourg, which is hardly represented in other categories, attracts almost 12% of all financial service entities. More than 20% of all holding companies have chosen the Netherlands as a location. Other prominent holding locations are the UK and Switzerland. Together, the three countries host almost half of all holding companies.

### **3.3 Tax Measures**

A further step towards the empirical analysis is the choice of relevant tax measures. First of all, the statutory tax rate of the corporate income tax is a reliable indicator for the expected tax payments at host locations. It neglects, however, all rules that determine the tax base. Most importantly, the opportunity to depreciate fixed assets. Therefore,

Table 3: Shares of German Outbound Investment in 2005

Host Country	All (#)	All (%)	Manu- facturing	Non-Manu- facturing	Financial Services	Holding Companies	Horizontal FDI	Vertical FDI	Vertical & Manu.	Parent M. & Vertical	Single Foreign S.	Multiple Foreign S.
Austria	822	7.91	6.89	8.31	7.60	8.81	6.89	10.59	10.37	8.08	9.42	7.80
Belgium	458	4.40	3.33	4.84	3.29	2.64	4.27	5.31	4.89	4.79	2.85	4.52
Bulgaria	42	0.40	0.50	0.36	—	—	0.43	0.41	0.48	—	0.71	0.38
Croatia	46	0.44	0.34	0.48	—	—	0.63	0.04	0.12	—	—	0.46
Cyprus	—	—	—	—	—	1.10	—	—	—	—	—	0.16
Czech Rep.	520	5.00	8.27	3.69	1.48	1.43	5.98	3.49	5.84	3.84	7.85	4.80
Denmark	217	2.09	1.65	2.26	1.25	1.98	2.34	1.70	1.31	2.19	1.28	2.14
Estonia	29	0.28	0.34	0.26	0.45	—	0.29	0.24	0.48	0.55	—	0.29
Finland	102	0.98	1.01	0.97	—	—	1.10	0.93	0.83	1.23	—	1.00
France	1362	13.10	15.73	12.04	6.47	12.44	14.06	12.25	15.49	14.11	13.98	13.03
Greece	80	0.77	0.54	0.86	1.25	—	0.99	0.37	—	0.68	0.71	0.77
Hungary	374	3.60	4.91	3.07	1.59	0.99	4.26	3.04	5.01	3.70	6.28	3.40
Iceland	—	—	—	—	—	—	—	—	—	—	—	—
Ireland	169	1.63	1.51	1.67	6.92	0.66	1.10	2.80	2.86	3.29	1.57	1.63
Italy	720	6.92	7.29	6.78	6.13	3.74	7.54	6.94	8.10	7.12	4.71	7.08
Latvia	16	0.15	0.17	0.15	—	—	0.21	0.04	—	—	—	—
Lithuania	25	0.24	0.20	0.26	—	—	0.32	0.04	—	—	—	0.25
Luxembourg	203	1.95	0.27	2.63	11.46	5.07	0.90	3.12	—	—	2.14	1.94
Malta	18	0.17	0.17	0.18	—	0.55	0.09	0.16	—	—	—	—
Netherlands	893	8.59	4.77	10.12	11.46	21.04	6.80	9.01	5.84	8.77	6.85	8.71
Norway	119	1.14	0.77	1.29	0.57	0.88	1.37	0.77	0.60	1.10	—	1.23
Poland	597	5.74	7.90	4.88	4.09	1.32	7.41	2.60	2.74	1.64	12.84	5.23
Portugal	167	1.61	1.78	1.54	1.25	0.99	1.59	1.74	2.26	2.88	0.86	1.66
Spain	731	7.03	8.10	6.60	4.31	5.84	7.45	6.77	7.27	6.99	5.28	7.16
Slovakia	153	1.47	2.39	1.10	0.91	—	1.84	0.89	1.43	0.82	1.57	1.46
Slovenia	42	0.40	0.61	0.32	—	—	0.44	0.32	0.60	—	—	0.41
Sweden	304	2.92	2.62	3.04	1.93	2.97	3.21	2.47	3.10	3.84	1.00	3.06
Switzerland	704	6.77	5.92	7.11	4.99	9.47	6.01	8.64	6.79	8.77	8.70	6.63
Turkey	121	1.16	1.38	1.08	0.68	—	1.63	0.32	—	0.55	1.14	1.17
UK	1345	12.94	10.62	13.86	20.20	17.29	10.68	14.89	12.16	13.10	8.27	13.27

Source: MiDi. Wholly-owned German outbound FDI projects in 2005 in 30 European countries. Column 2 reports the number of subsidiaries; all other columns report the percentage of subsidiaries in respective categories. “—” denotes data, where reporting is not allowed due to confidentiality reasons.

we additionally consider country-specific depreciation by measuring the present value of tax depreciation allowances for machinery. We expect tax depreciation allowances to be useful in predicting the number of investments if the fraction of fixed assets is significant. Consequently, higher depreciation allowances should imply a higher probability to choose a certain location.

While our basic specification relies on the two tax measures, statutory profit tax rate and present value of depreciation, we also consider effective tax rates. Effective tax rates are more complex and compress various aspects of the legal tax code at a respective location. We calculate effective tax rates according to the methodology proposed by Devereux and Griffith (2003).<sup>12</sup> The underlying idea of this measure is to determine the effective tax payment of a hypothetical, standardized investment project, while taking into account the legal tax code. An obvious advantage of using effective tax rates is the fact that several relevant components of the tax system are considered within one indicator. Consequently, these tax measures reflect all relevant income and non-income taxes imposed on corporate investments as well as all the rules determining the tax bases such as depreciation allowances.

We use two different effective tax measures. The effective marginal tax rate (EMTR) reflects the tax burden on a marginal project earning only the cost of capital. The effective average tax rate (EATR) is calculated assuming a higher profitability of the underlying investment project. Our specifications for computing the effective tax rates are very similar to assumptions in a comprehensive study about company taxation in Europe by the European Commission (2001).<sup>13</sup> The relative importance of rules determining the tax base,

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<sup>12</sup>An alternative approach for obtaining effective tax rates is to use firm-level information about current tax payments (e.g., Desai, Foley, and Hines, 2001). These indicators are denoted as backward-looking measures. However, MiDi does not contain any detailed information about affiliates' tax payments. Moreover, Devereux and Lockwood (2006) point at various conceptual problems if effective tax rates are based on historical tax payments. Therefore, we rely on indicators referred to as forward-looking measures.

<sup>13</sup>The standardized project contains an investment in the following five asset types: industrial buildings, machinery, intangible assets, inventories, and financial assets. The project is equally financed by retained earnings, new share issues, and debt. We assume an incorporated company. Only domestic taxes and only income and non-income taxes imposed at the corporate level are considered. With regard to the definition of



for example tax depreciation or investment credits, decrease with an increasing expected profitability.<sup>14</sup> We can interpret the EATR as the proportion of the underlying investment project's net present value which is reduced by tax payments. Previous empirical studies suggest that the EATR, rather than the EMTR, is a suitable indicator for location decisions (Devereux and Griffith, 1998; Devereux and Lockwood, 2006; Buettner and Ruf, 2007).

Since repatriated foreign profits are tax-exempt at the level of the German parent company due to Germany's double tax treaties, taxes paid abroad are definite. In addition to company taxation in host countries, withholding taxes are often imposed on dividends distributed by the foreign affiliate. Hence, we use withholding taxes as an additional tax variable.<sup>15</sup>

### 3.4 Non-Tax Determinants

We consider non-tax determinants according to theories that explain FDI. First, we capture the size of the local market by means of the host country's GDP. We expect an increasing number of affiliates with an increasing local GDP (e.g., Brainard, 1997). Furthermore, we use the sum of imports and exports as share of GDP as an indicator for the openness to trade. In particular, trade openness is expected to have a positive effect on the frequency of foreign affiliates in case of vertically integrated affiliates, because intra-firm trade with other group affiliates and vertical FDI are complements.

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the taxable bases, we consider the relevant rules concerning depreciation and capital allowances, valuation of inventories and interest deduction in case of debt financing. In accordance to the European Commission (2001), we assume a pre-tax rate of return of 20%.

<sup>14</sup>Take, for instance, two projects which differ only in their profitability. The impact of the statutory tax rate is comparatively high if the project is highly profitable, because the additional profit is taxed at the full rate, while no additional accruals or deductions are granted. Note that the profitability after profit-shifting activities is decisive.

<sup>15</sup>The variable for withholding taxes is calculated as an effective dividend tax: the nominal withholding tax rate multiplied by 1 minus the statutory corporate tax rate.

Table 4: Descriptive Statistics - All Observations

	Mean	Std. Dev.	Min	Max
Statutory Tax Rate	.312	.092	0	.616
EATR	.282	.078	.09	.553
EMTR	.210	.088	-.196	.485
Withholding Tax	.024	.042	0	.26
PV of Depr. Allow.	.814	.058	.679	1
GDP	291.45	430.92	2.72	2,227.55
Similarity	.591	.309	.041	.999
Distance	1,014.41	590.42	190	2,592
Adjacency	.348	.477	0	1
European Union	.551	.498	0	1
Lending Rate	11.14	10.41	2.11	123.48
Openness to Trade	.942	.462	.357	2.89
Public Investment <sup>(a)</sup>	3.14	1.70	.874	30

419 (<sup>a</sup>)365) observations covering 30 European countries during the period 1989 - 2005. *Statutory tax rate* is the headline tax rate of the corporate income tax adjusted for local income taxes. *PV of Depr. Allow.* is the present value of depreciation allowances calculated for an investment in machinery, assuming a discount rate of 7.1 percent. *EATR* and *EMTR* are calculated in accordance with the methodology proposed by Devereux and Griffith (2003). *Withholding tax* is the effective tax imposed on dividend distribution from the host country to Germany. Tax information is collected from databases and surveys provided by the International Bureau of Fiscal Documentation (IBFD), Ernst&Young, PwC and KPMG. *GDP* in billion US dollars, nominal, is taken from World Development Indicators (WDI, 2007). *Openness to Trade* is the sum of imports and exports as share of GDP. *Public Investment* is general government investment as share of GDP. Both are taken from WDI (2007), augmented with data from Eurostat. *Similarity* is an index, defined as 1 minus the ratio of the absolute value of GDP per capita minus GDP per capita in Germany, relative to the higher of both GDPs per capita (see Buch et al., 2005). *Distance* contains flight distance between the host country's capital and Germany (Frankfurt) in km. *Adjacency* is a dummy variable having the value one if a host country has a common border with Germany. *European Union* is a dummy variable having the value one if a host country is a EU member country. *Lending Rate* refers to private sector debt, taken from the IMF International Financial Statistics Yearbook (2007), augmented with corresponding OECD figures.

Previous empirical studies condition on distance and usually find negative effects (e.g., Carr, Markusen and Maskus, 2001; Blonigen, Davies and Head, 2003). Measures of greater geographic distance may also capture *cultural* distance. Consequently, distance should be associated with higher transport as well as communication and information costs. We expect negative distance effects if FDI and exports are complements, for example, in case of vertical FDI. However, cultural distance can also explain negative distance effects for horizontal FDI. For the empirical analysis, we employ two measures of geographic distance: *distance* is the distance between Germany and the host country's capital in flight kilome-

ters; *adjacency* is a dummy variable indicating whether the host country and Germany have a common border. A further variable, *European Union*, captures legal and institutional stability as well as market access. This is a dummy variable indicating whether the country is a member of the European Union.

With regard to the determinants of vertically motivated FDI, we employ measures reflecting differences in factor prices.<sup>16</sup> First of all, a similarity index is used, which varies between 0 and 1. A higher score implies that a country is more similar to Germany (Buch et al., 2005; Brainard, 1997).<sup>17</sup> Another factor price variable is a measure for local financing costs, reflected by lending rates to the private sector. We expect that higher factor prices negatively affect the decisions to locate in a specific country.

Finally, we control for the level of public goods such as infrastructure, using the proportion of public investment to GDP. We expect a positive effect of *public investment*. Table 4 provides descriptive statistics of all variables used in the empirical analysis.

## 4 Results

We estimate the determinants of location decisions by using a count data model. Our dependent variable is the number of German controlled affiliates in the respective host country. In a first step, we analyze the number of all FDI positions. The estimation results are presented in Table 5. In column (1), we estimate a Poisson model and start with a basic set of variables including the statutory tax rate, the host-country GDP, the similarity indicator, and geographical distance. Specification tests, however, reject the Poisson model

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<sup>16</sup>Recent empirical literature (Carr, Markusen, and Maskus, 2001) recommends considering measures of the local endowment with skilled labor as well. Unfortunately, no sufficient data on school enrollment or comparable measures are available for all European countries and the time span from 1989 to 2005.

<sup>17</sup>The index is 1 minus the ratio of the absolute value of GDP per capita in the host country minus GDP per capita in Germany, relative to the higher of both GDPs per capita (Buch et al., 2005).

Table 5: All Observations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Statutory Tax Rate	-1.68*** (.617)	-2.43*** (.940)	-2.00*** (.607)	-2.17*** (.588)	-1.84*** (.683)			-1.87*** (.604)		
PV of Depr. Allow.			.250 (.141)	.819 (1.40)	1.04 (1.60)			.671 (1.50)		
EATR						-2.17*** (.567)			-2.14*** (.599)	
EMTR							-.446 (.829)			-1.01 (.739)
Withholding Tax				-2.46* (1.28)	-2.60* (1.45)	-1.29 (1.03)	-1.61 (1.11)	-1.29 (1.35)	-1.49 (.859)	-584 (.960)
(ln)GDP	.717*** (.094)	.900*** (.083)	1.07*** (.085)	1.07*** (.084)	1.03*** (.088)	1.07*** (.089)	1.07*** (.086)	1.03*** (.099)	1.02*** (.105)	1.02*** (.104)
Similarity	-.398 (.525)	-.532 (.406)	-1.58*** (.290)	-1.59*** (.289)	-1.52*** (.336)	-1.61*** (.295)	-1.70*** (.302)	-1.41*** (.289)	-1.38*** (.293)	-1.47*** (.305)
(ln)Distance	-.736*** (.124)	-.968*** (.138)	-.245 (.183)	-.244 (.171)	-.659*** (.129)	-.217 (.164)	-.206 (.130)	-.206 (.200)	-.199 (.195)	-.167 (.162)
Adjacency			.588*** (.196)	.579*** (.189)		.596*** (.207)	.520** (.209)	.598*** (.196)	.613*** (.207)	.575*** (.206)
European Union			.112 (.153)	.086 (.157)	.105 (.170)	.081 (.165)	.036 (.160)	.067 (.168)	.071 (.175)	.024 (.169)
(ln)Lending Rate			-.504*** (.137)	-.460*** (.138)	-.501*** (.146)	-.520*** (.154)	-.580*** (.150)	-.477*** (.153)	-.513*** (.166)	-.578*** (.163)
Open. to Trade			.792*** (.284)	.784*** (.283)	.533* (.289)	.818*** (.290)	.906*** (.296)	.723** (.335)	.716** (.339)	.798** (.341)
Publ. Investment								.001 (.022)	.006 (.020)	-.001 (.018)
Observations	419	419	419	419	419	419	419	365	365	365
Pseudo Log L.	-9517.5	-2312.9	-2224.5	-2218.2	-2247.0	-2223.6	-2243.1	-2030.3	-2029.5	-2044.42
$\alpha$		.271	.176	.171	.200	.176	.196	.159	.159	.174

Dependent variable is the number of affiliates in a host country. Poisson estimation in column (1), Negbin II estimations in columns (2)-(10). All estimations include time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level.  $\alpha$  refers to the overdispersion parameter. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

and suggest negative binomial regressions also for further specifications.<sup>18</sup> Column (2) of Table 5 depicts that the statutory tax rate has the expected negative impact on the number of German affiliates. Furthermore, a bigger host market positively affects the number of affiliates, whereas distance is associated with less affiliates. In column (3), the basic set of variables is supplemented by two dummy variables indicating if a host country is a direct neighbor of Germany (Adjacency) and if a host is a member state of the European Union. The adjacency variable possibly picks up the preference for countries where the distance to Germany is rather small. Column (5) shows that the distance variable has a significant negative effect if the adjacency dummy is omitted.

Besides, Table 5 reveals that an increasing openness to trade is associated with more German subsidiaries. We also confirm that factor price differences are relevant, e.g., by finding a significant negative effect of the similarity index. A greater difference between Germany and the host country in terms of GDP per capita yields additional location decisions in favor of the host country. Another variable reflecting factor prices is the lending rate for private sector credits. We find a significant negative effect of higher local financing costs on the location probability.

With respect to the tax effects on location decisions, Table 5 indicates that the significant negative impact of the host-country statutory tax rate is rather unaffected by the set of controls. Since Germany exempts repatriated inter-company dividends from taxation, withholding taxes are definite. During the considered period, withholding taxes have been substantially reduced, e.g., by means of the Parent-Subsidiary Directive. However, several countries imposed significant withholding taxes, at least until they joined the EU. Our results confirm negative effects of withholding taxes on the number of affiliates. We also include the present value of depreciation allowances. Although the coefficient is positive,

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<sup>18</sup>We investigate, in a first step, the mean-variance relation descriptively. Subsequently, we use more formal test statistics and test all specifications. The test statistic  $\alpha$  corresponds to the overdispersion parameter, where overdispersion is modelled as a function of the expected mean,  $(1 + \alpha \exp(x_j \beta))$ . The Poisson model would correspond to  $\alpha = 0$ . A likelihood-ratio test of  $H_0 : \alpha = 0$  is always rejected. Moreover, a test of the goodness-of-fit of the Poisson distribution indicates that the Poisson model is not appropriate.

as expected, the effect is insignificant when considering all types of FDI.

In columns (6) and (7), we alternatively use effective tax rate measures (see Section 3.3). Our results suggest that only the effective average tax rate (EATR) is significantly related to location decisions, whereas the effective marginal tax rate (EMTR) proves to be insignificant. The findings confirm previous results (see Devereux and Griffith, 1998; Devereux and Lockwood, 2006; Buettner and Ruf, 2007).

Given the significant negative effects of host-country taxation on location decisions, higher public investment funded by corporate taxes may compensate, to some extent, the high tax level. In columns (8) to (10), we include the proportion of public investment to host-country GDP to control for the level of provided public goods. However, we do not find any impact of public investment on the probability to choose a location. Further analyses neglect this variable, because the data on public investment do not cover all considered European locations during the period 1989 to 2005.<sup>19</sup>

We proceed with a detailed analysis of tax asymmetries. Especially, we analyze the number of subsidiaries of a specific type of FDI. Basically, the following tables always present a set of three estimations, using different tax measures: the statutory tax rate and the present value of depreciation, the EATR, and the EMTR. In Table 6, we divide all FDI projects into manufacturing and non-manufacturing investments, according to subsidiaries' industry classifications. With respect to tax effects, we do not find significant differences between the two groups. Both a higher statutory tax rate and a higher EATR imply less subsidiaries. The withholding tax rate, however, is only significantly negatively related to non-manufacturing FDI.

We further subdivide business activities according to the detailed industry classifications from MiDi. First, we differ between heavy and non-heavy manufacturing. Columns (1) to (6) of Table 7 reveal stronger tax effects for the heavy-manufacturing projects. Depreciation

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<sup>19</sup>Note that we estimate an additional set of regressions including public investment. However, the results are qualitatively unaffected, whereby the impact of public investment is always insignificant.

Table 6: Business Activities I

	Manufacturing			Non-Manufacturing		
	(1)	(2)	(3)	(4)	(5)	(6)
Statutory Tax Rate	-2.22** (1.08)			-2.43*** (.588)		
PV of Depr. Allow.	2.45 (1.84)			.361 (1.28)		
EATR		-2.15* (.1.24)			-2.53*** (.582)	
EMTR			-.330 (1.28)			-.864 (.850)
Withholding Tax	-2.37 (1.87)	-.497 (.1.62)	-.825 (1.57)	-2.74*** (1.02)	-1.78* (.995)	-2.23*** (1.11)
(ln)GDP	1.20*** (.108)	1.17*** (.117)	1.17*** (1.18)	1.00*** (.083)	1.01*** (.087)	1.01*** (.087)
Similarity	-2.21*** (.361)	-2.25*** (.390)	-2.33*** (.381)	-1.18*** (.277)	-1.20*** (.282)	-1.29*** (.303)
(ln)Distance	.079 (.285)	.107 (.294)	.095 (.270)	-.366** (.181)	-.330* (.568)	-.301* (.157)
Adjacency	.646** (.280)	.715** (.317)	.624** (.298)	.555*** (.181)	.568*** (.193)	.503*** (.202)
European Union	-.082 (.243)	-.097 (.266)	-.124 (.279)	.115 (.154)	.107 (.156)	.045 (.151)
(ln)Lending Rate	-.358* (.201)	-.460** (.213)	-.525*** (.196)	-.493*** (.134)	-.543*** (.145)	-.611*** (.146)
Open. to Trade	.776* (.471)	.772* (.461)	.874** (.437)	.675*** (.254)	.719*** (.254)	.821*** (.266)
Observations	419	419	419	419	419	419
Pseudo Log L.	-1866.2	-1873.8	-1883.5	-2025.1	-2030.4	-2057.7

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

Table 7: Business Activities II

	Heavy Manufacturing			Non-Heavy Manufacturing		Business Services			Wholesale Trade			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Statutory Tax Rate	-2.97*** (.918)			-1.86* (1.13)			-1.28 (1.43)			-1.71* (.972)		
PV of Depr. Allow.	3.60*** (1.19)			2.48 (1.92)			.142 (1.66)			1.81* (1.03)		
EATR		-2.91*** (.1.09)			-1.73 (1.29)						-1.86* (1.09)	
EMTR			-1.82* (1.08)			.242 (1.29)			.623 (.802)			-947 (.798)
Withholding Tax	.774 (1.38)	2.87 (2.13)	2.12 (2.11)	-3.26 (2.06)	-1.60 (1.75)	-1.78 (1.67)	-3.17*** (2.02)	-2.68 (1.97)	-2.50 (1.97)	-666 (1.01)	.483 (1.19)	.124 (1.15)
(ln)GDP	1.09*** (.102)	1.05*** (1.03)	1.05*** (1.01)	1.21*** (1.128)	1.18*** (1.134)	1.18*** (1.131)	1.05*** (1.110)	1.05*** (1.117)	1.04*** (1.109)	.999*** (.088)	.983*** (.093)	.976*** (.090)
Similarity	-1.09*** (.384)	-1.12*** (.469)	-1.20*** (.448)	-2.43*** (.412)	-2.46*** (.446)	-2.55*** (.440)	-1.62*** (.376)	-1.64*** (.375)	-1.69*** (.384)	-554*** (.259)	-608*** (.273)	-661*** (.268)
(ln)Distance	.313 (.254)	.308 (.294)	.332 (.288)	.070 (.302)	.085 (.307)	.063 (.267)	-.155 (.260)	-.136 (.253)	-.150 (.215)	-.354* (.215)	-.340 (.236)	-.334* (.201)
Adjacency	.674*** (.272)	.728*** (.326)	.696*** (.326)	.655*** (.297)	.721*** (.313)	.624*** (.292)	.826*** (.256)	.816*** (.265)	.757*** (.274)	.558*** (.175)	.595*** (.195)	.559*** (.191)
European Union	.271 (.177)	.289 (.240)	.205 (.232)	-.189 (.248)	-.201 (.272)	-.213 (.279)	-.122 (.242)	-.136 (.253)	-.165 (.247)	-.119 (.113)	-.106 (.131)	-.153 (.145)
(ln)Lending Rate	-.400*** (.169)	-.488*** (.175)	-.571*** (.156)	-.412* (.222)	-.506*** (.234)	-.568*** (.213)	-.444*** (.200)	-.476*** (.206)	-.510*** (.193)	-.246 (.176)	-.315* (.166)	-.365*** (.149)
Open. to Trade	.506* (.280)	.421 (.263)	.491* (.256)	.877 (.540)	.860 (.534)	.952* (.495)	.880*** (.389)	.912*** (.404)	.947*** (.390)	-.143 (.399)	-.154 (.404)	-.116 (.379)
Observations	419	419	419	419	419	419	419	419	419	419	419	419
Pseudo Log L.	-1178.8	-1203.4	-1216.9	-1777.1	-1783.9	-1789.4	-1424.3	-1426.5	-1427.3	-1682.5	-1688.0	-1697.2

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.



Table 8: Business Activities III

	Financial Services			Holding Companies			R&D			Residual Group		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Statutory Tax Rate	-5.25*** (1.24)			-.404 (1.86)			-3.64 (2.34)			-.883 (1.81)		
PV of Depr. Allow.	-.692 (1.82)			-3.92 (3.85)			3.21 (6.25)			3.24* (1.84)		
EATR		-5.74*** (1.44)			-.814 (1.79)			-5.77** (2.81)			-.287 (1.98)	
EMTR			-3.29* (1.92)			1.42 (1.14)			-3.95 (2.79)			1.01 (1.08)
Withholding Tax	-3.00* (1.65)	-1.73 (1.51)	-3.49* (1.91)	-3.15 (3.24)	-4.29 (3.84)	-4.07 (3.73)	-5.01 (6.85)	-2.63 (6.33)	-3.15 (7.01)	-3.59*** (2.16)	-2.25 (1.82)	-1.87 (1.91)
(ln)GDP	.910*** (1.84)	.938*** (1.76)	.989*** (1.87)	.788*** (2.24)	.833*** (2.29)	.814*** (2.11)	.638* (3.84)	.663* (3.88)	.639* (3.52)	.916*** (1.26)	.861*** (1.30)	.843*** (1.23)
Similarity	-2.29*** (.719)	-2.28*** (.777)	-2.48*** (.884)	-.292 (.587)	-.180 (.711)	-.287 (.678)	2.34 (1.53)	2.15* (1.30)	2.25* (1.31)	-1.70*** (.453)	-1.75*** (.497)	-1.77*** (.488)
(ln)Distance	-1.16*** (.307)	-1.07*** (.317)	-.873*** (.344)	-.633 (.565)	-.602 (.650)	-.628 (.582)	-7.42 (5.45)	-7.77 (5.06)	-7.32 (6.02)	-.396 (.337)	-.401 (.343)	-.431 (.322)
Adjacency	-.109 (.313)	-.081 (.327)	-.125 (.341)	.540 (.451)	.476 (.457)	.393 (.426)	-.116 (.479)	.100 (.426)	.105 (.601)	.592* (.318)	.646* (.356)	.592* (.359)
European Union	1.20*** (.283)	1.17*** (.269)	.967*** (.244)	-.093 (.349)	-.135 (.331)	-.169 (.336)	-.362 (.711)	-.086 (.529)	-.300 (.535)	-.197 (.215)	-.191 (.268)	-.185 (.257)
(ln)Lending Rate	-.621*** (.211)	-.676*** (.230)	-.850*** (.296)	-1.39*** (.269)	-1.29*** (.265)	-1.36*** (.262)	-.138 (.649)	-.025 (.667)	-.175 (.531)	-.617*** (.264)	-.720*** (.271)	-.732*** (.256)
Open. to Trade	.905*** (.410)	1.02** (.428)	1.38** (.528)	.493 (.645)	.547 (.696)	.541 (.622)	.052 (.966)	-.129 (.997)	-.202 (.914)	-.072 (.435)	.014 (.432)	.017 (.415)
Observations	419	419	419	419	419	419	311	311	311	419	419	419
Pseudo Log L.	-1346.9	-1356.2	-1395.0	-1195.0	-1206.3	-1204.3	-187.9	-187.0	-187.2	-1281.4	-1291.9	-1290.3

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

allowances are now statistically significant. This confirms theoretical expectations, because descriptive statistics summarized in Table 2 indicate that fixed assets are on average very high for this group. Consequently, we also find a significant effect of the EMTR. For the labor-intensive non-heavy manufacturing subsidiaries (see Table 2), we find a stronger negative impact of the similarity indicator. This is what we expect, because the variable reflects similarity in terms of GDP per capita, which can be interpreted as a rough indicator of similar labor costs.

Moreover, we distinguish between six different industry groups of the non-manufacturing sector. The results are presented in Tables 7 and 8. We consider business services, wholesale trade, financial services, holding companies, and finally, a residual group of other non-manufacturing subsidiaries. The results suggest significant asymmetric tax effects. Financial service entities and R&D subsidiaries are particularly tax sensitive.<sup>20</sup> This confirms the outstanding relevance of these subsidiaries for tax planning within multinationals (see Grubert, 2003). If these activities are located in low-tax countries, they can be used to shift profits towards them by means of intra-company interest and royalties, respectively. Considering financial services, we also expect higher mobility, because the fixed-assets-to-total-assets relation is rather small. This is a general characteristic of several non-manufacturing activities, and hence, only the wholesale trade affiliates and the residual non-manufacturing group, which contains construction and public utilities, are significantly affected by the value of depreciation allowances.<sup>21</sup>

Surprisingly, we do not find any significant impact of taxation on the location of holding companies. This result is possibly related to the fact that their assets mainly consist of shares. Thus, their earnings predominantly contain inter-company dividends which are often tax exempt due to ordinary tax law or because of special holding regimes. A

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<sup>20</sup>Note that the considered time period is reduced in case of R&D, because MiDi has only begun to report R&D activities separately since 1995.

<sup>21</sup>Note that the significant effect of the EMTR in case of financial services is obviously driven by the strong impact of the statutory tax rate, considering the insignificant impact of depreciation (see column (1) in Table 8).

particularly noteworthy finding is that financing conditions reflected by lending rates are an important determinant of the number of holding companies.

While we find asymmetries in behavioral responses considering taxation, we also identify asymmetries with respect to other control variables. The similarity variable, for example, is in most specifications negatively related to the number of affiliates. However, the host's similarity to Germany positively affects the number of R&D subsidiaries. This result is reasonable, given the comparatively high German per capita GDP, which may reflect, to some extent, the average availability of skilled workers. Another asymmetry is related to the EU membership status of host countries. EU membership results in significantly more financial service subsidiaries, whereas this fact does not matter for other business types.

In a further step, we take into account the motivation of FDI and divide the subsidiaries into horizontally and vertically motivated FDI. We classify observations according to the amount of outgoing intra-firm deliveries (see Section 3.2). Columns (1) to (6) of Table 9 refer to all FDI projects. We find that vertical FDI is slightly more tax sensitive, although the difference is not statistically significant. Thereafter, we maintain the vertical versus horizontal classification, but further subdivide the sample in manufacturing- and non-manufacturing investments. The results in columns (7) to (12) in Table 9 and columns (1) to (6) in Table 10 suggest that only in case of manufacturing, taxes asymmetrically affect the number of subsidiaries. An additional set of results is shown in columns (7) to (12) in Table 10, where we consider only FDI projects if the parent company is active in the manufacturing sector. We confirm the higher tax-elasticity for vertical FDI. This is what we expect, because vertical FDI is mainly cost driven. In consideration of other control variables, the regressions presented in Tables 9 and 10 highlight that vertically integrated FDI is generally more sensitive to local financing conditions and to the host country's openness to trade than horizontal FDI.

Finally, we classify German outbound FDI projects according to the degree of internationalization of the whole company group. On the one hand, we consider foreign subsidiaries

Table 9: Motivation I

	All Affiliates				Manufacturing Affiliates							
	Vertical		Horizontal		Vertical		Horizontal					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Statutory Tax Rate	-2.48*** (.839)			-1.93*** (.714)			-3.27*** (1.23)			-2.01* (1.05)		
PV of Depr. Allow.	1.31 (1.49)			1.65 (1.33)			2.65 (1.95)			2.67 (1.74)		
EATR		-2.45*** (.773)			-1.99*** (.756)			-3.35** (1.37)			-1.90 (1.25)	
EMTR			-408 (1.02)			-561 (.702)			-888 (1.51)			-170 (1.17)
Withholding Tax	-1.29 (2.06)	.207 (1.81)	-258 (1.88)	-2.57** (1.13)	-1.17 (.946)	-1.46 (.943)	-1.26 (2.62)	1.02 (2.29)	.180 (2.34)	-2.70 (1.65)	-957 (1.49)	-1.21 (1.39)
(ln)GDP	1.15*** (.103)	1.14*** (.113)	1.14*** (.106)	1.10*** (.082)	1.08*** (.087)	1.08*** (.088)	1.15*** (.156)	1.13*** (.162)	1.12*** (.156)	1.18*** (.106)	1.15*** (.114)	1.14*** (.115)
Similarity	-1.26*** (.401)	-1.27*** (.403)	-1.36*** (.402)	-1.59*** (.272)	-1.65*** (.292)	-1.82*** (.293)	-1.55*** (.584)	-1.56*** (.587)	-1.69*** (.577)	-2.38*** (.355)	-2.43*** (.396)	-2.51*** (.390)
(ln)Distance	.095 (.271)	.126 (.273)	.115 (.239)	-.188 (.185)	-.170 (.184)	-.164 (.148)	.369 (.360)	.418 (.377)	.396 (.343)	-.091 (.278)	-.069 (.290)	-.072 (.260)
Adjacency	.712** (.279)	.740** (.302)	.630** (.304)	.585*** (.192)	.626*** (.218)	.566*** (.211)	.754* (.386)	.836* (.431)	.686* (.415)	.572** (.263)	.644** (.301)	.570** (.281)
European Union	-.025 (.235)	-.033 (.250)	-.102 (.246)	-.080 (.141)	-.075 (.162)	-.114 (.168)	.020 (.327)	.006 (.351)	-.077 (.355)	-.098 (.215)	-.111 (.249)	-.135 (.261)
(ln)Lending Rate	-.845*** (.206)	-.917*** (.210)	-.987*** (.211)	-.281* (.164)	-.361** (.178)	-.412** (.168)	-.648** (.271)	-.746*** (.276)	-.849*** (.261)	-.267 (.205)	-.373* (.220)	-.435** (.202)
Open. to Trade	1.24*** (.345)	1.28*** (.359)	1.36*** (.344)	.496 (.324)	.499 (.324)	.570* (.317)	.994* (.552)	1.00* (.551)	1.16** (.533)	.568 (.461)	.547 (.452)	.640 (.428)
Observations	419	419	419	419	419	419	419	419	419	419	419	419
Pseudo Log L.	-1622.0	-1626.9	-1641.6	-2059.4	-2065.5	-2079.5	-1373.6	-1379.2	-1393.3	-1725.2	-1734.4	-1742.2

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

Table 10: Motivation II

	Non-Manufacturing Affiliates						Manufacturing Parent Companies					
	Vertical			Horizontal			Vertical			Horizontal		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Statutory Tax Rate	-2.20** (.853)			-2.01*** (.714)			-4.13*** (1.21)			-1.82* (.944)		
PV of Depr. Allow.	.862 (1.23)			1.49 (1.14)			2.38* (1.43)			2.61* (1.50)		
EATR		-2.15** (.846)			-2.14*** (.740)			-4.43*** (1.27)			-2.05* (1.08)	
EMTR			-488 (.708)			-880 (.569)			-2.00 (1.42)			-862 (.966)
Withholding Tax	-1.60 (1.39)	-610 (1.41)	-929 (1.44)	-2.57*** (.919)	-1.38* (.834)	-1.75** (.857)	-328 (2.11)	2.18 (2.05)	.982 (2.24)	-2.04 (1.49)	-632 (1.26)	-1.02 (1.19)
(ln)GDP	1.07*** (.093)	1.07*** (.098)	1.07*** (.090)	1.02*** (.077)	1.01*** (.082)	1.01*** (.082)	1.10*** (1.27)	1.09*** (1.27)	1.09*** (1.29)	1.13*** (1.01)	1.10*** (1.07)	1.10*** (1.10)
Similarity	-.783*** (.283)	-.800*** (.301)	-.865*** (.298)	-1.08*** (.242)	-1.13*** (.251)	-1.19*** (.258)	-.622 (5.24)	-.648 (5.23)	-.830 (5.17)	-1.52*** (.309)	-1.58*** (.349)	-1.64*** (.344)
(ln)Distance	-1.87 (.222)	-162 (.229)	-143 (.194)	-.234 (1.86)	-.216 (1.85)	-.201 (1.46)	.296 (.293)	.363 (.310)	.371 (.288)	-.223 (.251)	-.216 (.270)	-.203 (.241)
Adjacency	.635*** (.228)	.649*** (.241)	.588** (.243)	.590*** (.186)	.624*** (.187)	.576*** (.188)	.785** (.332)	.869** (.366)	.721** (.360)	.493** (.235)	.565** (.274)	.518** (.262)
European Union	-.142 (.177)	-.148 (.193)	-.226 (.185)	-.071 (.126)	-.063 (.145)	-.116 (.149)	-.042 (.232)	-.047 (.256)	-.169 (.255)	-.102 (.135)	-.093 (.167)	-.139 (.183)
(ln)Lending Rate	-.968*** (.195)	-1.02*** (.197)	-1.09*** (.195)	-.288* (.157)	-.358** (.164)	-.410*** (.154)	-.655*** (.247)	-.762*** (.237)	-.907*** (.228)	-.158 (.187)	-.245 (.201)	-.299 (.187)
Open. to Trade	1.11*** (.274)	1.13*** (.286)	1.19*** (.270)	.385 (.296)	.385 (.301)	.454 (.293)	.733 (.463)	.751 (.465)	.943 (.477)	.246 (.391)	.204 (.390)	.277 (.379)
Observations	419	419	419	419	419	419	419	419	419	419	419	419
Pseudo Log L.	-1342.1	-1346.1	-1359.7	-1845.5	-1850.2	-1866.9	-1309.8	-1315.6	-1344.2	-1742.9	-1749.9	-1759.0

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

Table 11: Degree of Internationalization

	Single Investment			Multiple Investments		
	(1)	(2)	(3)	(4)	(5)	(6)
Statutory Tax Rate	-4.96*** (.1.20)			-1.97*** (.569)		
PV of Depr. Allow.	1.24 (1.20)			.866 (1.36)		
EATR		-5.18*** (1.31)			-1.93*** (.547)	
EMTR			-1.97 (1.82)			-304 (.738)
Withholding Tax	-5.10* (2.89)	-3.80 (2.45)	-5.62** (2.64)	-2.09* (1.22)	-953 (1.02)	-1.21 (1.07)
(ln)GDP	.973*** (.145)	.960*** (.146)	1.00*** (.150)	1.07*** (.083)	1.06*** (.088)	1.06*** (.084)
Similarity	-2.88*** (.646)	-2.82*** (.680)	-3.08*** (.744)	-1.46*** (.282)	-1.49*** (.287)	-1.57*** (.291)
(ln)Distance	-.058 (.309)	-.019 (.315)	.078 (.402)	-.262 (.169)	-.238 (.163)	-.229 (.128)
Adjacency	1.36*** (.353)	1.39*** (.379)	1.24*** (.402)	.526*** (.184)	.543*** (.201)	.474** (.200)
European Union	.329 (.342)	.302 (.360)	.148 (.332)	.071 (.150)	.067 (.158)	.026 (.153)
(ln)Lending Rate	-.562*** (.243)	-.622*** (.282)	-.759** (.311)	-.448*** (.135)	-.508*** (.149)	-.563*** (.144)
Open. to Trade	.723* (.435)	.759* (.453)	1.13** (.515)	.760*** (.278)	.790*** (.284)	.866*** (.285)
Observations	419	419	419	419	419	419
Pseudo Log L.	-1218.3	-1286.3	1317.4	-2177.0	-2182.6	-2199.1

Dependent variable is the number of affiliates in a host country. Negbin II estimations, including time effects. Robust standard errors (in parentheses). Pooled estimation clustered at the country level. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

that are single foreign subsidiaries of German parent companies. On the other hand, we consider those companies whose parent companies have at least a second foreign subsidiary. The results in Table 11 show that the tax sensitivity of location choices is significantly higher if no further subsidiary is controlled by the same parent.<sup>22</sup> The results support the expectation that differences in profit-shifting opportunities affect the tax sensitivity of location decisions. The tax level in Germany has been one of the highest in the world during the considered period. Therefore, the gains from profit shifting away from a single foreign subsidiary towards the German parent company are very small. Consequently, the host-country tax rate is especially important if a subsidiary is a single foreign entity. In contrast, if we consider multiple foreign activities, additional profit-shifting opportunities arise within the foreign company structure, which is anticipated by the multinational. The results indicate similar offsetting mechanisms with respect to control variables. For example, the effects of similarity or the lending rate are also remarkably higher for single-subsidiary multinationals.

## 5 Conclusions

We contribute to the existing literature by examining possible asymmetries in tax effects, depending on different FDI characteristics. As to the statutory tax rate, the estimation based on all different types of FDI suggests a tax-rate elasticity of -0.68. This is remarkably close to results provided by previous studies. Additionally, our finding that predominantly the statutory corporate tax rate as well as an effective average tax rate affect location decisions confirms results of earlier studies. When we consider the heterogeneity of FDI projects, we find strong evidence that specific characteristics of FDI can explain very different tax effects.<sup>23</sup> All estimated tax-elasticities are summarized in Table 12.

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<sup>22</sup>It is worth emphasizing that tax-sensitive groups, e.g., vertical FDI or financial services, are rather equally distributed among both categories.

<sup>23</sup>More formal tests reveal significant differences in tax-rate elasticities. We merge comparison groups and test, by using simple *t*-statistics, whether coefficients are different. Pairwise comparisons between,

Table 12: Overview on Asymmetric Tax Rate Elasticities

	Tax Rate Elasticity		Average Number of Subsidiaries per Host Country
	Statutory Tax Rate	EATR	
All Observations	-.676**	-.611***	278.0
Manufacturing	-.692*	-.607*	86.0
Non-Manufacturing	-.758***	-.712***	192.0
Heavy Manufacturing	-.928***	-.820**	66.8
Non-Heavy Manufacturing	-.580*	-.488	19.2
Business Services	-.398	-.278	34.2
Wholesale Trade	-.534*	-.524*	88.8
Financial Services	-1.64***	-1.62***	27.5
Research & Development	-1.07	-1.53**	0.5
Holding Companies	-.126	-.230	21.9
Residual Group	-.276	-.081	19.3
Vertical FDI	-.776***	-.691**	61.3
Horizontal FDI	-.603***	-.560**	183.3
Manufact., Vertical	-1.02***	-.944**	22.7
Manufact., Horizontal	-.629*	-.535	62.8
Non-Manufact., Vertical	-.688**	-.607**	38.6
Non-Manufact., Horizontal	-.629***	-.604***	120.5
Parent Manufact., Vertical	-1.29***	-1.25***	23.3
Parent Manufact., Horizontal	-.569*	-.576*	76.8
Single Foreign Investment	-1.55***	-1.46***	17.0
Multiple Foreign Investments	-.614**	-.544***	261.0

Elasticities are evaluated at sample means. Calculations are based on specifications presented in columns (4) and (6) of Table 5, as well as on the corresponding specifications of Tables 6 to 11. (\*), (\*\*), (\*\*\*) denote significance at the (10%), (5%), and (1%) level.

We identify, as a first source of asymmetries, the type of business activity. Financial service and R&D activities, which are expected to be highly mobile, have the highest sensitivities. In contrast, no significant tax effect is found in case of holding companies. One may speculate whether this latter finding is caused by specific tax regimes. Moreover, our results predict that depreciation allowances affect location choices of typically capital-intensive production. Our second main finding is that vertical FDI in manufacturing is more responsive to local tax rates than horizontal FDI. This confirms expectations because

for example, financial services versus holdings, single investments versus multiple investments, vertical manufacturing versus horizontal manufacturing, confirm statistically different elasticities.



the main goal of horizontal FDI lies in serving a specific host market; this implies, that relative to vertical investments, taxes are less important. The third main result suggests that an increasing degree of internationalization is associated with decreasing tax-rate elasticities. We find that single foreign activities of highly taxed German parents are very tax-sensitive. We also find, as already mentioned, that financial service entities and R&D activities, whose profits are expected to be highly mobile, are very tax-sensitive. While the single foreign subsidiaries cannot avoid taxes by means of shifting profits away, the latter subsidiaries are the entities towards which profits are often shifted. This suggests that profit-shifting opportunities intensify but also mitigate the response to host taxation.

We believe that our contribution is of particular relevance for policymakers, because taxes are one of the few determinants of FDI, which can be directly affected by policy decisions. Indeed, our findings indicate that policymakers should be aware that different tax instruments can have asymmetric effects on the composition of FDI inflows. Moreover, we show which FDI types move first if taxing conditions are unfavorable. From a different point of view, the results provide some insight into the relevant dimensions of tax competition. Especially, the actual composition of FDI types among European countries may explain governments' different behavioral response to tax competition.

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