Sven Stöwhase:

Profit Shifting opportunities, Multinationals, and the determinants of FDI

Profit Shifting opportunities, Multinationals, and the determinants of FDI[*]

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02.12.2002

Abstract

The theory of tax competition suggests that different tools might be used to attract physical capital and taxable profits. While it is assumed that FDI in real activity is deterred by high effective taxes, investment undertaken for purpose of profit-shifting is deterred by a higher statutory tax rate. Using information from the RWI-Database "Globalisation", which contains statistics about foreign engagements of the most important German enterprises, this paper investigates if this assumption holds in reality. Differentiating between the functional form of engagement and using a linear regression, the analysis provides evidence that FDI in real activity (production) is correlated with effective tax rates while FDI that implies more opportunities for profit shifting activities (service, finance and R&D) is correlated with the statutory tax rate.

Keywords: foreign direct investment, profit shifting, multinational corporations

JEL classification: F23, H25, H26, H32

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I. Introduction

The implementation of a single European Market and increasing tax competition has created a number of problems for fiscal authorities in the European Union during the last years. When we think of corporate taxation there are two issues which are particularly interesting. One is the possibility to attract foreign direct investment in the form of physical capital, creating positive spill-over effects to the local economy such as increased demand for labour. The other one is profit shifting, mostly affecting tax revenues. The second issue is of major concern for tax authorities in typical high tax countries such as Germany: while corporate tax revenues grew in most countries of the EU and stayed constant in the OECD average in the first half of the 1990s (see Table 1), they declined from 0.96 percent of GDP to 0.57 percent of GDP in Germany, which equals a decrease of 40 percent. A considerable proportion of this decline stems from the behaviour of large multinational firms, which have, even though they work very profitable, ceased to pay corporate taxes at home. Several examples of such behaviour can be found: from 1994 to 1995 Commerzbank doubled its profits and simultaneously halved its tax load. At the same time Siemens made 1.3 Billion Euro profits which where fully exempted from taxation in Germany[1].

This problem is certainly not confined to German corporations, but the German case is more obvious than that of any other country. A recent global survey performed by the consulting firm Ernst&Young (2001) supports this hypothesis. According to this study, transfer pricing and profit shifting are the most important future international tax issues for multinational corporations (61%), followed by double taxation relief and foreign tax credits (10% and 13%). While profit shifting is presently part of the corporate strategic planning process for approximately one third of all responding corporations, it is important for more than half of the German firms. More detailed insights in multinationals tax planning come from the Ruding Committee. Already in 1992, the committee asked businesses within the European Union, to which degree their location decisions are tax driven. The general result was that taxes play an important role in the decision making process of firms. Moreover, this survey revealed that while taxes appear to be a key factor in decisions where to locate real productive activity, they appear to be even more important in the decision where to locate financial service centres[2]; a clear sign for profit shifting.

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[1] More examples are given by Weichenrieder (1996).
[2] More information can be found in Ruding Report (1992) and Devereux (1992).

Table 1

Corporate tax revenues in percent of GDP

	1990	1996	Percentage change
Belgium	2.53	2.63	+ 3.97
France	2.33	2.09[a]	- 10.18
Germany	0.96	0.57	- 39.93
Ireland	1.88	2.98[b]	+ 58.56
Netherlands	3.36	4.16	+ 23.72
United Kingdom	4.02	4.27[a]	+ 6.27
United States	1.63	2.25	+ 37.71
OECD average	2.57	2.49	- 3.14

[a] Values for France and the United Kingdom belong to the year 1997.
[b] The value for Ireland comes from the year 1995.
Source: OECD Revenue Statistics, own computations.

While the results of these business surveys indicate that profit shifting actually takes place in the European Union, empirical evidence is rather scarce. Most studies concern the US, but since multinationals typically do not reveal much about their intra-firm commerce, e.g. trade prices, these studies can only give indirect evidence for profit shifting[3]. Hines and Rice (1994) are one prominent example: They find a negative correlation between host country average tax rates and reported profits of US-Corporations in these countries. Another example is the work of Grubert and Slemrod (1998). They simultaneously examine the effect of taxes on real investment and profit shifting and find that profit shifting advantages are the predominant reason for US-investment in Puerto Rico.

To my knowledge, there exists only one empirical study dealing with profit shifting in the European Union and this study is limited to the banking sector. Demirgüc-Kunt and Huizinga (2001) regress the taxes paid by domestic and foreign owned banks (as a percentage of assets) on changes in the statutory tax rate and find significant differences. While a rise in the statutory tax rate results in increasing tax payments by domestic owned banks, tax payments by foreign banks do not only increase less, but do in fact decrease. They explain their results with the possibility that foreign owned banks can reduce reported profits, and hence tax

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[3] One exception is the analysis of Clausing (2001). Using data on external trade prices as well as intra-firm trade prices of US multinationals, her study gives us direct evidence that cross-border intra-firm trade prices are likely influenced by the profit-shifting strategies of multinational firms.

payments relative to a constant stock of assets, just by shifting a part of these profits out of the country.

Other studies, primarily focusing on the determinants of multinationals´ location of production, rather than on profit shifting, find a significant correlation between effective tax rates and location decisions[4]. Like others, Devereux and Griffith (1998) further control for the possibility of profit shifting by using the statutory tax rate as an additional variable in their model, but they do not find any significant correlation between investment and statutory tax rates. This unsatisfactory result may stem from the fact that for some of the firms in the dataset profit shifting is less relevant while it is more relevant for other firms. To obtain better results, it therefore seems promising to divide the data set used in the econometric analysis in several subsets of firms which differ from each other in important structural characteristics.

This is the approach taken in the present paper. In the theoretical part of this paper we argue that investment in firms that face lower transaction costs when shifting profits is relatively more sensitive to statutory tax rates than to effective tax rates. On the other hand, if firms face high costs when shifting income, they are relatively insensitive to the statutory tax rate. We test this theory in the econometric part of the paper with data on German multinationals´ FDI. Therefore we divide the data on FDI into two subsets. The criterion for allocation to the groups is the economic function of FDI such as production, finance or research and development which we associate with different opportunities (and hence costs) for profit shifting. We do not only employ two different measures of taxation in the empirical analysis, but, by using public inputs as an independent variable, we also follow the idea of Wildasin (1986) and Zodrow and Mieszkowski (1986) who explicitly consider this variable in their theoretical models on tax competition. Our econometric results show that FDI associated with little opportunities for profit shifting (production) is correlated to effective tax rates and public inputs while FDI that we associated with more opportunities for profit shifting (service, finance, R&D) is correlated with the statutory tax rate instead.

A simple and intuitive model of profit shifting and location decisions is provided in Section II of this paper. In Section III, we take a closer look at the sources and definitions of the variables used in the econometric analysis. Section IV gives an overview of the econometric approach and presents the empirical results. Section V concludes.

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[4] See Hines (1999) for an overview of these studies.

II. Theoretical background

Optimal behaviour of multinationals without profit shifting

Let us consider a multinational firm operating in two countries H and F where H is the home country and F is a foreign location[5]. We further assume that the home country is a high tax country and the foreign location is a low tax country. We have two factors of production, capital k and public inputs g. Capital is the only variable factor of production and gross profits in each country i are given by the value of production $f(k_i,g_i)$ less the cost of capital $r*k_i$. Total value of production is increasing in both k_i and g_i while it is marginally decreasing in k_i and g_i, so that $f_k \geq 0$; $f_g \geq 0$; $f_{kk} \leq 0$; $f_{gg} \leq 0$.

The gross profits defined above are subject to corporate taxation. Here we have to take into account that taxable profits are not the same as gross profits. Dependent on the tax code of a country some or all firms can claim special tax breaks, accelerated deduction et cetera, such that, in practice, the corporate tax rate τ_i, is applied on a tax base that is only a fraction of gross profits. Net profits are then given by

$$\pi = f(k_i, g_i) - r \cdot k_i - \tau_i \cdot [f(k_i, g_i) - \varepsilon_i \cdot r \cdot k_i - \upsilon_i]$$

where υ_i is a general exemption of profits from taxation and ε_i is a positive parameter describing the deductibility of investment costs. To simplify notation, we define

$$\gamma_i = \frac{f(k_i, g_i) - \varepsilon_i \cdot r \cdot k_i - v_i}{f(k_i, g_i)},$$

where the parameter γ_i describes the fraction of production (instead of profits) that is taxed. It can vary between zero and one, such that with $\gamma_i=0$ production is completely exempted from taxation while the total value of production is taxed if $\gamma_i=1$. We call the product $\gamma_i*\tau_i=T_i$ the effective tax rate[6] and rewrite net profits as

$$\pi = (1 - T_i) \cdot f(k_i, g_i) - r \cdot k_i \tag{1}$$

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[5] The theoretical analysis is adapted from Haufler and Schjelderup (1999, 2000).
[6] For our simple analysis, we assume that γ_i is independent from k_i.

We further assume that all foreign profits are exempted from taxation in the home country[7], such that total profits of the multinational are given by

$$\Pi = (1 - T_F) \cdot f(k_F, g_F) + (1 - T_H) * f(k_H, g_H) - r \cdot (k_F + k_H) \tag{2}$$

Maximizing (2) with respect to the optimal level of capital in each country, we are left with the following first-order conditions:

$$(1 - T_F) \cdot f_k(k_F, g_F) - r = 0 \tag{3a}$$
$$(1 - T_H) \cdot f_k(k_H, g_H) - r = 0 \tag{3b}$$

Conditions (3a) and (3b) can be easily interpreted: Capital in country F is invested up to the point where the marginal after tax profit generated by of one unit of capital is the same in both countries, which is equal to the cost of capital r.

Optimal behaviour of multinationals under profit shifting

We now introduce the possibility to shift profits from the parent company located in the high tax country H to a subsidiary located in the low tax country F. We denote by Q profits that can be transferred between the two establishments of the multinational by manipulating internal trade prices for final and intermediate goods, interest rates and royalties. This strategy generates (non deductible) costs of $\omega = \theta_j \cdot Q^2 / k_F$ since there are additional efforts that need to be taken in order to conceal the transfer pricing activity from tax authorities. We include Q^2 in the cost function since it is suitable to assume convex concealment costs in Q. On the other hand, including k_F in the denominator of the cost function takes into account the fact that concealment is less costly the more capital is employed in a country and makes the decisions of real investment and profit shifting interdependent. The last parameter determining ω is θ_j. θ_j is a firm specific positive parameter which can vary between a minimum value θ_j^{min} and infinity[8]. If, for instance, profits are shifted from one location to the other by manipulating

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[7] Things are getting trickier if we assume a tax credit regime in the home country. In the simplest case where all foreign profits are repatriated to the home country, total profits are given by equation (2) only if $T_F > T_H$ and $\Pi = (1 - T_H) \cdot [f(k_F, g_F) + f(k_H, g_H)] - r \cdot (k_H + k_F)$ else. If all profits are reinvested in the foreign location, equation (2) holds in any case. If only a part of foreign profits is repatriated to the home country, total profits are given by a weighted combination of the different equations.
[8] The minimum value of θ_j ensures that profit shifting is limited in any case.

internal transfer prices, shifting costs can differ with respect to the goods traded. A firm that provides its parent with overhead services which are not commonly traded on the free market will face lower concealment costs than a firm that trades intermediate or final goods and is more restricted by the arms-length principle of transfer pricing. So, θ_j is expected to be lower for the former type of firms, while it is expected to be higher for the latter ones, e.g. firms that produce more tradable goods.

With the possibility of profit shifting, total after tax profits of the multinational are given by

$$\Pi = f(k_F, g_F) + Q - \tau_F \cdot [\gamma_F \cdot f(k_F, g_F) + Q] - r \cdot k_F + f(k_H, g_H) - Q$$
$$- \tau_H \cdot [\gamma_H \cdot f(k_H, g_H) - Q] - r \cdot k_H - \omega$$

$$= f(k_F, g_F) - T_F \cdot f(k_F, g_F) + f(k_H, g_H) - T_H \cdot f(k_H, g_H) - r \cdot (k_F + k_H) + (\tau_H - \tau_F) \cdot Q - \omega \qquad (4)$$

In this case the multinational can not only decide about k_F and k_H but also about the amount of profit shifted from H to F. Differentiating equation (4) with respect to Q gives us the optimal level of profit shifting, that is

$$\tilde{Q} = \frac{(\tau_H - \tau_F) \cdot k_F}{2\theta_j} \qquad (5)$$

From (5) it is straightforward to see that, with a lower corporate tax rate τ_F, incentives for profit shifting increase. Substituting (5) in (4) and differentiating with respect to k_F and k_H, we get the first-order conditions under a strategy including profit shifting:

$$(1 - T_F) \cdot f_k(k_F, g_F) - r + \frac{(\tau_H - \tau_F)^2}{4\theta_j} = 0 \qquad (6a)$$

$$(1 - T_H) \cdot f_k(k_H, g_H) - r = 0 \qquad (6b)$$

Comparing (3) with (6), it becomes obvious that investment is distorted by the term $(\tau_H - \tau_F)^2 / 4\theta_j$ towards country F if profit shifting into this country is possible. This distortion becomes larger as the difference in corporate tax rates between the two countries grows and decreases with higher transfer costs θ_j.

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Since $(1-T_H) \cdot f_k(k_H, g_H) \geq 0$, the term $r - [(\tau_H - \tau_F)^2 / 4\theta_j]$ has to be positive to fulfil condition (6a). However, this is the case only as long as the marginal cost of capital (the world interest rate r) is higher than the marginal gain from profit shifting[9]. To ensure this and to close our model, the minimum level of θ_j has to be $\theta_j^{min} = [(\tau_H - \tau_F)^2 / (4 \cdot r)]$.

Predominant factor for multinationals' location decision under profit shifting

In a next step, we want to show that the decision to invest in country F crucially depends on the transfer costs θ_j. For this purpose we use a Cobb-Douglas production function of the form $f(k_i, g_i) = k_i^\alpha \cdot g_i^{1-\alpha}$, but the results derived below do not change qualitatively if we use a more general kind of production function such as CES. Concentrating our analysis on the foreign country we take all other variables as given, but note that we assume positive profits in country H that can be shifted to country F. Using the Cobb-Douglas production function defined above, we can solve equation (6a) for k_F:

$$ k_F = \left[\frac{r - [(\tau_H - \tau_F)^2 / 4\theta_j]}{(1-T_F) \cdot \alpha \cdot g_F^{1-\alpha}} \right]^{\frac{1}{(\alpha-1)}} \tag{7} $$

As we can see from (7), investment in country F is a function of three different country specific variables: the foreign effective as well as the statutory tax rate and the level of public inputs offered by the foreign country. Partially differentiating the investment function with respect to these variables, we get the following elasticities:

$$ \eta_T = \frac{\partial k_F}{\partial T_F} \cdot \frac{T_F}{k_F} = \frac{T_F}{(\alpha-1)} \cdot \frac{1}{(1-T_F)} < 0 \tag{8a} $$

$$ \eta_g = \frac{\partial k_F}{\partial g_F} \cdot \frac{g_F}{k_F} = \frac{g_F}{(\alpha-1)} \cdot \frac{(\alpha-1)}{g_F} = 1 > 0 \tag{8b} $$

$$ \eta_\tau = \frac{\partial k_F}{\partial \tau_F} \cdot \frac{\tau_F}{k_F} = \frac{\theta_j}{(\alpha-1)} \cdot \frac{[4\theta_j \cdot r \cdot (\tau_H - \tau_F)^2] - (\tau_H - \tau_F)^3}{(4\theta_j^2 r) - \theta_j \cdot (\tau_H - \tau_F)^2} < 0 \tag{8c} $$

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[9] If this were not the case the level of investment in country F would be infinite.

These equations reveal three facts: First, while the investment elasticity with respect to the tax rates (8a) and (8c) is negative, it is positive with respect to the public input (8b), implying that higher taxation lowers investment in country F while public inputs encourage investment. Second and more important, while (8a) and (8b) are completely independent from the transaction cost parameter θ_i, this is not the case for the investment elasticity with respect to the statutory tax rate[10]. Third, equation (8c) describes a concave function in θ_j, such that $\left|\eta_\tau(\theta)\right|$ converges against infinity for $\theta_j \rightarrow \theta_j^{\min}$ and against zero for $\theta_j \rightarrow \infty$.

Figure 1

Transfer costs and dominating economic activity
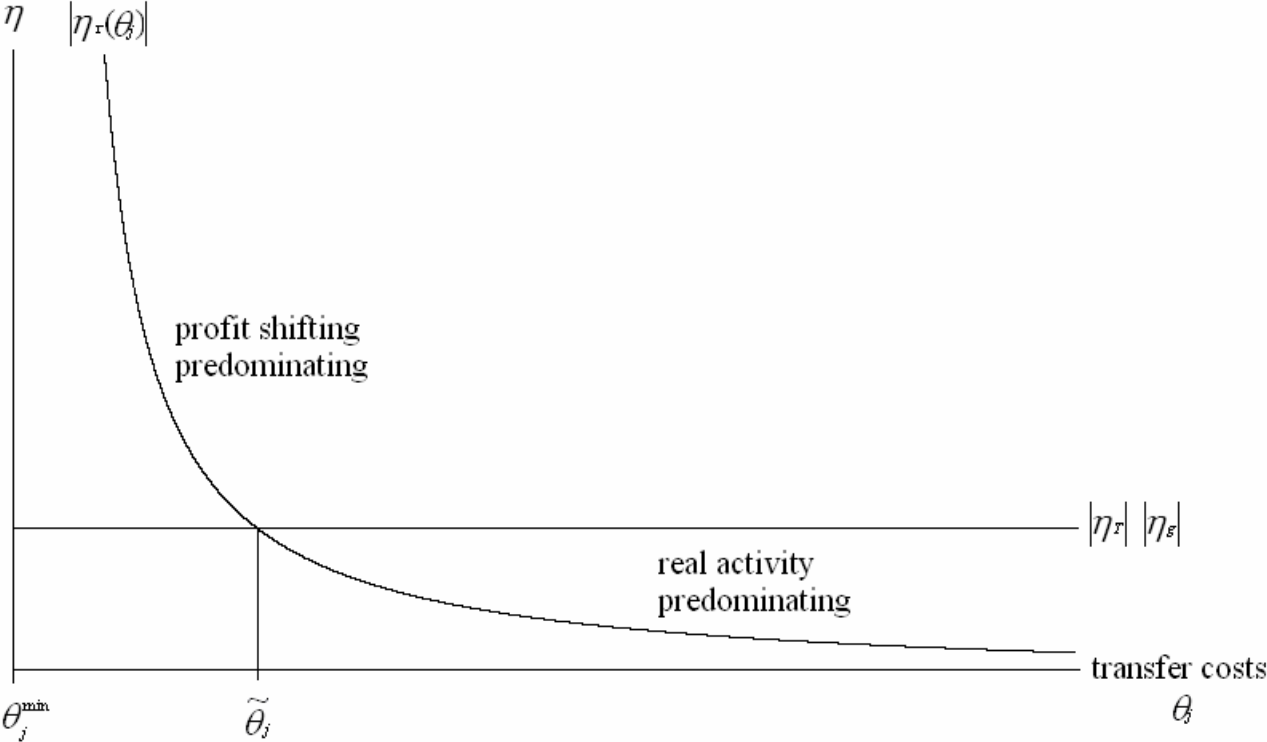
As shown by Figure 1, it therefore exists a point of intersection between $\left|\eta_\tau(\theta)\right|$ and either $\left|\eta_\tau\right|$ or $\left|\eta_g\right|$ at $\tilde{\theta}_j$. While the statutory tax rate is predominant for investment decisions as long as the

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[10] Intuitively η_τ and η_g are independent from θ_j because θ_j is only indirectly linked with T_F and g_F. A change in θ_j results not only in a change in the level of k_F, i.e. lowering θ_j leads to a higher level of investment in country F, but it proportionally changes $\partial k_F/\partial T_F$ and $\partial k_F/\partial g_F$. Since these two effects offset each other, η_τ and η_g are independent from θ_j.

firm specific transaction costs are lower than $\tilde{\theta}_j$, the effective tax rate and public inputs are predominant if θ_j is higher than $\tilde{\theta}_j$.

This result is quite intuitive, since total net profits in country F come from two different sources. One of them is real economic activity, affected by $(1-T_F) \cdot f_k(k_F, g_F)$, the other source is tax savings through profit shifting, affected by $(\tau_H - \tau_F)^2 / 4\theta_j$. For low transaction costs, the proportion of tax savings that stem from profits generated in country H rises and hence the statutory tax rate becomes more important in determining the optimal level of investment. Consequently, profit shifting is the driving force inducing investments in country F for $\theta_j < \tilde{\theta}_j$ and real economic activity is the predominating determinant of investment as long as $\theta_j > \tilde{\theta}_j$. In the extreme case where θ_j is equal to infinity, such that profit shifting is prohibited and real activity is the only source of income, investment does only depend on the effective tax rate and the level of public inputs. On the other extreme, if transaction costs are low and most profits stem from tax savings in country H, investment primarily depends on the statutory tax rate.

What we have shown above is that the determinants of multinationals' location decisions are influenced by the opportunities (or costs) of profit shifting. Without profit shifting, location decisions are only influenced by the effective tax rate and local inputs, e.g. public inputs. On the other extreme, if there are no costs for profit shifting and the only reason for establishing a firm is tax arbitrage rather than real economic activity, the parameter determining investment decisions is the nominal tax rate τ_i. Between these two extremes, all three parameters influence investment decisions but with higher values of θ_j, and hence less profit shifting, the influence of effective taxes and local inputs grows, while the influence of nominal taxes declines.

In the econometric part of this paper we test the theoretical results derived here. If we can find support for a positive relationship between corporate tax rates and investment decisions rather than between effective tax rates or public inputs and investment we have (indirect) evidence for profit shifting.

III. Data Sources and description

Data on German multinationals´ foreign investment decisions

We now want to test empirically the results of our model with a sample describing the foreign activities of German multinationals. Data on the foreign activities of German multinational corporations are taken from the RWI-Database "Globalisation" and act as dependent variable in our econometric analysis. The RWI-Database on the globalization of German companies is based on annual reports the enterprises provide for the public and is in some cases supplemented by other sources such as newspapers, internet pages and so on. The panel covers activities of approximately one hundred firms which are responsible for a large proportion of German outward FDI[11].

Built on these annual reports a panel-like dataset of time series for individual companies is constructed[12]. Among other statistics, this panel provides us with data about foreign activities of the companies investigated. Examples of such activities are the acquisition of a foreign company, the foundation of a new company abroad or the start of a joint venture. Additionally, for all these activities the economic function of the foreign affiliate is provided, e.g. whether it is intended to produce final or intermediate goods or whether it is intended to provide its parent company with overhead services, such as finance or research and development.

From these data we can get count numbers of German multinationals´ foreign activities, separated by year, host country and economic function[13]. Sufficient data is available for the years 1991-1998 and eight European host countries, Austria, Belgium, France, Ireland, Italy, the Netherlands, Spain and the United Kingdom, leaving us with 64 different counts. As shown in Figure 2, almost half of these activities took place in France and the UK, while the share of activities in the small countries Belgium and Ireland is rather small. The count data is separated into two groups by the economic function of the activity. Figure 3 describes the

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[11] The database indirectly covers almost one seventh of FDI stocks under review by the Deutsche Bundesbank for the balance of payments statistics. When consider employees working abroad, the representativity is even higher: more than 40% of employees at affiliates of German companies abroad are working in firms included in the database.

[12] A detailed description of the database is given by Döhrn (2001) or Döhrn and Radmacher-Nottelmann (2000).

[13] Of course, it would be interesting to look at more disaggregated data, e.g. the count number of engagements in each year and country, where the economic function is production given that the engagement is the foundation of a new firm abroad or a joint venture etc. We focus on the economic function, independent of the form of activity taking place since data on this most disaggregated and basic level is very scarce.

Figure 2

Share of German multinationals´ foreign activities, 1991-1998
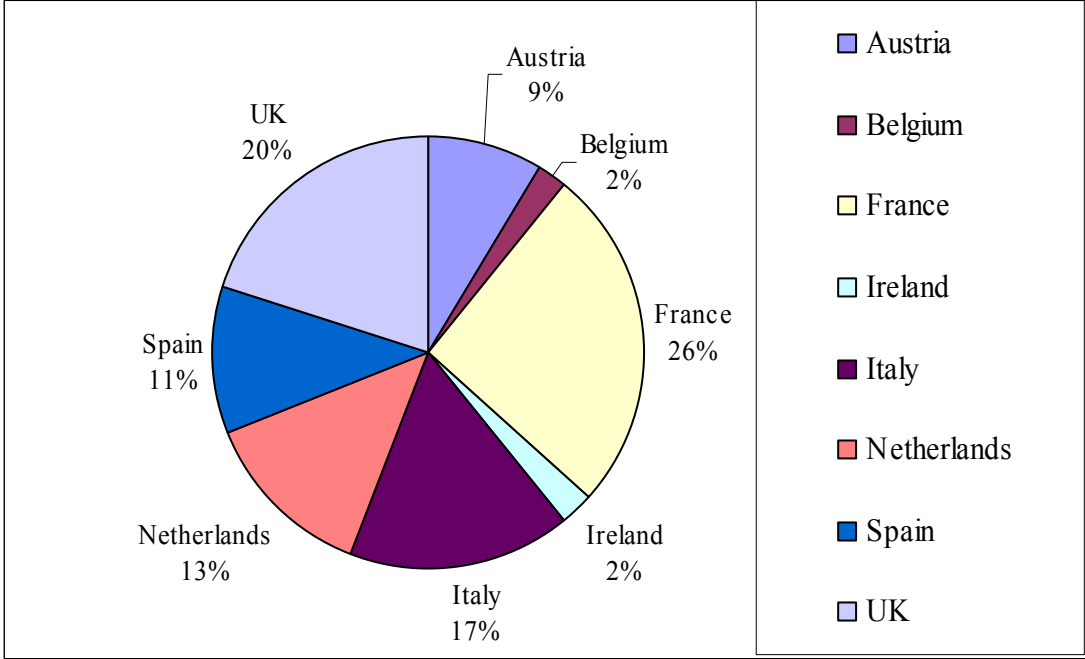

Source: RWI-Database Globalization, own calculations.

composition of the two groups: On the one hand we have a group including activities within the functional area of management and finance, research and development and overhead services, on the other hand we have a group consisting of engagements which are only undertaken in purpose of production.

**Figure 3**

Composition of FDI subsets
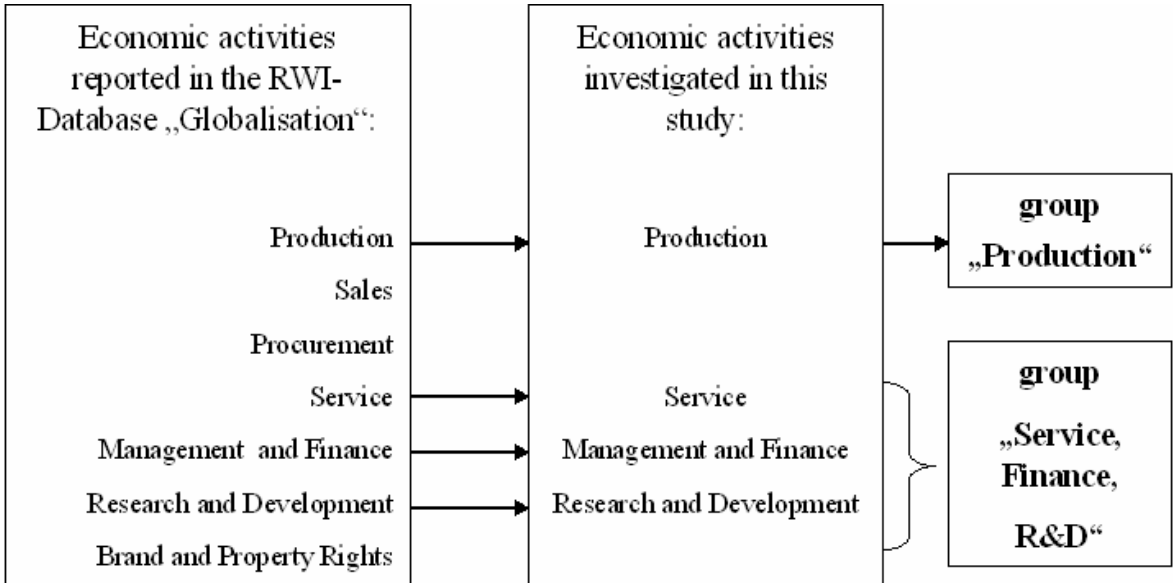
The number of activities in each group is roughly the same, 189 of 322 activities observed between 1991 and 1998 being acquisitions of a foreign company, the foundation of a new company or the start of a joint venture with the intention to produce abroad. However, the relative size of the two groups varies in the course of time. Figure 4 gives us a picture of this development: although investments in the two groups seem to behave similar at first glance, there are some differences. For example, while the number of activities in the first group (finance, service and R&D) decreased in the years from 1991 to 1993 and increased from 1996 to 1997, the development for the second group (production) was the opposite during this time periods.

The fundamental idea of this paper is that these two groups differ from each other in the degree profits can be shifted between countries[14] and that the determinants of FDI decisions between the two groups therefore differ, too. In the following we test whether we can find significant differences in the determinants of FDI decisions between the two groups.

Figure 4

German multinationals´ foreign activities by economic function, 1991-1998
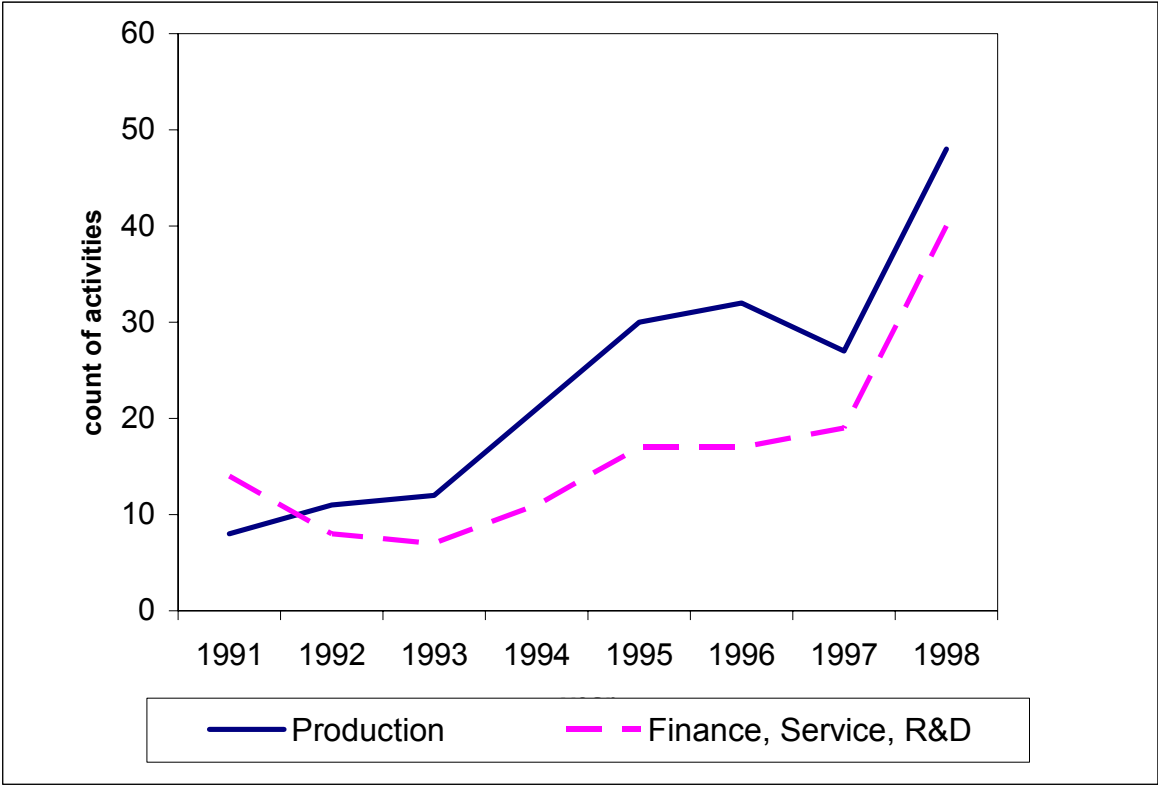
Source: RWI-Database Globalization, own calculations.

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[14] Genschel (2001) expects the costs for profit shifting into firms located in the second group (production) to be much higher than that for the first group.

Data on tax rates

There are two different measures of corporate taxation used in the analysis. One is the effective tax rate T_i, which is a function of the corporate tax rate and the tax base. It measures the tax burden of investment by dividing taxes paid by pre-tax profits. Without the possibility of profit shifting, and using the notation of our model in section II [see equation (1)], the effective tax rate is equal to

$$T_i = \tau_i \cdot \gamma_i = 1 - \frac{\pi_i}{f(k_i, g_i) - r \cdot k_i} \qquad (9)$$

The measures used here are taken from Büttner (2002) and were also employed in Stöwhase (2002). Using a sample of approximately six thousand companies, individual effective tax rates are computed for each company using equation (9). In a second step, the effective tax rate for each country is derived by using the median tax rate paid by its corporations. Since profit shifting in multinational corporations may reduce the effective tax for these firms, we exclude multinational corporations from the sample tax rates are derived from[15].

Moreover, as pointed out in the theoretical part of this paper, the statutory tax rate may have to be taken into account if substantial intercompany transfers open possibilities for reducing the overall tax burden. Table 2 presents figures for both tax rates. While the statutory tax rate is very stable over time (most of the variance comes from the implementation or abolishment of several surtaxes), there is a relatively high variance in the effective tax rates. Also, effective tax rates are in any case lower than statutory tax rates. This is consistent with our model where the upper bound of γ_i is unity and hence $T_i = \gamma_i \cdot \tau_i \leq \tau_i$. Italy and Ireland are exceptions; in these countries the effective tax rate is higher than the nominal tax rate. While there is no simple explanation for Italy, the case of Ireland is very clear: effective tax rates are computed from local firms which face the regular Irish corporate tax rate which is around 35%. Consequently effective tax rates based on this normal corporate rate are much higher than the reduced rate of 10%. We can not use the regular tax rate, however, since the multinational firms under consideration face only the reduced rate. We take account of this

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[15] Nevertheless, tax rates can be biased by other forms of profit shifting such as shifting between corporate and personal income. This possibility is recently under discussion in the context of the Nordic Dual income tax (see Lindhe, Södersten and Öberg (2002)). Empirical evidence for profit shifting between corporate and personal income comes from Gordon and Slemrod (2000). They found that a substantial amount of income was shifted from corporate to personal income in the United States since 1965 by changing the form of compensation for executives and other workers. We will abstract from this problem and assume that the effective tax rates are not significantly distorted by profit shifting activities.

problem in the empirical analysis by excluding these countries from our sample used in the robustness check.

Table 2

Statutory and effective rates of corporate taxation*

		1991	1992	1993	1994	1995	1996	1997	1998
Austria	statutory	30.00	30.00	30.00	34.00	34.00	34.00	34.00	34.00
	effective	22.90	13.90	14.90	10.60	10.90	16.80	25.50	10.30
Belgium	statutory	39.00	39.00	40.17	40.17	40.17	40.17	40.17	40.17
	effective	15.70	17.70	22.70	22.30	23.90	23.40	22.00	20.60
France	statutory	34.00	34.00	33.33	33.33	36.66	36.66	36.66	41.66
	effective	32.40	32.50	32.10	32.40	34.80	33.90	37.10	36.10
Ireland**	statutory	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	effective	16.40	13.60	13.60	14.30	14.40	16.80	20.20	23.50
Italy	statutory	36.00	36.00	36.00	36.00	36.00	37.00	37.00	37.00
	effective	41.10	47.00	50.70	44.40	45.80	45.30	44.10	43.90
Netherlands	statutory	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
	effective	32.10	32.50	31.40	31.10	30.60	31.70	30.10	31.00
Spain	statutory	35.50	35.50	35.50	35.50	35.34	35.31	35.27	35.26
	effective	27.90	28.80	26.80	24.60	24.20	26.40	26.00	27.70
UK	statutory	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
	effective	31.70	31.40	30.70	31.40	31.10	30.10	29.70	28.90

Source: Büttner (2002).

* Statutory tax rates include additional surtaxes.

** Ireland has a reduced rate of 10% for international investments. The tax rate for local firms was 40% in 1991 and decreased to 36% in 1998.

Data on other explanatory variables

Beside the two measures of taxation, we are most interested in a measure of public inputs g_i. Unfortunately detailed data on different kinds of public inputs such as public infrastructure investments are not available for the whole dataset. Instead we have to take a more general indicator for services provided by the government: government consumption expenditures. Statistics about government consumption expenditures are taken from the National Accounts statistics of the OECD and can be split into two different parts, government individual and

government collective consumption. Since the latter one includes expenditures for general administration, costs that play at least no role in determining the level of public infrastructure, we use government individual consumption as proxy for public inputs. These expenditures, expressed in terms of national currency and at 1995 prices, are normalized by GDP in order to make countries comparable.

Despite the importance of taxation and public inputs, these variables alone can hardly explain all of the distribution of foreign direct investment. Additional variables used in the econometric analysis are GDP and labour costs. GDP, which also comes from the OECD National accounts, serves as proxy for market size. Market size itself is associated with lower transport costs and hence is an important source of locational advantages. Markusen (1995) points out that locational advantages appear when transport costs are high, the foreign market is sizeable and factor prices are low relative to other locations. It would be promising, therefore, to include German exports in the econometric analysis[16], but GDP and exports are in fact strongly correlated with each other. Finally, labour costs are included to control for country differences in factor costs[17].

IV. Econometric approach and empirical results

Econometric approach

For count data, like the number of engagements used in our analysis, the Poisson distribution is very useful since it describes phenomena with non-negative integer outcomes where zero is a frequent observation. So, the number of engagements n is modelled as a Poisson distributed random variable. The likelihood of observing a count of engagements in country i in year t is

$$f(n_{i,t}) = \exp(-\lambda_{i,t}) \cdot \lambda_{i,t}^{n_{i,t}} / n_{i,t}! \tag{10}$$

with $E(n_{i,t}) = \lambda_{i,t}$

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[16] A close link between German exports and FDI was observed in an empirical study of the Deutsche Bundesbank (1997). Using German Exports instead of host countries GDP as independent variable in the regression, does not change the results reported below.
[17] A detailed description on the source and properties of the labour costs variable is given in Stöwhase (2002).

The corresponding link-function for the Poisson distribution is the log-link $\log(\lambda_{i,t})$, which ensures that the dependent variable in our model can not become negative. Now, the expectation $\lambda_{i,t}$ can be written as the product of a linear equation

$$\lambda_{i,t} = \exp(\beta \cdot X_{i,t}) \tag{11}$$

where $X_{i,t}$ is a vector of observable country and time specific exogenous variables that determine the number of engagements and β is a parameter vector to be estimated using generalised least squares[18]. With tax rates, public inputs, GDP and labour costs as exogenous variables, our baseline regression can be written as:

$$\lambda_{i,t} = \exp(\alpha_i + \alpha_t + \beta_1 \cdot T_{i,t} + \beta_2 \cdot \tau_{i,t} + \beta_3 \cdot g_{i,t} + \beta_4 \cdot y_{i,t} + \beta_5 \cdot w_{i,t} + \varepsilon_{i,t}) \tag{12}$$

where α_i is a dummy that covers country specific effects, α_t is a dummy that controls for exogenous shocks in time, $y_{i,t}$ represents host countries GDP in year t, $w_{i,t}$ denotes labour costs and $\varepsilon_{i,t}$ is the error term.

The parameter β_i estimated from regression (12) then gives us the ceteris paribus change in the expected number of engagements in a country, if the related parameter variable alters. Note that this is just a mean value. What we do in our regression is the following: first, we estimate the expected (mean) number of engagements in each country for the given economic conditions. In a second step, we estimate the change of this expected number.

Results for the baseline regression

Table 3 shows the econometric results based on regression (12). Column (1) presents the results for the activities undertaken in order to produce abroad: While the statutory tax rate seems to have no significant influence on the dependent variable, the opposite holds for the effective tax rate. The parameter for T_i has the expected negative sign and is significant at the five percent level. The other variable of interest is government individual expenditure. As predicted by theory, the influence of government individual consumption as a measure for

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[18] It follows from $\log(\lambda_{i,t}) = \beta * X_{i,t}$ that $\lambda_{i,t} = \exp(\beta * X_{i,t})$.

public inputs is positive and also significant. As indicated by the positive parameter for GDP, market potentials may also play a major role in determining investment decisions. This result is very plausible and comes indeed from the fact that locational advantages appear when production takes place in a big country and transport costs disappear.

Table 3

Baseline Regression

	Production			Service, Finance, R&D			Pooled Sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effective tax rate, T_i	-1.987**	-1.819*		0.394	0.268		-0.442
	(-2.048)	(-1.949)		(0.542)	(0.387)		(-0.829)
Statutory tax rate, τ_i	2.139		1.144	-7.016**		-6.972**	-1.994
	(0.911)		(0.506)	(-2.467)		(-2.435)	(-1.123)
Public inputs, g_i	5.513*	6.189**	5.749*	4.265	2.359	4.479	4.570*
	(1.759)	(2.018)	(1.801)	(1.152)	(0.679)	(1.224)	(1,943)
GDP, y_i	6.759**	6.334*	7.208**	-4.399	-2.572	-4.385	1.176
	(1.973)	(1.847)	(2.056)	(-1.246)	(-0.786)	(-1.237)	(0.494)
Labour costs, w_i	-0.767	-0.682	-0.798	-0.151	-0.874	-0.260	-0.729
	(-0.689)	(-0.615)	(-0.729)	(-0.132)	(-0.783)	(-0.230)	(-0.933)
R-Squared	0.77	0.77	0.75	0.70	0.66	0.70	0.83
Adj. R-Squared	0.67	0.67	0.64	0.56	0.51	0.57	0.76
Observations	64	64	64	64	64	64	64

z-statistics are given in brackets; * and ** indicates significance at the level of 10%, and 5%.
All variables expressed in logarithmic values.
Coefficients for time and country dummies not shown.

Completely different results appear, however, when we look at activities in the context of overhead services, financing and R&D, shown in column (4). In contrast to the first group, the only variable that significantly influences the location decision is the statutory tax rate. Variation in the dependent variable can not be explained by effective taxes, public inputs and the GDP. Labour costs are insignificant in all cases and for both groups.

When we compare the outcome of the baseline regression with our theoretical results, it becomes obvious, that the determinants of multinational activities in the two groups are close to the extreme cases described in section II. The results for the first group, consisting of activities undertaken in purpose of production, fit very well to the case where the transaction cost parameter θ_j is relatively high and profit shifting is almost prohibitive so that locational advantages such as effective taxation and public inputs are important determinants of profits. On the other hand, empirical results for the latter group are consistent with the assumption that firms in this group face relatively low costs when shifting profits and hence real activity plays only a small role in determining investment decisions. As real activity plays only a small role, it is not surprising that public input and market size parameters are insignificant since these parameters do not directly influence the decision on profit shifting. These results imply that most of the firms providing overhead services, financial intermediation or undertaking research and development for its German parent company are located strategically in order to reduce the overhead tax burden of the multinational by shifting profits.

Our results therefore give us indirect evidence of profit shifting. Furthermore, the analysis shows us that shifting is limited to the kind of firms that face lower transaction costs and are more independent from location specific factors of production such as public inputs. Since we have expressed all our variables in logarithmic terms, the observed regression parameters shown in Table 2 can be interpreted as elasticities. Thus, a one percent decrease in the effective tax rate of a country is expected to stimulate the number of engagements undertaken in purpose of production in this country by about two percent. This confirms previous empirical work where the elasticity of FDI with respect to the effective tax rate typically fluctuates in a range between -2 and -4[19]. On the other hand, a one percentage increase in the statutory tax rate diminishes engagements in firms providing its parent with overhead services or undertaking research by approximately seven percent.

Column (7) presents empirical results for a pooled sample where we do not distinguish between the two different groups. Here, the effects observed using disaggregated data completely disappear. The only variable that significantly influences investment decision is

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[19] De Mooij and Ederveen (2001) make the outcomes of several empirical studies comparable and compute a mean tax-elasticity around -3.3, i.e., a one percentage point increase in the host countries tax rate leads to a 3.3 percent reduction of foreign direct investment. This mean value is calculated from studies that typically report elasticities between -2 and -4. Moreover, the elasticity derived here is also very close to that reported for bilateral foreign direct investment in the manufacturing sector by Stöwhase (2002).

the level of public inputs. Although they have the expected sign, all other variables are insignificant. It is not surprising that we get such insignificant results when pooling the data, since investments are underdone for different purposes, and therefore have completely different determinants. As a consequence, the econometric model can not carve out clear results.

Note that investments in the first group (production) often employ more capital than investments in the second group (investments in R&D facilities are sometimes an exception). The total sum of capital invested in the first group is therefore much higher than that invested in the second group. Using the amount of capital rather than count numbers in our regression, the results for the pooled sample would be more similar to that of the first group since the weight of this group measured in terms of capital is relatively high. We would get results very similar to that of Devereux and Griffith (1998): the effective tax rate would be significant; the statutory tax rate would be insignificant in determining investment decisions. This demonstrates the importance of using data disaggregated by the type of FDI for econometric analysis on the effect of taxes.

In the remaining columns of Table 3 we tested whether the simultaneous use of the two tax measures in one regression biases our results. Since T_i is a function of γ_i and τ_i, there is a high possibility that the effective tax rate is not exogenous, but endogenously given by the nominal tax rate. Although observed correlation between the two variables is almost negligible in our sample, we tested for this possibility. Therefore we ran two additional regressions for each group, excluding one measure of taxation in each. As we can see from columns (2) to (3) and (5) to (6) respectively, results do not change much, neither in the size of the regression parameters nor in its level of significance[20].

Robustness Test

We have mentioned above that effective taxation in Ireland and Italy is higher than the statutory tax rate and that the results derived from the baseline regression could be biased by the use of the reduced tax rate for multinational corporations in Ireland. Hence, we excluded Ireland and Italy from the sample. Results of this regression are presented in Table 4. Even

after exclusion of the two countries the results appear to be quite robust. When we take a closer look at our findings, however, we get one striking result: while the importance of the effective tax rate in the first group grows after exclusion (the coefficient changes by approximately 30 percent and becomes more significant), the importance of the statutory tax rate for activities in the second group declines (in this case the coefficient decreases by approximately 20 percent and simultaneously loses significance).

Table 4

Exclusion of Ireland and Italy

	Production			Service, Finance, R&D		
	(1)	(2)	(3)	(4)	(5)	(6)
Effective tax rate, T_i	-2.643**	-2.478**		0.765	0.612	
	(-2.478)	(-2.405)		(1.005)	(0.835)	
Statutory tax rate, τ_i	2.696		1.514	-5.497*		-5.272**
	(0.999)		(0.592)	(-1.796)		(-2.435)
Public inputs, g_i	8.155**	9.505**	7.799*	0.019	-1.484	0.902
	(2.042)	(2.506)	(1.904)	(0.004)	(-0.347)	(0.204)
GDP, y_i	7.855**	7.606**	7.934**	-3.497	-2.508	-3.343
	(2.063)	(1.970)	(2.023)	(-0.935)	(-0.711)	(-0.891)
Labour costs, w_i	-0.966	-0.919	-1.127	-0.051	-0.676	-0.291
	(-0.924)	(-0.872)	(-1.096)	(-0.042)	(-0.576)	(-0.241)
R-Squared	0.83	0.83	0.78	0.72	0.69	0.71
Adj. R-Squared	0.73	0.73	0.66	0.54	0.52	0.55
Observations	48	48	48	48	48	48

*z-statistics are given in brackets; * and ** indicates significance at the level of 10%, and 5%.*

All variables expressed in logarithmic values.

Coefficients for time and country dummies not shown.

One explanation for observed changes in the first group could be the fact that the effective tax rates for Ireland and Italy used in the econometric analysis are too "high". Tax induced

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[20] Indeed, some parameters drop from the 5 percent level to the 10 percent level of significance while others advance. As indicated by the small changes in the z-statistics, these variations are not very high. Discrete jumps in the level of significance come from the fact that z-values are distributed near to the 5 percent level.

investments in these countries are not treated as tax induced and hence underestimated by the model. To give an example: a multinational enterprise locating a subsidiary in Ireland de facto faces an effective tax rate lower than or equal to 10 percent[21]. Because of this low tax rate the multinational decides to locate in Ireland. Our econometric model, however, suggest that this location decision is based on an effective tax rate that is around 15 or 20 percent and hence is not tax induced. Consequently, the observed tax sensitivity of investment grows after exclusion of the two countries.

When we think of Ireland as a tax haven, changes in the second group can also be explained. With its preferential corporate tax rate of 10 percent, Ireland can be considered as an outlier in our sample as the next lowest tax rate is 30 percent (Austria from 1991-1993). Our results in the baseline regression are then to some degree influenced by the existing preferential taxation offered by the Irish government and primarily applied to multinationals´ subsidiaries engaged in financial investments[22]. As expected, the tax sensitivity of investment in the second group declines after adjusting our sample.

Other variations of our model, such as the exclusion of the labour cost variable, which is insignificant in all cases, or the limitation to specific time periods, do not lead to major changes for our findings reported above. This suggests that the results derived from our database are robust with respect to the exact specification of the model.

V. Summary and conclusion

This paper has analysed count data about foreign engagements of German multinationals differentiated by their economic function, in order to investigate if there is substantial variation in the determinants of FDI between these functional groups. Results indicate that foreign engagements in real activity depend on variables that refer to locational advantages, e.g. GDP, public inputs or the effective tax rate, measuring the actual rather than the statutory burden of taxation. Completely different outcomes appear when we look at engagements in the functional area of management and finance, research and development or overhead services which we associate with high potentials for (respectively low costs of) profit shifting.

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[21] The statutory tax rate of 10 percent multiplied with a factor $\gamma \leq 1$.

[22] Because most of these subsidiaries, which are part of the second group in our regression, are located in a small area near the docks in Dublin, they are often referred to as the Dublin docks companies.

Instead of locational advantages, investments in these groups only follow the statutory tax rate, showing us indirect evidence for profit shifting activities. The effect of the statutory tax rate is thereby approximately three times higher than that of the effective tax rate on investments in real activity. Unfortunately we can not distinguish whether this is due to differences in capital mobility between the two groups, or to differences in the ratio of capital employed per count of activity.

As we have seen in the analysis, higher effective tax rates for investments undertaken for purpose of real activity (production) can be balanced out by other location factors such as public inputs. Consequently, from this point of view, there is little possibility for a "race to the bottom" in effective corporate tax rates across Europe, as feared by many scholars. On the other hand, profit shifting can indeed result in a "race to the bottom" since a country can easily gain corporate tax revenues by lowering the statutory tax rate, leaving the effective level of taxation constant.

The main result of our analysis is that the separation of different types of FDI leads to very sharp results on the effects that different parts of the corporate tax system have on different types of FDI. Using aggregated data instead, as has been done by most empirical studies of the subject, gives a less clear-cut picture of the correlation between tax parameters and investment, since it "averages" over different, and sometimes even opposite effects. Provided the availability of suitable data, further research should therefore concentrate on the effects of taxation on specific types of FDI.

References

Büttner, Thiess (2002), "The impact of taxes and public spending on FDI: an empirical analysis of FDI-flows within Europe. ZEW Discussion Paper No.01-17, Mannheim.

Clausing, Kimberly A. (2001), "Tax-Motivated Transfer Pricing and U.S. Intrafirm Trade Prices", mimeo.

De Mooij, Ruud A. and Ederveen, Sjef (2001), "Taxation and foreign direct investment: a synthesis of empirical research", CESifo Working Paper No. 588.

Demirgüc-Kunt, Asli and Huizinga, Harry (2001), "The taxation of domestic and foreign banking", Journal of Public Economics, 79, 429-453.

Deutsche Bundesbank (1997), "Development and determinants of international direct investment", Monthly Report, August 1997.

Devereux, Michael P. (1992), "The Ruding committee report: An economic assessment", Fiscal Studies, 13, 96-107.

Devereux, Michael P. and Grifftith, Rachel (1998), "Taxes and the location of production: evidence from a panel of multinationals", Journal of Public Economics, 68, 335-367..

Döhrn, Roland (2001), "The RWI Data Base on the Globalisation of German Companies", Schmollers Jahrbuch 121, 427-434.

Döhrn, Roland and Radmacher-Nottelmann, Nils A. (2000), "A Database on the Globalization of German Manufacturing Companies: Conception and some Results", RWI-Papiere Nr. 69, Essen.

Ernst&Young (2001), "Transfer Pricing 2001 Global Survey"

Genschel, Philipp (2001), "Globalization, Tax Competition, and the Fiscal Viability of the Welfare State", MPIfG Working Paper 01/1, Cologne.

Gordon, Roger H. and Slemrod, Joel (2000), "Are ´real´ responses to taxes simply income shifting between corporate and personal tax bases", in Slemrod, Joel (ed), "Does Atlas shrug?" The economic consequences of Taxing the Rich", Harvard.

Grubert, Harry and Slemrod, Joel (1998), "The effect of taxes on investment and income shifting to Puerto Rico", Review of Economics and Statistics, 80(3), 365-373.

Haufler, Andreas and Schjelderup, Guttorm (1999), "Corporate Taxation, Profit Shifting, and the Efficiency of Public Input Provision", Finanzarchiv, 56(1999), 481-499.

Haufler, Andreas and Schjelderup, Guttorm (2000), "Corporate tax systems and cross country profit shifting", Oxford Economic Papers, 52, 306-325.

Hines, James R. (1999), "Lessons from behavioral responses to international taxation", National Tax Journal, 52, 305-322.

Hines, James R. and Rice, Eric M. (1994), "Fiscal Paradise: Foreign Tax Havens and American Business", Quarterly Journal of Economics, 109(1), 149-182.

Lindhe, Tobias; Södersten, Jan and Öberg, Ann (2002), "Economic Effects on Taxing Closed Corporations under a Dual Income Tax", Paper presented at the 58th Conference of the IIPF in Helsinki.

Markusen, James R. (1995), "The boundaries of multinational enterprises and the theory of international trade", The Journal of Economic Perspectives, 9(2), 169-189.

Ruding Report (1992), "Report of the Committee of Independent Experts on Company Taxation", Brussels.

Stöwhase, Sven (2002), "Tax rate differentials and sector specific foreign direct investment: Empirical evidence from the EU", mimeo.

Weichenrieder, Alfons (1996), "Fighting International Tax Avoidance: The case of Germany", Fiscal Studies, 17(2), 37-58.

Wildasin, David E. (1986), "Urban Public Finance", Chur.

Zodrow, George and Mieszkowski, Peter (1986), "Pigou, Tiebout, property taxation and the underprovision of local public goods, Journal of Urban Economics 19, 356-370.