# Corporate Tax Reform and Foreign Direct Investment in Germany - Evidence from Firm-Level Data

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**Abstract**

Does the reduction of the effective tax burden on corporations trigger foreign direct investment? We take the German tax reform of 2000 as a natural experiment in order to isolate the impact of corporate taxation on the investment of foreign-held affiliates in Germany. We do so by exploiting the very rich MiDi data base from the Deutsche Bundesbank. Although we choose an approach which is likely to underestimate the tax effects on investment we find significant evidence that the tax reduction had the intended effect of - ceteris paribus - fostering inward direct investment. We find an elasticity of inward foreign direct investment with respect to the effective marginal tax rate of 0.4.

**JEL Codes:** H25, H21

**Keywords:** Corporate Taxation, Foreign Direct Investment

# 1 Introduction

The strong increase in the international mobility of capital and firms have led to enormous welfare growth in many parts of the world. However, the fast proceeding structural change and the accelerating division of labor have forced firm owners, employees and governments throughout the world into a permanent process of adjustment. For governments, tax reform is one important instrument to adapt to a changing international environment. In recent years, many countries have implemented tax reforms which reduce the effective tax burden on investment. This type of tax reform is justified with the claim that it will foster domestic investment.

Given that the border crossing mobility of capital and firms increases, it is reasonable to consider a reduction of the tax burden on domestic investment. But lowering the tax burden on investment necessarily implies a cut in public expenditure or a shift of the tax burden to other tax bases like e.g. labor or consumption. Sound tax policy has to carefully weigh the benefits of a corporate tax reduction to the economy as a whole against the cost.[1] Therefore, public finance economists should seek to provide information on both the cost of tax reforms - i.e. revenue losses - and the benefit - i.e. more investment, more jobs etc.

The purpose of this paper is to measure the benefits of corporate tax reduction in the form of additional inward investment of foreign owned firms. We do so by analyzing the effect of the German tax reform in 2000, which came into force in January 2001. This reform abolished the full imputation system of dividend taxation and replaced it by a classical-type system. In addition, it implied substantial corporate tax rate cuts and broadened the corporate tax base. A frequently cited goal of the tax reform was to attract foreign direct investment in order to mitigate the huge unemployment rate. Now, five years after the reform, we ask whether the tax reform reached this goal and whether the resulting investment increases are worth the losses in tax revenue.

We analyze this question by using the very rich MiDi data set from the Deutsche Bundesbank with firm-specific balance sheet data. Our analysis contributes to a literature that tries to clarify the incentive effects of existing tax systems on corporate investment. As corporate investment is assumed to be crucial for the generation of new jobs and growth, we think that this question is at the heart of future debates on corporate tax reforms.

Figure 1 illustrates the increasing importance of cross-border investment. It shows the inward flows (left scale) and stocks (right scale) of foreign direct invest-

[1] For recent surveys on the theory of capital tax competition see e.g. Wilson & Wildasin (2004) or Fuest, Huber & Mintz (2005).

ment in Europe.

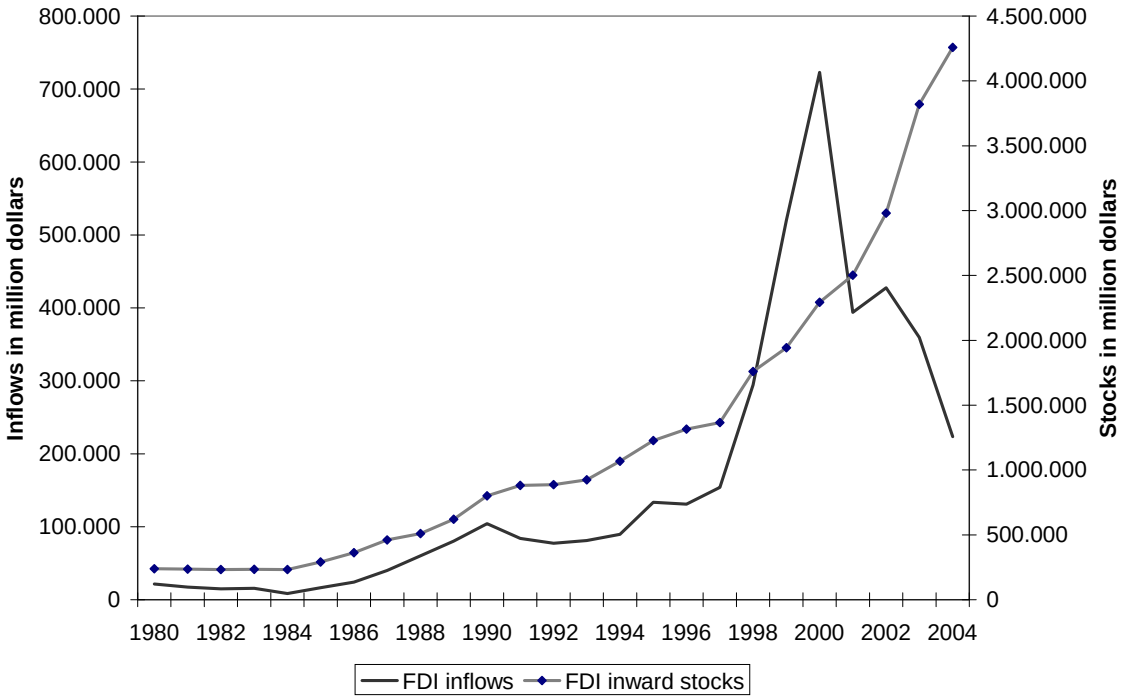


Figure 1: Inward FDI in Europe, flows and stocks. Source: UNCTAD.

As the graph indicates, international foreign direct investment stocks experienced high - and even exponential - growth rates in the last 25 years. There were extraordinary large inflows of FDI in the second half of the Nineties and then a sharp fall from 2001 on. The volatility of the flows time series hints at the difficulties which empirical economists face in isolating the impact of taxes. The German reform was passed in 2000, when investment had its peak, and came into power in 2001, when FDI - and domestic investment as well - saw a considerable decrease. As will become clear in the empirical section of this paper, the task of identifying the tax impact in such a volatile environment is a major challenge.

Our research objective touches mainly two types of literature. First, the literature on the determinants of FDI is concerned, which is greatly surveyed by Markusen (2002). Recently, Buch, Kleinert, Lipponer & Toubal (2005) analyzed the determinants of German outbound investment using the same data set we use in this paper. Taxes, though, have not been checked as possible impact factor.

Second, there is a vast literature on the tax influence on investment in general. Cummins, Hassett & Hubbard (1994) were among the first to propose interpreting tax reforms as natural experiments in order to isolate the tax impact. Hines (1999)

gives a thorough review of those studies related to cross-border investment data. A meta-study is provided by Mooij de & Ederveen (2003).

It is striking that the bulk of empirical studies on the causal relationship between taxes and FDI uses US data, although the tax competition is supposed to be fiercer among European countries.[2] Devereux & Griffith (1998) analyze the location decisions of US multinationals in Europe and find significant evidence that location depends on the effective average tax rate. Büttner & Ruf (2004) use a panel of German multinationals to examine the location decisions and are able to confirm the Devereux-Griffith results.

In the next section, we will briefly outline the main features of the German tax reform in 2000. In section 3, we discuss the main hypothesis - that taxes reduce foreign direct investment - the estimation approach and some conceptual issues. Section 4 describes the data set and reports the estimation results as well as some robustness checks. Section 5 concludes.

# 2 The German tax reform of 2000

The main goals of the German Tax Reform 2000 were to improve the competitiveness of firms in Germany, to foster investment, to increase the attractiveness of Germany from the foreign investors' perspective, to adapt the corporate tax system to the rules of the EC common market and to avoid distortions in the choice of organizational form. Next to fundamental changes in the corporate tax system, the reform lowered the top marginal individual tax rates, it abolished the imputation system and established the half income method (which is a type of the classical system) and it abolished a long list of loopholes.[3]

The changes in the personal income tax system are important and perhaps relevant for the investment decision of foreign investors. But, as we lack appropriate data on shareholders, we cannot use these reform parameters for our purpose. In the following we will restrict ourselves on the reform of the corporate tax system itself.

The corporate tax rate was decreased and the formerly different tax rates on retained earnings (40 percent) and distributed profits (30 percent) were turned into a single tax rate on all profits (25 percent). Before the reform, Germany allowed the full imputation of the tax on distributed profits on the personal income

[2] There are some papers using European aggregate data, like Bénassy-Quéré, Fontagné & Lahrèche-Révil (2005). But, the limited quality of aggregate data seems to shed some doubts on the validity of the results derived from this kind of data, as it is argued in Becker, Fuest & Hemmelgarn (2005).

[3] For a complete description of the reform please refer to Keen (2002), Homburg (2000) and Schreiber (2000).

tax, distributed profits were effectively tax free. The 30 percent withholding tax was fully creditable. Germany moved away from this full imputation system and switched to the classical system where only half of the dividend received is taxed with the personal income tax (Halbeinkünfteverfahren). Including local trading taxes (Gewerbesteuer) the combined marginal rate of the old system was 54,3% while the new combined marginal tax rate is on average 39,4%, see Spengel (2001).

The corporate tax base was broadened substantially with the 2000 reform. The rules for thin capitalization of foreign companies and related party financing were tightened. Depreciation allowances were reduced in terms of expected value for tangible assets, like machines, and structures, as is shown in table 1.

**Table 1: The reform of the tax depreciation allowances.**

| Asset type | Before 2001 | Since 2001 |
|---|---|---|
| Intangibles | 5 years linear deductions (20%) | 5 years of linear deductions (20%) |
| Machines | 4 years declining balance (30%), then 3 years linear deductions (8%) | 2 years declining balance (20%), then 5 years linear deductions (12,8%) |
| Structures | 25 years linear deductions (4%) | 33 years linear deductions (3%) |
| Inventories | - | - |

It turns out that real investment is discouraged compared to financial and inventory investment when looking at the EMTR. For the EATR all investments are more attractive but the relative winner are still financial and inventory investment.

For our purpose, we will mainly use the tax rate cut cum base broadening features, but we will discuss in how far the other reform parts might play a role in shaping the investment process.

# 3 The theoretical underpinning

As it is greatly clarified by Devereux and Griffith (2003) there are two tax impacts on FDI that must be carefully differentiated. First, taxes may influence the location decision by firms, second, taxes have an impact on the size choice of the optimal capital stock. Our dataset does not allow to analyse the location decision of multinational enterprises. We just observe existing capital stocks and their variation over time. Therefore, our main focus is on the choice of the optimal capital stock. But, discrete jumps in the balance sheet capital stock suggest that we can observe quasi-location decisions where firms decide to locate the production of new products in one country or another. Given that the firm is indifferent between the two production locations a change in the effective average taxation will lead a variation in the location decisions.

Before we present our simple model of the multinational firm we should quickly outline why we do not use the so-called "capital-knowledge model" which is the standard model in the literature for analyzing foreign direct investment. First, we are interested in the variation of capital stocks as a response to tax variations, not in their absolute size. That means, that every time-constant variable determining the capital stock drops out in our analysis. Second, our data requirements reduce the data sample considerably and excludes nearly all non-OECD countries. Since OECD countries are likely to have very similar factor proportions the capital-knowledge model might not be the best model to work with.

Now, assume that there is a multinational enterprise (MNE) located in a country outside Germany, which has an affiliate in Germany and - potentially - in other countries as well. Using a very general formulation, we can state that the MNE chooses the size of the capital stocks depending on a finite vector $\mathbf{x}$ including global, country-specific, activity-specific and firm-specific parameters:

$$\Pi = \Pi\left(K_1, ..., K_n\right) \quad \text{with } K_h = K_h\left(\mathbf{x}_h\right) \tag{1}$$

with $h = 1, ..., n$. The $\mathbf{x}$ is a 1xm variable vector of parameters which are candidates for influencing the investment decision. One of these parameters is supposed to be taxation. Total differentiation yields:

$$dK = \frac{\partial K}{\partial x_1} dx_1 + ... + \frac{\partial K}{\partial x_{tax}} dx_{tax} + ... + \frac{\partial K}{\partial x_n} dx_m \tag{2}$$

with $g = 1, ..., m$. $x_{tax}$ is some tax variable to be operationalized later on. Held everything else constant, i.e. $dx_g = 0 \; \forall \; g \neq tax$, the partial effect of the tax variable on the capital stock $K$ is:

$$\frac{dK}{dx_{tax}} = \frac{\partial K}{\partial x_{tax}} \equiv \beta_{tax} \tag{3}$$

Our main hypothesis is that taxation has a negative impact on FDI, i.e. $\beta_{tax} < 0$. There are two channels through which this relation can be established. First, if taxes increase the cost of capital, some marginal investment projects are not realized. In this case, the capital stock of the foreign mother company and the one of the German affiliate are not systematically linked: i.e. $\frac{dK_h}{dK_{-h}} = 0$. Second, if taxes increase the average tax burden of given project, the probability rises that this project will be realized elsewhere, e.g. in the country of the mother firm: $\frac{dK_h}{dK_{-h}} < 0$. Since we do not have any data on the foreign mother companies we cannot thoroughly differentiate between these two channels.

## 3.1 The identification problem

Given perfect data we would be able to unambiguously quantify $\beta_{tax}$ with standard econometric methods. But, as it is typical for this kind of research question, our

data are of limited extent and of limited quality. Therefore we have to make some assumptions on which we base our confidence that we can use these limited data to answer our research question. In our view the data imply three major identification problems.

The first is that we cannot separate exactly the aggregate effects of the tax reform from other aggregate effects. In other empirical studies, like in Cummins et al. (1994) or in Slemrod, Dauchy & Martinez (2005), some observable aggregate variable (like unemployment, consumption etc.) is used to clean the FDI time series from aggregate movements. This approach is only feasible if the time span before the tax reform is long enough to get a valid estimation of the relationship between the independent aggregate variable and the dependent investment variable. Our pre-reform dataset only covers five years (1996-2000) which proves to be far too less in order to get this reliable relationship. In order to deal with this problem, we decided to employ a rather radical technique which is to employ a full set of time dummy variables.[4] That is, we cleaned the time series from every time-varying macroeconomic effect, the macroeconomic tax effect included. If we assume that the tax reform has a positive effect on aggregate investment, our estimation results underestimate the tax impact on investment.

The graph in figure 1 shows that the tax reform took place at the turning point of the business cycle. Without taking into account the macroeconomic impact as suggested in the preceding paragraph, the analysis could yield contra-intuitive results like "cutting taxes reduces investment" just because the tax reform and the aggregate downturn coincided.

The second identification problem arises on the firm level. The data set we use is a very rich one, but we suspect that there remain a lot of unobserved variables that may have an important influence on the investment decision by the mother company or the affiliate itself. However, if we assume that those variables vary orthogonally to the tax variable we are able to detect the true impact of the tax variable. These unobservable effects play an important role for the third identification problem.

The third one is that we cannot isolate the impact of taxes if these do not vary. Due to unobservable time-varying effects the literature suggests that the tax reform has to be fundamental, i.e. that it implies changes of the tax system large enough to make firms change their investment plans. Cummins et al. (1994) enumerate different criteria for a tax reform to be "fundamental" which are met by the German tax reform. But, even fundamental reforms do not have observable in the reform year if they were expected. Therefore, we have to assume that

[4] Actually, we tried different methods of detrending the time series by regressing the data on aggregate consumption, aggregate domestic investment, demand and so on. It turns out that our estimation results of the tax term are highly sensitive to the detrending method or the detrending variable, respectively. So we abandoned this approach due to data limitations.

the tax reform comes as a surprise. If firms expect a tax reform years before it is realized, standard investment theory predicts that we should not observe jumps in investment in tax reform years. However, if firms do not expect the tax reform, they will start the adjustment process towards the new equilibrium stock of capital in the year in which the tax reform takes place. Due to the nature of the political process we cannot assume that firms were really surprised when the new tax became valid in January 2001. So we adopt the approach used in the previous literature which is to ignore the year in which the tax reform is passed (here: the year 2000). That means that we consider the years 2001-2003 as the treatment group and the years 1997-1999 as the control group.

## 3.2 The estimation approach

Our dependent variable is $\frac{I_{i,t}}{K_{i,t-1}} = \frac{K_t - K_{t-1}}{K_{t-1}}$ where the $K$ are the observable variable 'total assets' including tangible, intangible and financial assets. That means, we measure net investment $I_{i,t}$ because for $K$ to be stable over time there have to be replacement investment.[5] The $i$ refer to the individual firms. Following the assumptions outlined above, we split the investment in an aggregate component and a firm-specific component:

$$\frac{I_{i,t}}{K_{i,t-1}} = \frac{I_t}{K_{i,t-1}} + E_{i,t} \text{ with } \sum_i E_{i,t} = 0 \tag{4}$$

The aggregate component $\frac{I_t}{K_{i,t-1}}$ also includes the aggregate tax effect in the post-reform years which we willingly neglect. In other words, we overestimate the aggregate effect, given that the tax effect of an effective tax reduction is definitely positive. Thus, we will get a conservative (in the sense of biased downwards) measure of the tax impact on foreign direct investment.

In the first -stage regression we estimate

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha_t YEAR_t + u_t \tag{5}$$

The variable $YEAR_t$ is a time dummy which is equal to 1 if the year is equal to t and 0 otherwise. Following assumption 2, the $\alpha_t$-effect which sums up all macroeconomic effects of one year is equal for all firms. We then compute the difference between actual investment and the aggregate effect:

$$E_{i,t} = \frac{I_{i,t}}{K_{i,t-1}} - \hat{\alpha}_t YEAR_t \tag{6}$$

[5] It is true that replacement investment is no automatic process but a strategic decision which may be influenced by taxes as well. However, we lack the data to deal with these questions.

where $\hat{\alpha}_t$ is the estimated value of $\alpha_t$. In the second-stage regression we estimate equations of the following form:

$$E_t = \beta_0 + \beta_1 \Delta TAX + \beta_2 \left(POST \cdot \Delta TAX\right) + \sum_{g=3}^{m} \beta_j X_j + \varepsilon_j \tag{7}$$

where $\Delta TAX$ is the change of the firm-specific tax variable from 2000 to 2001, and the $X$ are firm-specific control variables variables. We have no prediction for the sign or the significance of $\beta_1$. But, if it is significant it seizes some unobservable firm characteristic. We do expect $\beta_2$ to be significantly negative. This approach is in line with the recent critique by Bertrand, Duflo & Mullainathan (2004) who show that most difference-in-difference estimators are strongly biased by serial correlation. They propose pooling the pre-reform and after-reform data in order to overcome these problems.

# 4 The empirical analysis

## 4.1 The data

### 4.1.1 FDI data

We use the Micro Database Direct Investment (MiDi) from the Deutsche Bundesbank which contains a large sample of German inbound and outbound FDI.[6] As we set out in the introduction the goal of this paper is to test wether foreign affiliates in Germany increased their investments within Germany as a response to the corporate tax reform 2000. We therefore use only data on inbound FDI for our estimations.

From 1996 on, the data are available as panel data. We construct a balanced panel data set by excluding all firms which do not have full coverage from 1996 to 2003. This limits of course the size of the sample but allows us to control precisely for firm specific effects which is necessary to isolate the effect of the tax change in 2000 on the firms investment behaviour. Furthermore, we exclude all public companies from the sample and keep only corporations in the sample in order concentrate on the effect of the corporate tax reform.[7] After limiting the data according to these specifications we have 2830 firms in the balanced data set.

These German affiliates of foreign mother companies are sometimes owned by investors from different countries. We assume that the largest investor is the

[6] For a description of the database see Lipponer (2003).

[7] The legal forms of organization in the sample are the German corporate forms AG, KGaA and GmbH.

dominant one and assume that the country of the dominant investor is the home country of the mother company.

Since our dependent variable $\frac{I_{i,t}}{K_{i,t-1}}$ uses two sequential periods we have seven observations (1997-2003) for each affiliate. This gives us 19.809 observations in our dataset. In order to deal with outliers the variables investment, profitability and debt level are winsorized at the 5 percent and 95 percent values of their distributions by setting values outside those ranges to the values at those percentiles.[8]

### 4.1.2 Tax-related data

We can differentiate between two tax effects. The first effect is that taxes increase the cost of capital and therefore change the size of the capital stock at which the marginal investment yields a return equal to the cost of capital. Firm-specific tax rates are constructed as follows: As Devereux and Griffith (2003) show, the EATR is a weighted average of the statutory tax rate $u$ and the EMTR. See Becker and Fuest (2004) for the calculation of

$$EMTR_i = \frac{u\left(1 - A_i - r_i b\right)}{\left(1-u\right) r_i + u\left(1 - A_i - r_i b\right)} \tag{8}$$

with $r_i = \frac{\rho - \pi}{\rho - \pi + (1+\pi)\delta_i}$. $\rho$ is the nominal interest rate, assumed to be equal to 7%, $\pi$ is the inflation rate, assumed to be 2%. $\delta$ is the firm-specific rate of economic depreciation, which is calculated according to $\delta_i$ is the firm-specific rate of capital depreciation which can be expressed as:

$$\delta_i = \sum \phi_{i,j}\delta_j \quad \text{where } \sum \phi_{i,j} = 1 \tag{9}$$

where $\phi_{i,j}$ is the fraction of asset $j$ in firm $i$ and the $\delta_j$ are estimations of economic depreciation rate taken from Spengel (2001). $A$ is the expected value of tax depreciation alloances: $A = \mu \sum_i \theta_i \sum_{t=1}^{T} \frac{d_{i,t}}{(1+r)^t}$ where $\mu$ denotes the fraction of tangible assets in the capital stock, and the $\theta_i$ denote the fraction of the asset type in the total tangible capital stock. We can observe $\mu$. The $\theta_i$ are taken from the Deutsche Bundesbank[9] assuming that the affiliates held by foreign owners have the same tangible capital structure as the industry average. $b$ is the fraction of debt finance in the marginal investment; we assume throughout the analysis that $b = 0$, i.e. we have pure equity finance.

The second tax effect is that taxes reduce the profitability of discrete investment projects. Although we do not have data on the location decision of MNEs with

[8] Winsorizing variables is a common method to deal with outliers in this type of datasets. See Hanlon, Mills & Slemrod (2005) for a similar procedure.

[9] Available online at:
http://www.bundesbank.de/stat/download/stat_sonder/statso6_2000_2002.pdf

respect to whole affiliates, the data suggest that there are discrete projects which could be realized in one affiliate or in another. Therefore, we also use the effective average tax rate (EATR) as a dependent regression variable for different values for the marginal rate of return $p^m$ and assuming that the profitability of the project $p$ can be approximated by the pre-reform profitability of the whole affiliate . The formula under consideration is:

$$EATR_i = \frac{p^m}{p_i} EMTR_i + \left(1 - \frac{p^m}{p_i}\right) T \tag{10}$$

The problem is that we cannot use firms in which $p < p^m$ which leads to a considerable reduction of the data sample.

### 4.1.3 Other data

Since we use a full set of year dummies seizing the aggregate effect, we do not need any information on aggregate control variables. We use country dummies in order to correct for time-invariant country-specific effects and we try GDP controls adding the country rates of GDP growth. Buch et al. (2005) employ standardized indicators as regression variables, like the index of economic freedom etc. We refrain from doing so because our data sample consists only of OECD countries for which these indicators do not vary sufficiently. In Buch et al. (2005) the corresponding coefficients vanish when employed to the subgroup of OECD countries.

## 4.2 Descriptive Statistics

Table 1 shows the summary statistics with the mean values and standard deviations in brackets below of the total balance sheet capital stock (in thousand Euros), the fraction of non-financial assets, profitability measured as periodical profits over total assets, the fraction of debt finance, investment as defined above and the effective marginal tax rate (EMTR).

**Table 2: Summary statistics**

| Year | Total assets in 1000 Euro | Non-financial assets | Profitability | Debt level | Investment | EMTR |
|---|---|---|---|---|---|---|
| 1996 | 48 553.5 | 0.20 | 0.010 | 0.66 | - | 0.5758 |
| | (352207.1) | (0.23) | (0.088) | (0.31) | | (0.0106) |
| 1997 | 54 000.7 | 0.20 | 0.013 | 0.66 | 0.14 | 0.5759 |
| | (443309.2) | (0.23) | (0.088) | (0.31) | (0.43) | (0.0106) |
| 1998 | 64 372.9 | 0.20 | 0.010 | 0.65 | 0.15 | 0.5657 |
| | (575958.5) | (0.23) | (0.088) | (0.31) | (0.43) | (0.0106) |
| 1999 | 69 532.5 | 0.20 | 0.019 | 0.65 | 0.12 | 0.5257 |
| | (721851.9) | (0.23) | (0.087) | (0.31) | (0.41) | (0.0110) |
| 2000 | 76 844.0 | 0.20 | 0.019 | 0.64 | 0.15 | 0.5255 |
| | (855132.2) | (0.23) | (0.090) | (0.31) | (0.42) | (0.0112) |
| 2001 | 80 599.7 | 0.20 | 0.018 | 0.63 | 0.11 | 0.3876 |
| | (864479.9) | (0.23) | (0.092) | (0.32) | (0.42) | (0.0101) |
| 2002 | 76 030.0 | 0.20 | 0.017 | 0.61 | 0.15 | 0.3877 |
| | (703414.9) | (0.23) | (0.094) | (0.33) | (0.50) | (0.0102) |
| 2003 | 89 152.5 | 0.19 | 0.016 | 0.59 | 0.04 | 0.4077 |
| | (1024766.3) | (0.23) | (0.092) | (0.33) | (0.33) | (0.0103) |

Notes: The table reports the means for the sample under consideration and the standard deviation in brackets below.

As the total assets column shows, the firms in our data sample experienced high growth rates. Meanwhile, the share of non-financial assets remained on a surprisingly low but time-constant level. The profitability measure is very low, between 1% and 1,9 %, the debt level slightly decreases over time. Investment is over 10% in each period, but shows a sharp fall in 2003. The tax reform in 2000 reduces the EMTR from over 50% to under 40% in the post-reform period.

## 4.3 Results

### 4.3.1 Baseline estimation

Table 3 shows the results of the baseline estimation regressions. The dependent variable is the $E_{it}$ as described in equation (6). Note that our estimation result are biased downwards due to the neglection of the aggregate effect of the tax reform. The estimation values can therefore be regarded as a conservative bottom line. Explanations of the variable definitions in table 3 can be found in the notes below the table.

**Table 3: Baseline regressions, profitability and number of investors.**

| | Baseline | | | Profitablility | | Number of investors | | | |
|---|---|---|---|---|---|---|---|---|---|
| Dependent variable | without 2000 | incl. 2000 | averages | profitable | non-profit. | one | two | three | > three |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Constant | 0,1281 | 0,1612 | 0,0930 | -0,0158 | 0,3409 | 0,1814 | -0,4651 | -0,4610 | -0,6705 |
| | (0,0973) | (0,0891) | (0,0986) | (0,1234) | (0,1568) | (0,1037) | (0,3504) | (0,4768) | (0,6189) |
| ΔEMTR | 0,1701 | 0,4119 | 0,7090 | -0,6839 | 1,3533 | 0,6060 | -3,6348 | -3,2971 | -4,3296 |
| | (0,6860) | (0,6270) | (0,6963) | (0,8739) | (1,0906) | (0,7333) | (2,4299) | (3,2821) | (4,3834) |
| ΔEMTR*POST | -0,1171 | -0,1313 | -0,1362 | -0,1868 | 0,0484 | -0,1015 | -0,1605 | -0,2269 | -0,2301 |
| | (0,0433) | (0,0407) | (0,0448) | (0,0498) | (0,0865) | (0,0480) | (0,1156) | (0,2395) | (0,2167) |
| PROFITABILITY | 0,3270 | 0,2971 | 0,0140 | 0,3095 | 0,3057 | 0,3304 | 0,3540 | -0,0394 | 0,4173 |
| | (0,0397) | (0,0371) | (0,0152) | (0,0530) | (0,0666) | (0,0427) | (0,1226) | (0,2929) | (0,2283) |
| NON-FIN ASSETS | -0,2378 | -0,2462 | -0,1072 | -0,2206 | -0,2677 | -0,2448 | -0,1800 | -0,1669 | -0,0020 |
| | (0,0173) | (0,0158) | (0,0177) | (0,0211) | (0,0300) | (0,0189) | (0,0531) | (0,1200) | (0,0988) |
| DEBT | 0,0868 | 0,08792 | 0,0208 | 0,1285 | 0,0252 | 0,0872 | 0,0846 | 0,1509 | 0,1166 |
| | (0,0119) | (0,0110) | (0,0121) | (0,0152) | (0,0200) | (0,0131) | (0,0346) | (0,0720) | (0,0578) |
| SALES | -0,0748 | -0,0749 | -0,0025 | -0,0747 | -0,0781 | -0,0772 | -0,0571 | -0,0554 | -0,0580 |
| | (0,0027) | (0,0025) | (0,0030) | (0,0031) | (0,0052) | (0,0029) | (0,0079) | (0,0188) | (0,0192) |
| SALESGROWTH | 0,4346 | 0,4394 | 0,3933 | 0,4468 | 0,4098 | 0,4220 | 0,5298 | 0,3966 | 0,5356 |
| | (0,0138) | (0,0126) | (0,0143) | (0,0172) | (0,0231) | (0,0147) | (0,0455) | (0,0950) | (0,1508) |
| SIZE | 1,14e-07 | 9,43e-08 | 4,58e-08 | 1,02e-07 | 1,46e-07 | 1,94e-07 | 2,63e-08 | 2,80e-07 | 4,26e-07 |
| | (4,03e-08) | (3,74e-08) | 2,91e-08 | (4,16e-08) | (8,76e-08) | (7,35e-08) | (3,12e-08) | (9,87e-08) | (1,35e-07) |
| EMPLOYEES | -1,52e-06 | 4,71e-06 | -2,02e-05 | -7,32e-06 | 3,69e-05 | 2,29e-05 | -1,38e-05 | -5,72e-05 | -4,92e-05 |
| | (1,22e-05) | (1,10e-05) | (9,67e-06) | 1,24e-05 | (3,20e-05) | (1,70e-05) | (1,34e-05) | (4,09e-05) | (1,81e-05) |
| INVESTORS | -0,0095 | -0,0094 | -0,0139 | -0,0106 | -0,0050 | | | | |
| | (0,0029) | (0,0027) | (0,0029) | (0,0029) | (0,0093) | | | | |
| No of obs | 14692 | 17165 | 14692 | 10395 | 4297 | 12396 | 1731 | 356 | 209 |
| R2 | 0,1939 | 0,1968 | 0,1333 | 0,1981 | 0,1936 | 0,1916 | 0,2477 | 0,2119 | 0,3633 |

Notes: Dependent variable is net investment over total assets in the preceeding period. PROFITABILITY, which is measured by periodical profits over total assets; NON-FINAN ASSETS is the fraction of non-financial assets in the total capital stock, DEBT measures the fraction of debt finance in the total capital stock. SALES are defined as sales over total assets. SALESGROWTH is equal to ((Sales(t)-Sales(t-1))/(Sales(t-1))). SIZE is the absolute balance sheet value of total assets. WORKERS is the number of employees. INVESTORS is the number of foreign investors as it is reported in the data set.To be included, affiliates data have to cover the whole period from 1996 to 2003. The largest and the lowest 5% of the variables NON-FINAN ASSETS, DEBT and SALES have been winsorized. All regressions are corrected for hetereskedasticity. The robust standard errors are reported in brackets below the coefficient values. Corrections for cluster-specific heteroskedasticity only brought minor and non-qualitative changes. Wald tests were routinely applied; results are reported in the text if unexpected.

The first column in table 3 reports our baseline estimation with a treatment group of 2001-2003 and a control group of 1997-1999. Before we analyze the results of the tax term we quickly discuss the outcomes of the control variables which are quite interesting, too. The term profitability is positive and highly significant. As one would expect, profitable firms invest more than less profitable ones. Firms with high fraction of non-financial assets invest significantly less than others. High-debt firms invest more, and firms with a high sales over assets ratio invest less. A strong impact on investment has the growth rate of sales which we should expect; note, though, that this coefficient should be interpreted as an idiosyncratic demand impact to an individual firm, since we cleaned the data from any aggregate demand influence. The number of workers has a negative but insignificant impact. Finally, the number of investors has a clear negative impact on investment: Ceteris paribus, an increase in the number of investors lowers investment.

Now, consider the tax variables. As outlined in the previous section the coefficient of the term $\Delta$EMTR is hard to interpret in a sensible way; it is not significant, either, and shows large variation over the course of regressions. In column (1), the

treatment effect of the tax reform with respect to the variation in the effective marginal tax rate (ΔEMTR*POST) is equal to -0,1171. It has the expected sign and is highly significant. If this first regression is valid, a reduction of the $EMTR$ of 10 percentage points leads to an increase in foreign direct investment flow of 1,1 percentage points. If investment is around 0,1 (see table 2) and the EMTR around 0,4, the resulting elasticity is around 0,4.

Column (2) repeats the regression adding the year 2000 to the control group; the treatment effect becomes slightly stronger. Nevertheless, for all of the following regressions we stick to our approch of leaving the 2000 data apart because of methodological reasons explained above. In column (3), we repeated the baseline regression by taking pre-reform averages of all control variables that are normalized by total assets. We do so in order to check whether we might run the risk of having some endogeneity bias that results from the fact that total assets is part of the dependent variable as well as of several independent variables. The results do not differ very much.

In columns (4) and (5), we split the sample in those firms that were profitable on average in the years 1997-2000 and those which were not. As one would expect the profitable firms have a significant tax impact and the non-profitable have not. In columns (6) to (9) finally, we split the sample according to the number of investors. Interestingly, only the group with just one investor has a significant tax term, all other groups have not. This might be a hint at agency problems or other firm politics related issues that might hinder firms from realizing a value-maximizing investment strategy.

### 4.3.2 Regional aspects

It has often been argued that the intercontinental tax competition differs considerably from the intracontinental tax competition. In the following, we therefore analyze our data according to some selected regional aspects. Table 4 shows the results.

**Table 4: Regional aspects, the three regions in split samples and three investor countries.**

| | Regional aspects | | | Regional split | | | Country split | | |
|---|---|---|---|---|---|---|---|---|---|
| Dependent variable | | Country dum | GDP control | America | Asia | Europe | USA | UK | France |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Constant | 0,1300 | 0,0884 | 0,08267 | 0,6131 | -0,0611 | 0,0448 | 0,6550 | -0,4096 | -0,2704 |
| | (0,0973) | (0,1174) | (0,1010) | (0,2553) | (0,4042) | (0,1069) | (0,2677) | (0,4002) | (0,3521) |
| ΔEMTR | 0,0615 | 0,0709 | 0,0406 | 3,2985 | -0,7083 | -0,4198 | 3,6020 | -3,5029 | -2,5958 |
| | (0,6859) | (0,6859) | (0,6854) | (1,8107) | (2,9105) | (0,7511) | (1,9032) | (2,8294) | (2,4865) |
| ΔEMTR*POST | -0,1114 | -0,1105 | -0,0558 | 0,1228 | -0,0023 | -0,1840 | 0,1220 | -0,1140 | -0,3499 |
| | (0,0432) | (0,0433) | (0,0597) | (0,1066) | (0,1056) | (0,0522) | (0,1089) | (0,1889) | (0,1363) |
| DUMMY-AMERICA | -0,0273 | | | | | | | | |
| | (0,0083) | | | | | | | | |
| DUMMY-ASIA | -0,0692 | | | | | | | | |
| | (0,0082) | | | | | | | | |
| PROFITABILITY | 0,3340 | 0,3372 | 0,3366 | 0,3370 | 0,3677 | 0,3332 | 0,3453 | 0,5125 | 0,3830 |
| | (0,0396) | (0,0397) | (0,0397) | (0,0937) | (0,1273) | (0,0461) | (0,0973) | (0,1545) | (0,1137) |
| NON-FIN ASSETS | -0,2545 | -0,2512 | -0,2515 | -0,3007 | -0,1354 | -0,2498 | -0,3163 | -0,1054 | -0,2605 |
| | (0,0177) | (0,0177) | (0,0177) | (0,0462) | (0,0553) | (0,0202) | (0,0481) | (0,0736) | (0,0535) |
| DEBT | 0,0881 | 0,0910 | 0,0908 | 0,0537 | 0,0743 | 0,1006 | 0,0521 | 0,0466 | 0,1254 |
| | (0,0119) | (0,0120) | (0,0120) | (0,0277) | (0,0385) | (0,0141) | (0,0282) | (0,0458) | (0,0378) |
| SALES | -0,0759 | -0,0763 | -0,07630 | -0,0845 | -0,0693 | -0,0743 | -0,0853 | -0,0726 | -0,0787 |
| | (0,0027) | (0,0027) | (0,0027) | (0,0070) | (0,0081) | (0,0031) | (0,0072) | (0,0117) | (0,0079) |
| SALESGROWTH | 0,4361 | 0,4367 | 0,4368 | 0,4216 | 0,4916 | 0,4323 | 0,4297 | 0,3781 | 0,5351 |
| | (0,0138) | (0,0138) | (0,0138) | (0,0322) | (0,0356) | (0,0165) | (0,0330) | (0,0534) | (0,0409) |
| SIZE | 1,16e-07 | 1,15e-07 | 1,14e-07 | 8,75e-09 | 3,49e-07 | 1,86e-07 | -4,86e-09 | 5,85e-07 | 6,83e-07 |
| | (4,05e-08) | (4,05e-08) | (4,04e-08) | (4,99-08) | (1,43e-07) | (5,92e-08) | (4,78e-08) | (1,26e-07) | (1,64e-07) |
| EMPLOYEES | -1,29e-06 | -1,04e-06 | -9,73e-07 | 3,43e-05 | -0,001 | -5,27e-06 | 4,16e-05 | -4,81e-05 | 0,0001 |
| | (1,23e-05) | (1,22e-05) | (1,22e-05 | (2,20e-05) | 5,97e-05 | (1,25e-05) | (2,16e-05) | 6,09e-05 | (4,53e-05) |
| INVESTORS | -0,0094 | -0,0082 | -0,0081 | -0,0115 | -0,0067 | -0,0093 | -0,0104 | 0,0101 | 0,0026 |
| | (0,0029) | (0,0029) | (0,0029) | (0,0044) | (0,0117) | (0,0039) | (0,0044) | (0,0269) | (0,0086) |
| No of obs | 14692 | 14692 | 14692 | 2466 | 1583 | 10643 | 2341 | 968 | 1471 |
| R2 | 0,1969 | 0,1987 | 0,1989 | 0,2016 | 0,2793 | 0,1908 | 0,2092 | 0,1645 | 0,2738 |

Notes: Variable definitions and other regression-specific information are given in the notes below table 3.

The regression reported in column (1) just adds dummies for American and Asian investors to the baseline regression. As becomes clear, American and Asian held affiliates invest slightly but significantly less than their European counterparts. In column (2), we employed a full set of country dummies which does not change the coefficient of the tax term significantly. But, as we add GDP controls for all countries in which the foreign investor is located the coefficient of the treatment effect falls by 50% and is not significant any more. However, one might argue that this is misleading because the foreign countries' GDP might be correlated with the German one, of which the data has been cleaned in terms of aggregate effects.

Columns (4) to (6) report the results for American, Asian and European investors respectively. Interestingly, only the European data show a significant tax term, now about fifty percent larger in value than in the baseline regression including all investors. Finally, we repeated the regression for subsamples of three important countries, the USA, the United Kingdom and France. Only France shows a significant tax term, which once again hints at the importance of geographical proximity for the strength of tax competition.

### 4.3.3 Different branches

In this subsection we analyse whether firms in different branches react differently to taxation. Unfortunately we cannot observe branch switchers as do Buch et al. (2005) because the inbound data do not include data on the mother firms. Table 5 reports the regression results for different branches.

**Table 5: Different branches.**

| | | Manufacturing | Holdings | Wholesale | Services | Finan. serv. |
|---|---|---|---|---|---|---|
| Dependent variable | | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Constant | 0,0835 | 0,2402 | 1,1300 | 0,1117 | 0,6792 | -1,3761 |
| | (0,0976) | (0,1615) | (0,6742) | (0,2003) | (0,4201) | (1,2535) |
| ΔEMTR | 0,1616 | 1,0985 | 8,6646 | 0,5305 | 3,5116 | -11,2989 |
| | (0,7020) | (1,1271) | (4,8284) | (1,4351) | (2,9725) | (9,0292) |
| ΔEMTR*POST | -0,1313 | -0,2227 | -1,0407 | -0,0623 | -0,0623 | 0,6338 |
| | (0,0432) | (0,0658) | (0,3935) | (0,0590) | (0,0590) | (0,5886) |
| BRANCH DUMMIES | Yes | | | | | |
| PROFITABILITY | 0,3278 | 0,1883 | 0,9576 | 0,3309 | 0,3309 | -0,0880 |
| | (0,0395) | (0,0600) | (0,2998) | (0,0541) | (0,0541) | (0,4736) |
| NON-FIN ASSETS | -0,1915 | -0,2040 | 0,2633 | -0,1502 | -0,1502 | 0,0934 |
| | (0,0181) | (0,0268) | (0,2071) | (0,0319) | (0,0319) | (0,2680) |
| DEBT | 0,0928 | 0,0694 | 0,3031 | 0,1179 | 0,1179 | 0,3076 |
| | (0,0121) | (0,0194) | (0,0819) | (0,0175) | (0,0175) | (0,1162) |
| SALES | -0,0689 | -0,0830 | -0,1671 | -0,0646 | -0,0646 | -0,1047 |
| | (0,0027) | (0,0059) | (0,0324) | (0,0034) | (0,0034) | (0,0434) |
| SALESGROWTH | 0,4434 | 0,5606 | -0,1203 | 0,5350 | 0,5350 | 0,2092 |
| | (0,0137) | (0,0259) | (0,0562) | (0,0200) | (0,0200) | (0,1140) |
| SIZE | 7,46e-08 | 2,04e-07 | 1,29e-07 | 2,82e-07 | 2,82e-07 | -2,47e-08 |
| | (3,85e-08) | (7,87e-08) | (6,63e-08) | (1,44e-07) | (1,44e-07) | (6,25e-08) |
| EMPLOYEES | 1,72e-05 | -2,13e-05 | 2,28e-05 | 3,21e-05 | 3,21e-05 | 0,0002 |
| | (1,22e-05) | (1,80e-05) | (0,0003) | (4,91e-05) | (4,91e-05) | (0,0004) |
| INVESTORS | -0,0084 | -0,0059 | -0,0066 | -0,0064 | -0,0064 | -0,1043 |
| | (0,0028) | (0,0033) | (0,0488) | (0,0067) | (0,0067) | (0,0967) |
| No of obs | 14692 | 4681 | 530 | 6215 | 701 | 176 |
| R2 | 0,2005 | 0,2939 | 0,0838 | 0,2688 | 0,1602 | 0,1331 |

Note: The difference of the sum of observations in columns (2) to (6) is a residual activity group labeled "Others". The 'Services' are specified as 'company-related services'. 'Finan. serv.' is financial services.

Including branch dummies increases the fit of the baseline regression, and the treatment effect is slightly larger. In the manufacturing branch, the coefficient is nearly twice as large as in the baseline regression (without branch dummies). The $R^2$ is considerably increased. The treatment effects for holdings is nearly ten times higher than the one of the total sample. But, the standard error is larger, too, and the subsample of holdings is relatively small. Interestingly, firms in the wholesale trade branch do not show a significant tax treatment term. This is what we expect if wholesale traders are complements to production units elsewhere. The same is true for services and financial services.

### 4.3.4 Quartile analysis

In the following, we analyze both the lowest and the highest quartiles of the sample according to four variables: profitability, level of debt, the fraction of non-financial assets and the size in terms of balance sheet capital. We do so in order to check different predictions derived from standard tax theory.

**Table 6: Highest and lowest quartiles.**

| | Profitability | | Level of debt | | Non-financial assets | | Size | |
|---|---|---|---|---|---|---|---|---|
| Dependent variable | lowest | highest | lowest | highest | lowest | highest | lowest | highest |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Constant | 0,4162 | -0,0590 | 0,2606 | 0,3067 | 0,2274 | 0,0566 | -0,3119 | 0,1898 |
| | (0,1393) | (0,1649) | (0,1373) | (0,1571) | (0,2544) | (0,0703) | (0,1252) | (0,1554) |
| ΔEMTR | 1,8694 | -1,3042 | 1,4189 | -1,0946 | 1,1530 | -0,2317 | -1,5564 | 0,2640 |
| | (0,9762) | (1,1780) | (0,9811) | (1,0536) | (1,8246) | (0,4927) | (0,8784) | (1,0944) |
| ΔEMTR*POST | 0,3061 | -0,0950 | -0,2763 | -0,1363 | -0,1822 | -0,1421 | 0,2407 | -0,1418 |
| | (0,0973) | (0,0794) | (0,0849) | (0,1031) | (0,1338) | (0,0459) | (0,0843) | (0,1005) |
| PROFITABILITY | 0,3061 | 0,0965 | 0,3282 | 0,2570 | 0,6647 | 0,2343 | 0,3780 | 0,4826 |
| | (0,0668) | (0,0694) | (0,0656) | (0,0811) | (0,1136) | (0,0385) | (0,0595) | (0,0988) |
| NON-FIN ASSETS | -0,2719 | -0,2355 | -0,1952 | -0,2240 | -7,8412 | -0,1850 | -0,1772 | -0,2718 |
| | (0,0303) | (0,0296) | (0,0290) | (0,0328) | (2,2407) | (0,0165) | (0,0273) | (0,0346) |
| DEBT | 0,0133 | 0,0971 | 0,0830 | -0,2626 | 0,1736 | 0,0541 | 0,0910 | 0,1483 |
| | (0,0205) | (0,0219) | (0,0565) | (0,0533) | (0,0305) | (0,0117) | (0,0187) | (0,0266) |
| SALES | -0,0760 | -0,0745 | -0,0700 | -0,0768 | -0,0681 | -0,0695 | -0,0573 | -0,0958 |
| | (0,0054) | (0,0046) | (0,0052) | (0,0053) | (0,0064) | (0,0028) | (0,0044) | (0,0061) |
| SALESGROWTH | 0,3989 | 0,5159 | 0,3974 | 0,4259 | 0,2569 | 0,5110 | 0,4157 | 0,4283 |
| | (0,0164) | (0,0167) | (0,0163) | (0,0174) | (0,0215) | (0,0094) | (0,0151) | (0,0183) |
| SIZE | 1,22e-07 | 1,31e-07 | 1,25e-08 | 7,07e-08 | 9,83e-08 | 9,53e-08 | 3,44e-05 | 7,62e-08 |
| | (4,04e-08) | (6,94e-08) | (2,88e-08) | (4,94e-08) | (3,35e-08) | (3.06e-08) | (5,13e-06) | (2,32e-08) |
| EMPLOYEES | 3,93e-05 | 1,4e-05 | 3,62e-05 | -4,94e-05 | 0,0002 | -1,19e-06 | 0,0002 | -8,95e-06 |
| | (3,08e-05) | (2,02e-05) | (1,7e-05) | (3,46e-05) | (0,0001) | (1,07e-05) | (0,0001) | (1,17e-05) |
| INVESTORS | -0,0027 | -0,0073 | -0,0118 | -0,0048 | -0,0057 | -0,0079 | 0,0052 | -0,0174 |
| | (0,0123) | (0,0060) | (0,0066) | (0,0123) | (0,0193) | (0,0040) | (0,0099) | (0,0068) |
| No of obs | 3536 | 3804 | 3549 | 3431 | 3522 | 3840 | 3493 | 3454 |
| R2 | 0,1874 | 0,233 | 0,1757 | 0,1966 | 0,1009 | 0,2452 | 0,2312 | 0,1879 |

Note: Profitablity is the average pre-reform ratio of profits over total assets. The level of debt is debt finance over total assets, non-financial assets are also divided through total assets. The size is equal to total balance sheet assets. Differences in the number of observations are due to rounding errors.

To begin with profitability it is not surprising that the quartile with the lowest profitability (which is beyond zero) in column (1) does not show the expected sign. But, as column (2) shows that the firms in the highest profitability quartile do not have a significant tax treatment effect, either. This could be due to the fact that highly profitable firms do react more strongly to tax rate cuts than to variations in the marginal tax burden. But this conclusion would require more testing.

Columns (3) and (4) show the regression results for the lowest and the highest quartiles of debt. As predicted by theory, firms with a low debt level react strongly to the variation in the effective marginal tax rate, whereas firms with high debt levels - i.e. with already high tax shields - do not react significantly.

In columns (5) and (6) the lowest and the highest quartiles of non-financial assets are analyzed. The results show that firms with a high fraction of non-financial assets react significantly to the tax reform while firms with a low fraction

do not. We could have expected to find more pronounced reactions for firms with high fractions of financial assets because the tax-exemption for divestment profits is supposed to be more important for those firms. However, the results do not confirm such a view.

The last two columns report the results for the lowest and the highest size quartiles. The smallest firms have a wrong sign in the tax treatment effect, the largest firms have virtually the same coefficient as in the baseline regression, but it is only marginally significant.

# 5 Conclusions

In this paper we evaluated the German tax reform of 2000 with respect to its effect on inward foreign direct investment. We solved the identification problem by referring to the rather radical assumption that the aggregate effect of the tax reform is equal to zero. Nevertheless, we found significant tax effects. The baseline regression indicates that a reduction in the effective marginal tax rate increases net investment by 1 percentage point. Given an investment level of around 0,1 and an EMTR of around 0,4, the elasticity of investment with respect to effective marginal taxation is approximately equal to 0,4. In comparison to other empirical studies this estimate is rather at the bottom line, but it should be recalled again that our results are based on an assumed aggregate effect of zero.

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