Tax Incentives and the Location of FDI: Evidence from a Panel of German Multinationals

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April 2006

forthcoming: International Tax and Public Finance

Abstract: Using a firm-level panel data set this paper investigates the impact of taxation on the decision of German multinationals to hold or establish a subsidiary in other European countries or abroad. Taking account of unobserved local characteristics as well as firm-specific preferences for potential locations, the results confirm significant effects of tax incentives, market size, and of labor cost on cross-border location decisions. In accordance with Devereux and Griffith (1998) we find that the marginal effective tax rate has no predictive power for location decisions. However, the results indicate a considerably weaker predictive power of the effective average tax rate as compared to the statutory tax rate.

Key Words: Location, FDI, Corporate Taxation, Firm-Level Data, Fixed-Effects Logit

JEL Classification: H25, F23, F21, R38

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[‡]We are grateful to the Deutsche Bundesbank, in particular, Heinz Herrmann, Alexander Lipponer, and Fred Ramb for granting access to the FDI database, to Mike Devereux, Beatrix Stejskal-Passler, Alfons Weichenrieder, and two anonymous referees for helpful comments. All errors are, however, our own. Support by the Deutsche Forschungsgemeinschaft is gratefully acknowledged.

1 Introduction

While many decisions of a company will be affected by corporate taxation, its impact on location decisions is of key interest for tax policy. Since taxation of corporations, in particular, taxation of multinational corporations is highly complex, it is important to understand which specific features of the tax system are important for the location of production and, hence, value added. Initiated by the study of Hartman (1984) several empirical studies have investigated the influence of taxes on foreign direct investment (surveys are provided by Hines, 1997, and de Mooij and Ederveen, 2003). However, in most studies the focus is on the volume and distribution of FDI rather than on the underlying location decisions. For the sub-national level Bartik (1985) shows that the corporate tax rate has a significant impact on business location decisions within the U.S. While subsequent empirical studies on interregional location decisions have confirmed this result (see Phillipps and Goss, 1995, for a survey), there is little research on location decisions at the international level. A notable exception is Devereux and Griffith (1998) who establish a significant impact of taxes on the choice of location of subsidiaries within Europe using firm-level data for U.S. enterprises.

The scarcity of empirical evidence on the impact of taxation on location decisions might be due to the fact that the corresponding analysis cannot be done using aggregate FDI data, but requires data on individual cross-border direct investments, which are usually difficult to obtain. Only recently the German Bundesbank has made available for research its micro-level data set for foreign direct investment, which offers interesting opportunities to study international location decisions (for a general description of the data see Lipponer, 2003).

The aim of this paper is to use this novel and promising data set in order to study empirically the location decisions of several thousand German multinationals in 18 foreign countries during a period of 8 consecutive years. To focus on German multinationals is particularly interesting as corporate taxation in Germany usually follows the exemption principle where

the tax burden on the foreign subsidiary is not credited against domestic taxation. Thus, the taxes at the location of the foreign subsidiary should be decisive for the actual location decisions of German multinationals whereas this is only the case for U.S. multinationals to the extent that repatriation is deferred or that taxes abroad are higher.

Drawing on the data provided by Devereux, Griffith, and Klemm (2002) the analysis employs various alternative indicators of the tax burden. While the traditional literature on investment has emphasized the role of the effective tax rate for a marginal investment, more recently, Devereux and Griffith (1998) put forward the concept of the effective average tax rate. Whereas these effective tax rates take account of the definition of the tax base, questionnaires among executives emphasize the significance of statutory tax rates (*e.g.*, Sørensen, 1992). Furthermore, to the extent that they engage in profit-shifting activities multinationals may locate physical activities in locations with low statutory tax rates in order to justify the profits that they plan to report (Hines and Rice, 1994, p.165).

Exploiting the panel-data features of the data set in order to control for unobserved location characteristics and firm-specific preferences for potential locations, the results confirm significant effects of labor cost, market size, and taxes on international cross-border location decisions. In accordance with Devereux and Griffith (1998) we find that the marginal effective tax rate has no predictive power for location decisions. Instead, effective average and, particularly, statutory tax rates are found to exert strong effects. However, in contrast to Devereux and Griffith the results indicate a considerably weaker predictive power of the effective average tax rate as compared to the statutory tax rate.

The paper is structured as follows. The next section lays out the investigation approach. This is followed in Section 3 by a description of the data set. Section 4 presents the empirical results; Section 5 draws some final conclusions.

2 Investigation Approach

Following Dunning's (1977) "Ownership, Location, and Internationalization" approach the international location decision of a company is part of a more general set of decisions directed at the company's international activities involving export, import, location, as well as production decisions (see Markusen, 1995, for a survey). Each of these decisions is affected by the characteristics and conditions faced in the markets within which the company is planning to be active or is active, already. The analysis of location decisions, therefore, might be embedded in a more general investigation of export and international production decisions of companies as in the seminal paper by Devereux and Griffith (1998). In particular, they distinguish between the decision of whether to produce at home or abroad and the decision of where to locate production conditional on the strategy to produce abroad. Our analysis poses the somewhat simpler question under which conditions a location will be able to attract a German multinational – regardless of whether this attraction results from offering more favorable conditions than the investor has in Germany or from offering more favorable conditions than rival locations elsewhere. Nevertheless, the investigation approach has to acknowledge the existence of a broader company strategy within which the company's location decision is taken.

Consider the location decision of a German multinational firm indexed with k. Let the propensity to locate productive activities in country i be determined by the expected profits at i and the alternative locations, which in turn are determined by taxes and other local conditions such as labor cost, for instance. Given a choice set $j = 1, ..., n$ of possible locations this can be formalized as

$$\begin{aligned} y_{k,i} &= 1, \text{ if } \pi^*_{k,i} > \pi^*_{k,j}, \ \forall j \neq i, \text{ and } y_{k,i} = 0 \text{ otherwise,} \\ \pi^*_{k,i} &= \pi\left(\tau_i, \mathbf{x}_i, \gamma_{k,i}\right), \end{aligned}$$

where $y_{k,i} = 0, 1$ is a binary variable indicating whether or not the multinational holds an affiliate at location i, and $\pi^*_{k,i}$ represents expected profits at location i in the view of firm k. Expected profits are determined by taxes τ_i, a vector of observable local characteristics $\mathbf{x}_i$, and firm-specific location effects $\gamma_{k,i}$, capturing unobserved characteristics of both firms and potential locations. The last term also reflects the above mentioned view that the location decision of a multinational is embedded in the company's broader strategy related to its international activities which may give rise to firm-specific preferences for specific locations. Differences in the preference for a location across firms may also arise in the presence of agglomeration or localization economies with other firms. These concepts are used in location theory (*e.g.*, Fujita, Krugman, and Venables, 1999) to describe a situation where a location is more attractive than others for an investment of a firm because of backward or forward linkages to other companies which are also present at the considered location. As a consequence, depending on the characteristics of the firm and the investment, for instance, in terms of the industry or the research intensity, a firm may find a specific location more or less attractive than other firms even if taxes and labor cost were the same.

In order to estimate location probabilities most of the empirical literature on location decisions employs some variant of the conditional logit model developed by McFadden (1974) (*e.g.*, Bartik, 1985, Coughlin et al., 1992). Also Devereux and Griffith (1998) employ a nested conditional logit specification which captures the above mentioned relationship with other decisions reflecting the company's strategy towards the international markets. Basically, the conditional logit approach determines the probability of an investment at a specific location conditional on the characteristics of the group of locations which are considered as choice alternatives. With the assumption that differences in the assessment of alternative locations as captured by $\gamma_{k,i}$ are purely random with a specific distribution and independent this approach exploits cross-sectional differences between locations in order to identify the determinants of location choice. One of the drawbacks of this assumption is that it conflicts with the

observation that many companies, almost every second company in the dataset used below, hold two or more subsidiaries abroad. In fact, most of the subsidiaries reported in the dataset share the parent company with one or more other subsidiaries, such that location decisions are hardly independent. Moreover, the conditional logit approach does not offer a solution to the key problem in cross-sectional policy analysis which is to distinguish the impact of policy choices against unobserved location characteristics. For instance, as we know from the empirical literature on local taxation, failure to control for differences in the quantity and quality of publicly provided infrastructure, which are notoriously difficult to observe, may lead to a potentially serious downward bias in the estimation of tax effects due to a positive correlation between taxes and public services (*e.g.*, Bartik, 1991, Phillips and Goss, 1995). Given the limitations of the conditional logit model, our analysis aims at using a panel data approach in order to identify the effects of local characteristics on location probability.

More generally, a panel structure of the data allows us to jointly address the two basic identification problems faced by the empirical analysis of location choice: the heterogeneity in the firms' assessment of locations and the heterogeneity of locations. To the extent that both the firm-specific preference for a location as well as unobserved local characteristics of locations are invariant over some time-period, a possible solution to both identification problems is to pool observations for different periods and to analyze the relationship using panel data. If we observe location decisions at the level of the firm over several years, identification of the impact of taxes and other locational characteristics is possible using the variation of those characteristics over time for each firm-country cell. In other words, panel data for international activities of firms allow us take account of two, possibly interrelated, dimensions of heterogeneity across firms and countries in a comprehensive way by means of idiosyncratic, or firm-specific, location effects. As a by-product, firm-specific effects will also capture important characteristics of the investor, as for instance the firm size, the ownership structure, or the industry.

These considerations suggest to study location decisions by estimating a linearized equation for the propensity of firm k to hold a subsidiary at location i in period t, which includes a full set of firm-specific location effects $\gamma_{k,i}$, formally:

$$\begin{aligned} y_{k,i,t} &= 1, \text{ if } \pi^*_{k,i,t} > 0, \text{ and } y_{k,i,t} = 0 \text{ otherwise,} \\ \pi^*_{k,i,t} &= \tau_{i,t}\beta + \gamma_{k,i} + \mathbf{x}_{i,t}\delta + \eta_t + \epsilon_{k,i,t}, \end{aligned} \tag{1}$$

where $\epsilon_{k,i,t}$ is an error term and η_t is a fixed time effect. Note that while the propensity to invest at location i is modelled without specific reference to the group of choice alternatives $j \neq i$ the firm-specific location effects will capture the cross-sectional distribution of the attractiveness of each location. The time effect controls for changes in the home country, such as changes in taxation or in the wage level, which might have an effect on the general propensity of the firms to invest abroad.

As usual in panel-data analysis, estimation requires further identifying assumptions about the unobserved effect $\gamma_{k,i}$ and its relationship to the observed variables. In contrast to random-effects approaches fixed-effects models allow for a correlation between observed explanatory variables and unobserved effects (Mundlak, 1978). As we have noted above this is important in the context of business location decisions where such correlation may arise from differences in the quantity and quality of publicly provided infrastructure, which are notoriously difficult to observe. Given a likely correlation between taxes and public services it seems difficult to treat the location-specific component in the location decision as random. Rather, we should explicitly allow for a correlation between taxes and location characteristics and treat the location-specific effects as fixed. Note that an implication for our approach is that we should also treat the combined firm-country effects $\gamma_{k,i}$ as fixed.

The inclusion of individual effects in the empirical analysis of equation (1) is, however, not trivial due to the binary nature of the observed dependent variable (firm k either holds an

investment at i or not). Chamberlain (1984) proposed a consistent fixed-effects logit estimator which models the probability of an event conditional on the number of events observed for the corresponding group. In our context, we can use this approach to model the probability of observing an investment of the considered firm in a specific country in a given year conditional on the observed frequency of corresponding investments in all years, *i.e.* conditional on the value of $\sum_{t=1}^{n} y_{k,i,t}$. Conditioning on this value removes the influence of the cross-sectional differences in the attractiveness of each location without further distributional assumptions. With regard to the remaining variation in the propensity to invest, however, the approach still relies on a conditional independence assumption.[1]

Note that this model supports some persistence in location decisions which arises from the fact that the unobserved propensity of firm k to hold an investment at i is relatively high or low in all periods. Following Heckman (1981) this kind of persistence due to heterogeneity can be distinguished from true state-dependence, where decisions are affected by the decision in the preceding period, perhaps, due to some sluggish adjustment. An alternative specification, hence, would also condition on the presence of an investment in the previous period at the considered location. However, the required discrimination between the two alternative sources of persistence is notoriously difficult (see Heckman, 1981, for a discussion). We, therefore, focus on the fixed effects logit specification.

3 Data and Variables

The empirical analysis basically uses the micro database ("MIDI") for FDI provided by the German Bundesbank. This is a comprehensive annual database of investment positions of German enterprises held abroad as well as of investment positions held in Germany by foreign

[1]Note that for purposes of inference we nevertheless use a robust variance covariance matrix estimator which allows for some random group effects.

companies. A favorable characteristic of the data set is the possibility to trace the investment positions of individual firms over time. In its current version, firm-level panel data are available for the period 1996 to 2003. The collection of the data is enforced by German law, which determines reporting mandates for certain international activities.[2] For each subsidiary the database reports some basic information about the balance sheet such as the balance sheet total as well as some broad subcategories such as the capital invested in property, plant, and equipment (PPE). With regard to outward FDI, each German investor has to report on her foreign subsidiaries, provided the balance sheet total is above some threshold level. Currently, reporting is mandatory if the balance sheet total of the investment exceeds € 3 million. The database contains directly as well as indirectly held FDI, which must be reported if an investment enterprise held by a majority participation holds 10% or more of another enterprise.

A problem with the raw data is that the threshold levels above which reporting is mandatory vary over time (see Lipponer, 2003). In order to make sure that the results are not subject to some bias originating in the sample selection, the current study consistently employs a uniform threshold level. Thus, an investment is only included in the estimation sample if the reported investment position is above all the various definitions of the threshold applied during the period from 1996 to 2003.[3]

For the purposes of the current study, we exclude FDI in the financial sector as well as investments in holdings, since we are basically interested in the tax effects of the location of productive capital. For the same reason we add the requirement that some positive investment in property, plant, and equipment (PPE) is reported. Furthermore, we exclude investments, which are made in branches or partnerships, since in such cases other effective or statutory

[2]Sec. 26 Aussenwirtschaftsgesetz (Law on Foreign Trade and Payments) in connection with Aussenwirtschaftsverordnung (Foreign Trade and Payment Regulations).

[3]While the uniformity of threshold levels across years proved important, note that variations in the definition of the threshold level have been found to exert only minor effects on the estimation results.

Table 1: Reported PPE of German Multinationals by Country

Country	Subsidiaries (1)	Size (in PPE) (2)	Share (in PPE) (3)
Australia	209.5	10054	.005
Austria	908.5	13025	.035
Belgium	422.9	14723	.020
Canada	275.5	23726	.018
Finland	81.4	15505	.003
France	1423.0	11956	.050
Great Britain	941.5	36768	.088
Greece	91.1	23072	.006
Ireland	86.9	7863	.002
Italy	829.8	9468	.023
Japan	246.4	44032	.028
Netherlands	661.5	24303	.041
Norway	100.0	10849	.003
Portugal	191.5	19001	.012
Spain	791.0	15066	.034
Sweden	236.9	21499	.014
Switzerland	741.0	16781	.050
USA	1728.5	68307	.330
Other countries	*4712.0*	*18329*	*.235*
Total	*14678.8*	*24237*	*1.00*

Subsidiaries: annual average number of subsidiaries reported in the period 1996 to 2003 in the considered country. Size: average size of investment stock in terms of PPE. Share: fraction of all PPE investment stocks allocated to the respective country or group of countries. Due to the lack of covariates the category "other countries" is not included in the empirical analysis below.

tax rates apply than in the standard case of subsidiaries.

Some descriptive statistics for the investment data are provided in Table 1. Considering only subsidiaries with some positive amount of PPE the average investment stock shows a value of property, plant, and equipment of about approx. € 24 million. Each year the estimation sample includes on average about 4,600 domestic investors reporting almost 15,000 foreign subsidiaries in more than 100 countries. The empirical analysis below, however, focuses on 18 countries for which comparable data on taxation and labor cost are available (see Table 1). Nevertheless, as can be seen from the third column in Table 1, the investment stocks in these

countries represent on average more than three quarters of the total PPE value of the foreign direct investment of German multinationals. Further inspection of the data reveals that FDI in multiple subsidiaries and countries is quite common for the German multinationals. Averaging over the years, some 42.5 % of investors report at least two foreign subsidiaries, 26.75 % report at least three, and 19 % report more than three foreign subsidiaries. On average, each company reports 3.2 subsidiaries. As a consequence, most of the subsidiaries (84 %, on average) reported in the dataset share the parent company with one or more other subsidiaries. Some of the subsidiaries are located in the same country such that the corresponding figures for countries are somewhat lower: 37,38 % of investors report subsidiaries in at least two countries, 22.38 % of investors report subsidiaries in at least three countries, and 15 % of investors report subsidiaries in more than three countries. On average, each company reports subsidiaries in 2.4 countries.

Note that the acquisition of an existing firm cannot be distinguished from the start-up of an entirely new firm. Provided the whole investment has a non-negligible size, in both cases the data base will report a new investment position of the considered firm. Similarly, the data do not allow us to distinguish a plant closure from the sale of a foreign affiliate; in these cases the investment will no longer be reported in the data set. It is also not entirely clear how a reorganization of the activities of a company in a host country will be documented in the data set and it seems likely that an existing subsidiary might appear in the following year as a different object. However, the analysis below is concerned with the presence of an investment of a company in the considered country regardless of the number of actual objects.

Following the existing empirical literature tax incentives are not sufficiently captured by the statutory tax rates. In particular, Devereux and Griffith (1998) emphasize that location decisions are affected by the effective average tax rate, which takes account of the definition of the tax base including depreciation allowances. Moreover, as has been emphasized in the literature on international taxation (*e.g.*, Slemrod, 1990, Hines, 1995), companies' investment

Table 2: Descriptive Statistics

Variable	Mean	Std.Dev.	Min.	Max.
		Levels		
Effective av. tax rate, eq.	0.255	0.057	0.074	0.399
Effective av. tax rate, eq. (20%)	0.283	0.062	0.083	0.432
Effective av. tax rate, eq. (30%)	0.298	0.065	0.087	0.452
Effective av. tax rate, eq. (40%)	0.306	0.067	0.090	0.468
Effective av. tax rate, eq. & debt	0.188	0.043	0.052	0.301
Statutory tax rate	0.340	0.077	0.100	0.532
Effective marginal tax rate	0.205	0.067	0.025	0.373
		Annual changes		
Effective av. tax rate, eq.	-0.004	0.016	-0.085	0.064
Effective av. tax rate, eq. (20%)	-0.004	0.015	-0.097	0.060
Effective av. tax rate, eq. (30%)	-0.004	0.015	-0.102	0.057
Effective av. tax rate, eq. (40%)	-0.004	0.015	-0.106	0.056
Effective av. tax rate, eq. & debt	-0.003	0.013	-0.064	0.052
Statutory tax rate	-0.004	0.016	-0.120	0.050
Effective marginal tax rate	-0.005	0.027	-0.138	0.097
		Levels		
GDP	1239	2280	356.04	11000
Labor cost in manuf.	18.30	5.36	4.49	31.6
		Annual changes		
log GDP	.035	.088	-.143	.245
log Labor cost in manuf.	.015	.094	-.159	.257

144 observations representing 18 countries observed over the period 1996 to 2003.

decisions might not only be affected by the corporation taxes in the host country, but also by the taxation of repatriated profits according to the corresponding double taxation treaty. But, note that Germany usually exempts the foreign earnings of a German parent. Hence, the tax burden at the location of the affiliate is decisive from the point of view of German companies. The empirical analysis, therefore, employs statutory and effective tax rates on investment in the corporate sector of the host country as reported by Devereux, Griffith, and Klemm (2002).[4]

Table 2 provides descriptive statistics of the data set. Accordingly, the various tax indicators show some variation not only across countries but also over time. The annual variation in statutory taxes, for example, shows a minimum of -12 percentage points and a maximum of +5 percentage points. The logarithm of GDP taken from the OECD is used as a proxy variable for the size of the local market. The logarithm of hourly compensation of employees in manufacturing provided by the Bureau of Labor Statistics at the U.S. Department of Labor is used as an indicator of local labor cost. The nominal figures are converted using purchasing power parity (PPP) equivalent exchange rates. Other potential location characteristics are captured by firm-country effects, or country effects, depending on the specification.

4 Results

As discussed above the empirical analysis involves the estimation of location probabilities depending on location characteristics. Table 3 reports results making use of the fixed-effects logit model following equation (1). Each regression contains a full set of location effects which are, as explained above, allowed to vary across investors, thereby, taking account of firm-specific preferences for potential locations. The analysis distinguishes 18 potential host

[4]The data have recently been updated and are available from the Institute for Fiscal Studies.

Table 3: Basic Results

	(1)	(2)	(3)	(4)	(5)
log GDP	2.11 **	2.21 **	2.46 **	2.09 **	2.40 **
	(.636)	(.643)	(.642)	(.643)	(.638)
log Labor cost in manuf.	-2.09 **	-2.16 **	-2.38 **	-2.08 **	-2.45 **
	(.636)	(.641)	(.646)	(.638)	(.645)
Effective av. tax rate		-.634			1.64
		(.875)			(11.9)
Statutory tax rate			-2.52 **		-5.41
			(.951)		(4.57)
Effective marg. tax rate				.137	1.25
				(.523)	(5.37)
Log-Likelihood	-14931.9	-14931.4	-14924.4	-14931.8	-14916.5
Firm-country cells			5,839		
Observations			37,695		

Logit estimation with fixed effects for each firm-country cell. Time-specific effects included. The dependent variable is the existence or non-existence of a subsidiary in each of the 18 countries considered in up to 8 consecutive years from 1996 to 2003. Robust standard errors (in parentheses). $^{**}(^{*})$ indicate significance at the 5%(10%) level.

countries, mainly European countries, but also the U.S., Canada, Japan, and Australia (see Table 1). In order to avoid the Moulton (1990) problem, standard errors are robust against random firm-specific country effects using the usual Huber-White sandwich formula.

The basic estimation sample consists of the 18 possible investment locations for all companies which have some positive amount of PPE invested abroad in at least one of the 18 countries in the current year. However, note that the decision to hold an investment is a binary variable which is only to a limited extent dependent on the local characteristics. The observation that a specific firm does or does not hold an investment in a specific country can only be revealing of an impact of local conditions if the location decision is not dominated by the firm-specific preference for this location. Thus, the estimation of the marginal effects will not use those groups of firm-country observations where an investment is reported during the whole time-period considered or which never report an investment.[5] However, there are still more than 5,800 firm-country cells available in order to study the location behaviour over time.

GDP and labor cost both show the expected sign and are both significant across all specifications suggesting that a large market size of a country as well as low labor cost are associated with a higher probability to observe an investment. The three indicators of the tax burden show different results. While the effective marginal and average tax rates prove insignificant, the statutory tax rate shows a significant negative impact. Specification (5) reports results where the different tax indicators are included jointly. But, probably due to the high correlation between these indicators, their joint inclusion fails to yield further insights.[6]

Quantitatively, the estimated coefficients indicate the relative impact on the odds-ratio: an

[5]More precisely, a firm-country cell will not contribute to the empirical likelihood if the total number of investments reported for a specific country is equal to the number of observations ($\sum_{t=1}^{n_{k,i}} y_{k,i,t} = n_{k,i}$) or zero ($\sum_{t=1}^{n_{k,i}} y_{k,i,t} = 0$), because in these cases the fixed effect perfectly predicts the outcome.

[6]In the analysis of Devereux and Griffith (1998) the effective average tax rate proved significant even if statutory tax rate and cost of capital were included.

increase in the statutory tax rate by 10 percentage points reduces the odds ratio by about 25 %. For an investment which has a 50 % chance of being carried out at the current tax rate, this implies that the probability declines by about 12.5 percentage points – if the tax rate increases by 10 percentage points.[7] For means of comparison consider the impact of an increase in the labor cost. In order exert a similar effect on the location probability as a 10 % increase of the tax rate, labor cost will have to rise by about US $ 1.9 per hour. Taking the observed variation for hourly wages and for tax rates into account (see Table 2) this suggests that labor cost differences are at least as important for explaining the observed location decisions as taxes. It is important to note, however, that the estimated effects are non-linear: an investment with a high, or low, chance of being carried out will be affected much less by a change in local conditions. For instance, the probability of an investment with a 90 % chance of being realized at the current tax rate will decline only by 3 percentage points upon a tax increase by 10 percentage points.

It seems useful to compare the effects of the statutory tax rate with the existing literature on location decisions. In his analysis of the location of new plants, Bartik (1995) finds that a 10 % increase in the tax rate reduces the odds ratio of a new plant by about 58 to 87 % depending on the specification. This is about 2 to 3 times larger than our basic result. Considering the decision to hold an investment, regardless of whether it is a new investment, Devereux and Griffith (1998) also find a stronger effect: according to their results a 10 % increase in the effective average tax rate reduces the odds ratio by about 68 %. Of course, a slightly larger effect should be expected since a 10 % increase in the effective average tax rate would generally imply an increase in the statutory tax rate by more than 10 %. Nevertheless, the comparison indicates that the tax sensitivity of the location decision in the case of German multinationals is smaller than has been indicated by previous studies of other cases.

[7] Note that an average partial effect cannot be obtained as the firm-specific country effect and its distribution are not determined in the fixed effects logit model.

Table 4: Results for Alternative Effective Av. Tax Rate Indicators

	(6)	(7)	(8)	(9)	(10)
log GDP	2.20 **	2.40 **	2.46 **	2.09 **	2.38 **
	(.644)	(.638)	(.642)	(.643)	(.645)
log Labor cost in manuf.	-2.15 **	-2.45 **	-2.38 **	-2.08 **	-2.41 **
	(.641)	(.645)	(.646)	(.638)	(.647)
Effective av. tax rate, eq.	-.634				
	(.875)				
Effective av. tax rate, eq.& debt (10%)		-1.00			
		(1.14)			
Effective av. tax rate, eq. (20%)			-1.32		
			(.938)		
Effective av. tax rate, eq. (30%)				-1.67 *	
				(.958)	
Effective av. tax rate, eq. (40%)					-1.88 *
					(.965)
Log-Likelihood	-14931.4	-14931.1	-14929.8	-14828.7	-14927.9
Firm country cells			5,839		
Observations			37,695		

See Table 3.

With regard to the various effective tax rate indicators it should be emphasized that the additional information about the definition of the tax base is implemented using several a-priori assumptions on the characteristics of the investment, *i.e.*, with regard to the financing of investment, the type of investment, as well as with regard to the profit rate. In order to test whether the results obtained are sensitive to those assumptions, Table 4 provides further results using alternative tax rate indicators. The results indicate that the effective average tax rate has a better predictive power and shows a significant negative effect if calculated at higher rates of return. But since the effective average tax rate approaches the statutory tax rate for high rates of profit it is difficult to argue that the effective average tax rate at higher profit rates captures a different source of variation than the statutory tax rate.

Of course, as it is rather unlikely that the assumptions used to compute the effective tax rate will fit equally well to all firms and investments, the weak significance of the effective average tax rate likely reflects a measurement problem. In fact, in calculating effective tax rates Devereux and Griffith (1998) take account of differences in the conditions across industries and, thus, tailor the tax rate more to the specific conditions in each industry. Given the information available and the organization of the data set a corresponding approach is not feasible in the current analysis. However, as the extent of the measurement problem should depend on the degree of heterogeneity across firms and investment projects it might be the case that the predictive power of the effective average tax rate improves if we consider a less heterogeneous sub-sample. Of course, a reduction of the sample size might contribute to less precise estimates. Nevertheless, in order to get some preliminary indication of the importance of heterogeneity for the weak significance of the effective average tax rate, we carried out some sensitivity analyses for a sub-sample where the largest 10 % of the investment projects in terms of property, plant, and equipment are excluded. Given the skewed distribution of the size of projects, this ensures that the heterogeneity in terms of size is considerably reduced. While the results (available upon request) do in fact indicate a stronger significance of the effective average tax rate they also point at a stronger impact of the statutory tax rate. The effective marginal tax rate, however, still proves insignificant.

5 Conclusions

The aim of the analysis in this paper is to test empirically the influence of taxation on the decision of multinationals to hold a foreign direct investment at a specific location. In difference to most of the literature this paper uses a firm-level panel data set to study those location decisions. While this raises difficulties in combining data at the firm as well as at the country level, it enhances possibilities to identify tax incentives relative to unobserved

country characteristics and firm-specific country preferences. The paper uses a novel data set of German multinationals made available by the German Bundesbank. The German case is of particular interest as Germany exempts repatriated profits from subsidiaries such that the tax conditions in the host country should be decisive for location decisions.

Significant effects are found in particular for the statutory tax rate, the market size, as captured by the GDP, and the labor cost. The results indicate that an increase in the statutory tax rate by 10 percentage points reduces the odds ratio to observe some positive investment by approximately 25 %. For an investment which has a 50 % chance of being carried out at the current tax rate, this implies that the probability declines by about 12.5 percentage points, if the tax rate increases by 10 percentage points. With regard to the labor cost variable the estimated impact suggests that an increase in the labor cost by about U.S. $ 1.9 per hour would have the same effect on the location propability. Taking into account the observed variation of hourly wages and tax rates this suggests that labor cost differences are at least as important for explaining the observed location decisions as taxes.

Testing for the various alternative indicators of tax incentives, the statutory tax rate shows the strongest predictive power and yields the strongest effects. In contrast, the marginal effective tax rate is not significant at all. Given the significance of the effective average tax rate if calculated at higher rates of profit this is in accordance with Devereux and Griffith (1998) who argue that the effective average rather than the marginal tax rate matters for location decisions. However, in contrast to Devereux and Griffith the results indicate a considerably weaker predictive power of the effective average tax rate as compared to the statutory tax rate.

The weaker predictive power of the effective average tax rate as compared to the statutory tax rate might indicate that multinationals take account of profit-shifting opportunities in the choice of location of their subsidiaries. However, it could also arise from the variation in

the specific conditions of an investment. While further research is necessary on this issue, the results suggest that a policy directed towards the attraction of multinationals should care for low levels of both the statutory tax rate on corporation profits as well as of the labor cost.

Datasources and Definitions

Firm-level data are taken from the micro data set of the Bundesbank, see text.

GDP in Bill. U.S. Dollars converted using PPP equivalent exchange rates. Source: OECD.

Labor cost: Hourly compensation costs in U.S. Dollars for production workers in manufacturing converted using PPP equivalent exchange rates. Source: U.S. Bureau of Labor Statistics.

Tax incentives are taken from Devereux, Griffith, and Klemm (2002). The data which have recently been updated are kindly provided at the IFS website. *Effective av. tax rate, eq.* refers to the basic EATR assuming a 10 % rate of profit. EATR with alternative profit rates are denoted with a parentheses reporting the corresponding rate of profit. *Effective av. tax rate, eq. & debt* is an average of EATR for equity and debt finance assuming weights of 2/3 and 1/3, respectively. The *Effective marginal tax rate* considers equity finance, only.

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