Taxes and multinational enterprises in the EU: Location decisions and income shifting

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CHAPTER ONE:

Introduction

1.1. Motivation of the analysis

The last decades have seen increased economic integration world-wide, removing many barriers to trade and obstacles for international investment. Along with this globalisation process, there has been an increase in the number of regionally integrated areas. In some of these areas, national borders between member states have lost economic importance. Particularly in the European Union (EU), factor mobility increased with the implementation of the single market. Factor mobility allows both firms and workers to locate where income is highest. While there still exist some limitations to the mobility of labour, e.g. through language barriers, regulated labour markets, or migration costs, capital mobility is rather high. Since income is at least partially determined by tax policy, this may play an important role for the location decision of business within Europe. One of the fears often expressed in the context of this mobility is that multinational enterprises may put competitive pressure on governments to reduce taxation in order to remain attractive for the location of capital. The most pessimistic view is that this will lead to a "race to the bottom" with extremely low or zero taxation.

Although this view is supported by most of the theoretical literature (e.g. Zodrow and Mieszkowski, 1986, Wilson, 1986), empirical evidence for a "race to

the bottom" in tax rates among EU member states is not that clear[1]. There are three necessary conditions for tax competition to take place: First, business has to be mobile across national borders. Second, investments have to be sensitive to differences in the tax burden opposed by several countries. Third, governments in these countries have to be able to actively use the tax policy instrument, and thus react to downward revisions of other countries' tax rates or capital outflows.

Evidently, the first condition is fulfilled: Statistics on either cross-border portfolio investment or on foreign direct investment (FDI) illustrate the mobility of capital world-wide and within the European Union and show that these investments have become important for at least some regions. For example, from the late 1980s to the late 1990s, FDI flows have increased more than sevenfold in the European Union and do account for more than three percent of GDP. Moreover, empirical studies suggest the third condition to be fulfilled as well. Some recent studies (Altshuler and Goodspeed, 2002, Devereux et al., 2004) present evidence that corporate tax rates of EU member states are positively correlated with each other.

The focus of this study is on the second condition for tax competition. The central question of the present analysis is how taxes influence the location decision of international mobile investments. Although investment decisions may be influenced by a number of different taxes, we will follow the majority of the empirical literature and concentrate our analysis on corporate taxes since these can be assumed to be the most important measures of the tax burden.

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[1] In an empirical study, Rodrik (1998) finds a positive rather than a negative correlation between the openness of a country and the size of its government suggesting that tax competition does not restrict government expenditures. However, evidence on tax rates is somewhat indirect and there are other reasons than capital mobility that lead to this result. More direct evidence comes from a recent study by Krogstrup (2004). She directly tests for the correlation between capital mobility and tax rates and finds that increased capital mobility has resulted in a downward pressure on corporate tax burdens among EU countries since the early 1980s.

Evidence so far suggests that cross-border investments are generally deterred by high tax rates. For example, for investment from the United States to Europe, Devereux and Griffith (1998) show that a 1% higher tax rate of a country reduces the probability of an investment there by 0.5% to 1.3%. Concerning foreign direct investment within the European Union, Gorter and Parikh (2003) find that a one percentage point increase in the tax rate of a country decreases the stock of foreign investment there by approximately five percent.

However, empirical evidence concerning foreign investments within the European Union is based on aggregated data. In fact, FDI is a very heterogeneous measure that can be distinguished in several ways and it can be assumed that different types of investment are differently affected by tax rates and other economic variables. Therefore, the tax elasticities reported by the empirical studies so far may be of only limited help for policy purposes since they combine data from sectors and industries with a relatively small mobility with data from sectors in which investment is almost perfectly mobile.

A further issue that has not been discussed so far by the empirical literature on the activities of multinational enterprises in Europe is income shifting. The growing importance of foreign direct investments through multinational enterprises has increased the relevance of this new type of capital tax base mobility. By shifting income from affiliates in high tax countries to affiliates in low tax countries, multinational firms can minimise their overall tax payments rather independently from the allocation of their real activities. A visible effect of these tax-planning strategies can be found particularly in the tax payments of large German multinationals during the 1990s which had, even though their profitability was high, ceased to pay taxes at home (Weichenrieder, 1996). While income shifting benefits low tax countries in which the tax base increases, high tax countries are harmed from a decrease in their tax base. Consequently, this is an important issue for high tax countries such as Germany.

The existence of income shifting opens room for new research questions which are particularly relevant for policy purposes. As income shifting is considered to

be harmful, there exist several proposals within the EU to reform tax policy so as to make income shifting of multinational enterprises more difficult or even impossible. However, these proposals neglect the impact of income shifting on the optimal corporate tax rate set on the national level by EU member states. The theoretical literature on income shifting has just begun to analyse these effects. However, while income shifting typically takes place between asymmetric regions, the literature so far has concentrated on the case of symmetric regions

1.2. Multinational enterprises and foreign direct investment

Definitions

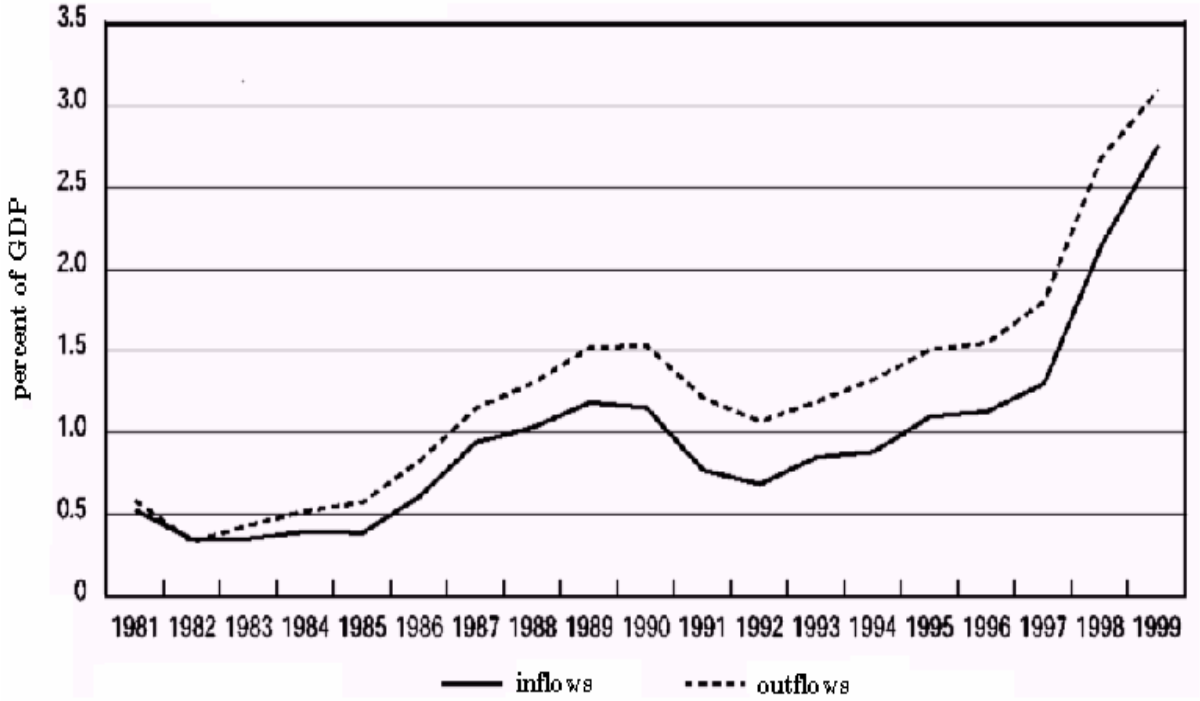
Before we present some data on foreign direct investment and on the importance of multinational enterprises, it will be useful to define these terms at first. There does not exist a general definition of FDI. However, most of the definitions share common features. Following the definitions of the IMF (1993) and the OECD (1996), foreign direct investment "*reflects the objective of obtaining a lasting interest by a resident entity in one economy (direct investor) in an entity resident in an economy other than that of the investor (direct investment enterprise). The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence on the management of the enterprise*". The most important feature of this definition is that the lasting interest and the control of the foreign enterprise distinguish FDI from other components of international capital flows. This becomes clear when setting FDI against portfolio investment, since the latter are typically undertaken by pension funds or trust funds which involve a smaller share of ownership and, in most cases, do not involve a long-term relationship between the investor and the foreign enterprise. According to the OECD definition, to control an enterprise, the foreign investor has to own at least ten percent of the enterprise. This threshold of equity ownership is

chosen to guarantee that the enterprise is at least partly controlled by foreigners[2].

Using the above definition for FDI, it is also possible to define the term "multinational enterprise". Basically, a multinational enterprise is then a company with two or more affiliates located in different economies. Consequently, a purely domestic firm can become a multinational by setting up affiliates abroad.

Figure 1.1.

OECD flows of FDI as a percentage of GDP, 1981 to 1999*



* *GDP is the weighted average of all OECD countries.*
Source: OECD (2000a).

[2] It has to be noted, however, that definitions regarding this threshold level do sometimes differ across countries and that some countries do not specify a threshold level for their definition of FDI at all. Data which is collected by supranational institutions (such as the OECD) on the basis of individual country statistics should therefore be interpreted with care.

Recent trends in foreign direct investment

During the last twenty years, the investment climate among countries improved considerably. This improvement was accompanied by continued removals of domestic impediments though deregulation and privatisation. Moreover, globalisation has become an integral part of corporate strategies. This led to a massive increase in the volume and the importance of cross-border investment flows. As shown by Figure 1.1., foreign investment flows among OECD countries, either measured in terms of FDI received by a country or by investments of that country abroad, have grown much faster than GDP[3]. While investment flows only accounted for approximately 0.5 percent of GDP in the early 1980s, their share increased to about 3 percent at the end of the century.

A closer look at the geographical distribution of FDI reveals that the majority of foreign direct investment takes place between developed countries. As shown by Table 1.1., the European Union and the United States (US) account for more than 70 percent of world-wide inflows and 80 percent of world-wide outflows of FDI in 2000. For both these regions, FDI inflows have increased sevenfold between 1989 and 2000 in total value and similar effects can be observed for outflows as well[4].

However, a visible effect of globalisation does not only come from statistics on cross-border investment flows. Parallel to the development of FDI flows, the number of multinational corporations has increased markedly in the last years. UNCTAD (2000) presents some data on the number of parent multinational corporations located in several European countries and the US[5]: while there existed only about 7.000 multinational enterprises at the end of the 1960s, their

[3] Theoretically, inflows and outflows should be equal. Dissimilarities occur since definitions of FDI differ among reporting economies.

[4] The observed trends in investment flows are reflected in the stocks of FDI, too. Similar to investment flows, the European Union and the United States account for more than 50 percent of inward and 70 percent of outward stocks.

[5] European countries are the „EU-15“, less Finland, Greece and Ireland, plus Norway and Switzerland.

number increased to about 40.000 in the second half of the 1990s. The figures presented here thus illustrate the importance of foreign direct investment both in relative and in absolute terms. Furthermore, they show that although FDI is a global phenomenon, it is particular important for the EU and the US.

Table 1.1.

FDI flows by region[a], 1989 to 2000

Region	1989-94[b]	1995	1996	1997	1998	1999	2000
Inflows							
European Union	76.6	113.5	109.6	127.6	261.1	467.2	617.3
United States	42.5	58.8	84.5	103.4	174.4	295.0	281.1
Japan	1.0	0.0	0.2	3.2	3.3	12.7	8.2
CEE[c]	3.4	14.3	12.7	19.2	21.0	23.2	25.4
DC[d]	59.6	113.3	152.5	187.4	188.4	222.0	240.2
World total	200.2	331.1	384.9	477.9	692.5	1075.1	1270.8
Outflows							
European Union	105.2	159.0	183.2	220.4	454.3	720.1	773.0
United States	49.0	92.1	84.4	95.8	131.0	142.6	139.3
Japan	29.6	22.5	23.4	26.1	24.2	22.7	32.9
CEE[c]	0.1	0.5	1.1	3.4	2.1	2.1	4.0
DC[d]	24.9	49.0	57.6	65.8	37.8	58.0	99.6
World total	228.3	355.3	391.6	466.0	711.9	1005.8	1149.9

[a] In billion US dollar. [b] Annual average. [c] Central and Eastern Europe. [d] Developing Countries.
Source: UNCTAD (2001).

Distinguishing between different types of investment

With the definitions given above, we can distinguish FDI from other cross-border financial flows. However, the definitions of foreign direct investment are rather broad and there exist many types of investment that can be subsumed under these definitions. In some cases, FDI statistics are only provided at an aggregated level and do not distinguish between different types of investment. Generally speaking, FDI can be distinguished by its source of finance, by its target industry or sector, by the economic function it is intended for, and by the type of transaction through which it takes place.

With respect to its source of finance, statistics distinguish three different types of foreign direct investment: FDI can either be financed with new equity, with retained earnings, or with intra-company loans. Quite obviously, differences in the source of finance indicate different characteristics of the investment. Financing foreign investments with retained earnings or with intra-company loans implies that there already existed a relation between the investor and the investment previously. In this case, actual investments may be determined to a large degree by previous activities of the multinational enterprise. Moreover, intra-company loans may be used to cover actual losses of foreign affiliates. Although these flows can hardly be classified as investments, they enter FDI statistics as well. If the investment is financed with new equity instead, a previously existing relation between the investor and the investment is not necessary. It may either be the case that the multinational enterprise invests in an already existing affiliate or in an entirely new affiliate. Differences in the financing of FDI seem to be important therefore. This is a crucial point since statistics on foreign investment do sometimes not distinguish between different sources of finance.

Another possibility is to distinguish FDI in different economic sectors or industries. Table 1.2. presents some statistics on foreign direct investment flows of EU countries that are disaggregated with respect to the economic sector and the industry they take place in. As can be seen, figures differ not only significantly between economic sectors but also between industries within sectors. With a share of approximately 15 percent, investments in the primary sector are rather small when compared to those in manufacturing and service which account for more than 30% and more than 50% respectively, of total FDI[6]. The differences observed here indicate that FDI is more attractive in some sectors and industries than in others. This may have some important implications on policies that aim to improve a country's attractiveness for foreign investment.

[6] These figures correspond to the case of FDI outflows.

Table 1.2.

Sectoral distribution of FDI flows in the EU, 1997*

	Outflows		Inflows	
	total	percent	total	percent
All industries	480513	100%	295385	100%
Primary	67942	14%	46	0%
Manufacturing	152731	32%	76948	26%
Food products	5243	1%	7077	2%
Textiles and wood	15665	3%	9684	3%
Petrol, chemicals and rubber	31624	7%	20160	7%
Metal and mechanical	19537	4%	9615	3%
Office machinery and radio	10236	2%	16034	5%
Services	257078	54%	214878	73%
Electricity, gas and water	9825	2%	12494	4%
Trade and repairs	39721	8%	20940	7%
Transport, communication	17509	4%	17414	6%
Financial intermediation	117080	24%	73808	25%
Real estate and business activity	62834	13%	77175	26%

**Measured in million Euros.*

Source: Own computations based on UNCTAD (2000).

Moreover, we can distinguish FDI with respect to its economic function. Foreign direct investment can be undertaken for different purposes. This can be, for instance, to produce final and intermediate goods abroad, to undertake research and development, to provide the parent or other affiliates of the multinational enterprise with some overhead services, or merely to sell the goods produced at home at the foreign market. It can be assumed that FDI undertaken for different purposes does vary in its size as well as in its determinants[7].

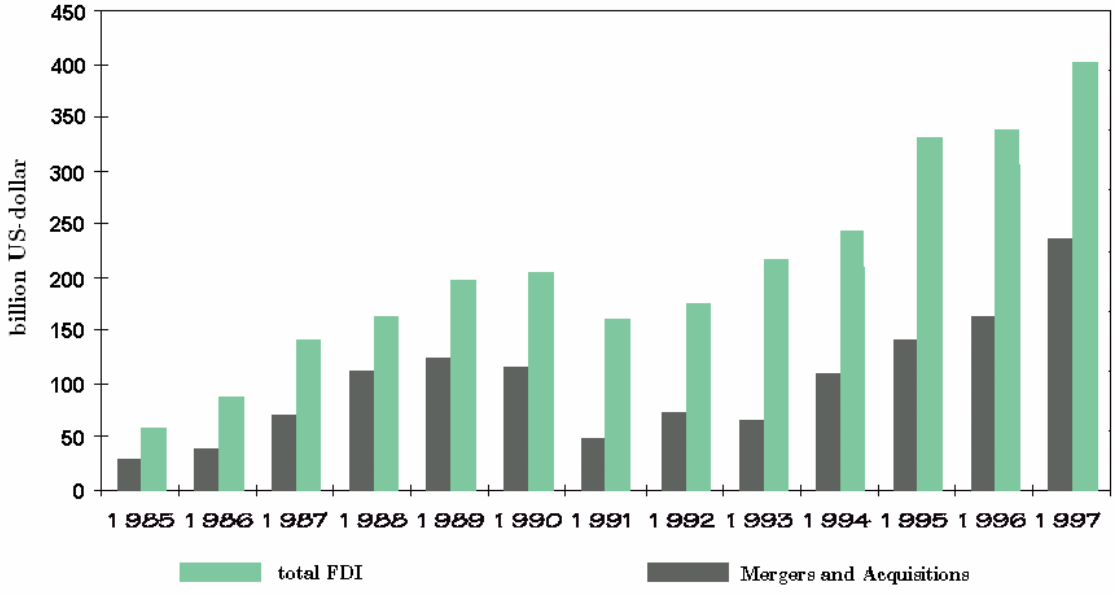
Finally, FDI can be disaggregated into two broad categories by the type of transaction through which it takes place, greenfield and brownfield investment. The term "greenfield" investment is used if FDI is associated with an entirely

[7] In most cases, statistics on this type of data has to be taken from firm-level data.

new activity, e.g. by setting up a new plant, and the term "brownfield" investment is used if the investment is associated with an existing indigenous firm. Again, it can be argued that a distinction between these two groups is very important since they differ in several characteristics. For instance, while greenfield investment is generally associated with additional employment in the target country of investment, the effect of brownfield investment on employment is not that clear and may be negative in some cases. Moreover, motivations for investment may differ too. These two broad categories can be divided into several subcategories such as investment in a new plant, the expansion of an existing plant, an increase in equity, the acquisition of an existing firm or the merger of two firms. While some of these transactions are more important in determining the total amount of investment flows, others are less important. As can be seen from Figure 1.2., especially mergers and acquisitions account for a large share of FDI.

Figure 1.2.

The share of Mergers and Acquisitions in total FDI flows



Source: UNCTAD (1998).

According to this figure, almost half of the world-wide investments that have taken place between 1985 and 1997 came in the form of mergers and

acquisitions. Hence, a large portion of FDI stems from brownfield investment. Most of the public and academic discussion on foreign direct investment, however, is focused on greenfield investment, which is typically associated with positive economic effects for the host country of investment, instead. Consequently, analysing FDI at the aggregate level where greenfield and brownfield investment are not distinguished, may be problematic. This is the case since investments do not only differ with respect to its effects on the host economy but also in other economic characteristics.

1.3. Contributions of the analysis

As we have shown in section 1.2. the disaggregation of foreign direct investment data may be an important issue since different types of FDI have different characteristics and may react differently to taxation therefore. This work contributes in several ways to the existing empirical and theoretical literature on the taxation of multinational enterprises. In its empirical chapters, it makes use of disaggregated data on foreign direct investments to test if the tax sensitivity of foreign direct investment within the EU differs with its economic function and the sector it takes place, i.e. if some types of investment are more affected by taxes than others. Moreover, we distinguish between two measures of taxation, effective taxation and statutory taxation, and test if different types of investment are differently affected by these two measures.

In the theoretical part of this work we try to explain the differences we found for the tax sensitivity of FDI when we distinguished investment by its economic function. Combining our theoretical results with empirical evidence, we are able to provide indirect evidence for the fact that German multinational enterprises engage in income shifting activities. With respect to this finding, we then analyse how the tax policy of governments that compete for taxable profits is affected by income shifting activities.

As a starting point, Chapter 2 gives a short overview on the determinants of foreign direct investment. In addition, we present different methodologies to measure the tax burden of an investment project. We then discuss properties and possible interpretations of these measures. In Chapter 3 we review the empirical literature on the tax sensitivity of multinational enterprises. We discuss separately the literature on real investment decisions and on income shifting. This chapter reports several shortcomings of empirical studies so far and shows their limitations: The use of aggregated data on FDI flows by studies concerned with the location decision inside the European Union, and the lack of empirical evidence for income shifting in the EU.

Both, Chapter 4 and 5, make a contribution to overcome these limitations and to analyse the effect of taxes on multinational activities in more detail. In Chapter 4 we estimate the tax sensitivity of FDI among the primary, the manufacturing, and the service sector and find remarkable differences: While some investment in the primary sector is insensitive to tax rates, investment in the service sector is particularly sensitive to taxation. We conclude that tax authorities should take into account these differences when designing tax policies that aim to attract foreign investments.

We go one step further in Chapter 5 where we investigate how different measures of taxation affect the investment behaviour of alternative firms. We develop a small theoretical model in which income shifting is a feasible strategy to minimise tax payments for some but not for all firms and show that investment of these firms is affected by different measures of taxation. This is tested for empirically with disaggregated data on German multinationals' foreign activities. We group firms' investment into two broad categories and show that their investment decision is determined by different measures of taxation, depending on the firms' possibilities for income shifting.

After having presented some evidence for income shifting in Chapter 5, we change the perspective of the analysis. While we were concerned with the firms' optimal decisions in Chapter 5, we analyse the optimal policy of regional

government in Chapter 6. Our model is concerned with the question of how the existence of income shifting affects the optimal choice of tax rates in two asymmetric regions that compete for taxable profits. It is shown that income shifting may reduce tax competition. This is the case since the tax-base elasticity of the low tax region will decrease with income shifting such that it has an incentive to increase its tax rate.

Our analysis has some clear implications for policy purposes which become clear in our conclusion of Chapter 7. First, sector specific tax elasticities obtained from the analysis in Chapter 4 suggest that different policies are needed to attract FDI in different economic sectors. Policies aimed to attract specific types of FDI should take care of this result. Second, the existence of harmful income shifting among German multinationals suggests that tax authorities should take this problem more serious. Third, tax authorities should be careful when designing tax policies aimed to prevent income shifting since these may reinforce tax competition.

CHAPTER TWO:

Theoretical background

2.1. The location decision of multinational enterprises

2.1.1. Introduction

As a starting point for our further analysis, this section provides a short overview on the motives and determinants of foreign investment and multinational activity as it is provided by the theoretical literature. Early theoretical work distinguishes two key motives for multinational activity: to serve a foreign market and to reduce the costs inputs[8]. This distinction is used to differentiate between "horizontal" and "vertical" investment as the two main types of FDI. The term "horizontal" refers to the foreign manufacturing of products and services which are quite similar to those the firm produces (and sells) at home and it is used since the multinational enterprise duplicates activities in different countries. Horizontal FDI arises primarily due to high transport costs which make it too costly to serve foreign markets via exports. In contrast, vertical FDI refers to those multinationals that fragment their production process geographically. If the production process of a firm involves different input factors at different production stages, the multinational firm can

[8] Dunning (1993) provides a detailed review of the early literature on the motives for foreign direct investment.

locate each production stage in the country where factor prices are lowest. In practise, multinationals will be affected to some degree by both these motives, e.g. factor costs do affect market seeking FDI as well, and a distinction between the two is quite difficult if not impossible. However, we will follow the (early) theoretical literature which deals separately with these two different motives for multinational activity[9]. Based on this general discussion on the determinants of FDI, we will explore the effect of agglomeration forces and taxes in more detail.

2.1.2. Theories of horizontal FDI

Horizontal multinational enterprises are firms that produce the same goods or services in multiple plants in different countries where the local market is served from the production in the local plant. The central question here is for what reason the firm sets up a new plant abroad instead of serving the foreign market via exports from home. Two factors are important in determining the choice of a firm to become a horizontal multinational: the presence of trade or transport costs[10] and economies of scale at the plant and at the firm level.

First attempts to model the decision of a firm to become a horizontal multinational are the studies by Horstmann and Markusen (1987, 1992). Horstmann and Markusen (1992) analyse the case of imperfect competition in a two-country model with one homogeneous good. Initially, there is one monopolistic firm in each country which serves the local market only. Firms are assumed to have constant marginal costs in production and there exist two different types of fixed costs associated with the firm. One is plant-specific costs, i.e. fixed costs for each single production plant. The other is firm-specific costs,

[9] More recent studies combine the two different strands of literature in one single framework (Markusen et. al., 1996). In doing so, they can analyse the interaction of different motives in more detail. However, the present work will only present the general motives for multinational activity. The interested reader is referred to Markusen and Maskus (2003).

[10] Note that transport costs differ from trade costs. The latter does not only include the costs to transport goods from one country to another, but it does also contain tariffs and the effects of other trade barriers.

which are independent from the number of production plants. Together with constant marginal costs of production, these fixed costs result in economies of scale, making it profitable for the firm to serve a larger market. That is, if the domestic market is already served, to expand activity to foreign markets.

Of course, serving the foreign market is costly. If the goods are exported to the foreign country, transport costs have to be added to the production costs. An alternative is to set up a new plant abroad. Although this is costly as well (plant-specific costs are doubled in this case), this is a feasible strategy if plant-specific costs are lower than transport costs which disappear in this case. As Horstmann and Markusen (1992) show, the decision to become multinational does crucially depend on the size of economies of scale and therefore on the production technology of the firm[11]. They find that firms are more likely to produce in both locations, i.e. becoming horizontal multinationals, if plant-specific costs are low relative to firm-specific costs.

In a more general model, Brainard (1993) discusses the role of scale effects at the firm and at the plant level in relation to transport costs. Her analysis makes the impact of trade costs on the firm's decision more explicit. In a model very similar to those of Horstmann and Markusen (1992), it is argued again that a firm seeking for foreign markets will make horizontal investments abroad if the trade costs associated with export are larger than the costs of setting up a completely new production plant there. So, there is a trade-off between the advantage of being near to the foreign market to avoid transportation costs (proximity) and scale effects in case of production in one plant (concentration)[12]. The model predicts two situations in which horizontal FDI will dominate over exports or crowd them out completely. The first is when

[11] In fact, since the decision of the domestic firm to become multinational has to be made in the context of a Curnot duopoly, it does also depend on the decision of the other firm initially located in the foreign country and vice-versa.

[12] With respect to the costs and benefits from locating abroad, this is called "proximity-concentration approach".

economies of scale at the firm-level are larger than at the plant-level. The second situation is when transport costs are higher than plant-level fixed costs.

From the latter result, we can derive two assumptions regarding the attractiveness of a country for foreign investment: First, for given plant-level fixed costs and assuming transport costs to be increasing in distance, foreign investment becomes more attractive the larger the distance between countries. Second, since total transport costs will increase with the number of goods sold in the foreign market, production will be more attractive abroad the larger the foreign market. Thus, it can be expected that the size of a country has a positive effect on the inward FDI it receives. As FDI is a substitute for trade within this "proximity-concentration approach", it can be further expected that investment between two countries increases with distance. However, as we will show below in section 2.1.3. it may also be the case that FDI follows trade instead.

2.1.3. Theories of vertical FDI

A second strand of literature we want to report here is concerned with vertical FDI. While horizontal FDI may occur between similar countries, the theory of vertical FDI assumes countries to be different. Following trade theory, Helpman (1984) and Helpman and Krugman (1985) assume that countries differ with respect to relative factor costs. Vertical multinationals use these differences in factor prices to minimise production costs.

Helpman (1984) assumes that a firm produces its output with two inputs, unskilled labour and skilled labour (or human capital). There exist two countries which differ in their endowment of the two factors, one is relatively abundant of unskilled labour and one is relatively abundant of skilled labour, such that factor prices differ between them. It is further assumed that production factors can not move across national borders. The production process consists of two stages which require different input factors. The example given by Helpman (1984) is one in which some overhead services are provided in

the first stage while final production takes place in the second stage. The overhead services provided at the first stage require the use of skilled-labour and can serve many plants in different countries. Final production in the second stage involves the use of unskilled labour. Again, the choice to become a multinational can be described as a trade-off between costs and benefits. On the one hand, a firm can decrease its costs by splitting its production process across countries. Overhead services are produced in the country that is abundant of skilled labour and final production takes place where the costs for unskilled labour are lowest. On the other hand, fragmentation incurs costs such as the fixed costs when setting up a new plant abroad.

If a firm becomes a vertical multinational enterprise it thus makes use of the same advantages that lead to international trade flows. Consequently, and in sharp contrast to the case of horizontal investment, we therefore expect that vertical FDI will in general follow trade flows. Moreover, the more the multinational enterprise fragments the production process of different stages geographically, vertical investment by itself may increase trade flows. Since investment decisions are primarily driven by differences in factor costs across countries, it can be expected that a multinational enterprise will locate each of its activities in that country which offers the lowest factor prices. Consequently, a country becomes more attractive for inward FDI the lower its factor prices. These can be, for example, prices for skilled and unskilled labour, energy prices or the cost of capital.

2.1.4. Agglomeration effects

An issue that is closely related to the location decision of a multinational enterprise is the existence of agglomeration effects. Agglomeration effects can be best characterised as external economies of scale that occur if firms concentrate in a specific location. There are several reasons why these economies of scale may occur. First, the concentration of several firms in a single location offers a pooled market for workers with specific skills. Second, localised industries may support the production of (non-tradable) specialised inputs. Third,

informational spillovers may increase output of clustered firms. As Krugman (1991) shows in a theoretical model, the existence of such positive spillover effects may result in a clustering of firms which is self-reinforcing: Firms will concentrate in an attractive location. This will make the location even more attractive for other firms.

Following the two motives for foreign investment presented above, agglomeration effects can arise for two reasons. As we have seen, a country with a large market will be an attractive place for market seeking (horizontal) FDI. In most cases, however, these firms will not only sell in this market but will also demand some (intermediate) goods from the market which makes it attractive for other firms to locate there as well. It can be therefore assumed that the concentration of firms in a specific location makes it more attractive for FDI. Vertical FDI offers another reason for agglomeration effects. Producing only these goods that require the low-cost input factor will lead to a specialisation of the country. This specialisation may reduce production costs further in a way that the country becomes more attractive for similar types of foreign investment. Having these agglomeration effects in mind, it can be supposed that a location becomes more attractive for a specific foreign investment, the larger the concentration of similar firms is.

2.1.5. The impact of taxation

The focus of this work is on the question how taxes affect the decisions of multinational enterprises. It can be assumed that taxes play an important role particularly in determining vertical FDI. Taxes will influence the factor prices a firm has to pay in a certain country and low tax rates will therefore make a location more attractive. Labour taxes, for example, increase the factor costs for labour and environmental taxes may increase energy prices. In this work, however, we will primarily focus on the corporation tax. Most of the theoretical literature in the field of taxation models the corporation tax as a unit tax on capital (for an extensive overview see Wilson, 1999). As shown by these models, a unit tax on capital will typically increase the costs of capital for a firm and

will therefore make investment less attractive. Although a unit tax on capital is rather unrealistic, results derived from these simple models carry over to the taxation of corporate profits. In this case, taxation does not increase the costs of the investment but decrease the return of the investment. We can suppose therefore that higher tax rates will make a country less attractive for foreign investment.

However, the effect of taxes is more complicated than it seems at first sight. In fact, it is not that clear whether multinational enterprises can benefit from low tax rates abroad or not. This crucially depends on how the tax system employed by the home country of the multinational enterprise treats foreign profits. Two broad types of tax systems can be distinguished, tax-exemption systems and tax-credit systems. Under tax-exemption, taxation in the home country follows a source principle. In this case, only that income of the multinational is taxed in the home country that is generated there. Income generated abroad is exempt from taxation at home but is taxed by the foreign country with its corresponding tax rate. Hence, under a system that exempts foreign profits, there will be incentives to locate foreign activities in low tax countries. Under tax-credit, however, incentives are different. In this case taxation follows the principle of world-wide income and multinational income from abroad will be taxed at home. However, to avoid a double taxation of foreign income that is already taxed at its source abroad, the tax credit system allows the multinational enterprise to subtract taxes paid abroad from the tax liabilities at home. If tax liabilities abroad are lower than those at home, the multinational firm has to pay the difference to its home country. If, on the other hand, tax liabilities abroad are larger than that at home, the firm will typically get no refund on taxes from the home country since tax credits are limited. So under tax-credit, there will be no tax-specific incentives to locate foreign activity in low tax countries. However, since tax credits are limited there will be disincentives to locate in high tax countries. Moreover, taxation at home does only take place when the foreign income is repatriated. If the multinational firm delays repatriation and reinvests in the foreign country, there do exist invectives

to locate in low-tax countries even under tax credit. Note that these reinvestments do typically enter FDI statistics (see section 1.2.3).

In addition to the decision where to locate real investment, taxation also affects the income reporting of multinational enterprises. By shifting income from one location to another, multinationals have the opportunity to minimise their overall tax burden. This can be done, e.g. by manipulating transaction prices for intra-company trade or by manipulating interest rates for intra-company loans. For instance, an affiliate located in a high tax country may sell some products to another affiliate of the multinational located in a low-tax country. By charging a price lower than actual production costs, income in the high-tax affiliate will decrease while those of the affiliate in the low-tax country will increase. Remarkably, as Mintz and Smart (2004) have only formalised recently, since tax liabilities will be lower in the high tax country then, the possibility to shift income will make the high tax country attractive for real investment, despite its high tax rate.

Nevertheless, due to its negative effect on tax revenue, high tax countries may try to prevent income shifting. With respect to transfer pricing, tax authorities can compare intra-company trade prices with those prices observed in inter-company trade. If the intra-company trade price differs too much from this "arms-length price", tax authorities may treat the transaction as being irregular. However, there exist some goods which are not commonly traded on the market and those regular prices are difficult to observe. Examples of such goods are royalty payments and some special types of overhead services such as expenses on research and development. An alternative to prevent income shifting is the use of apportionment rules. Under these rules, the multinational enterprise has to allocate its world-wide income according to some measures of real economic activity such as the capital employed in a country or the number of employees. Yet, this again leads to incentives to reallocate real activity from the high tax country to the low tax country in order to increase the potential for income shifting. It can be argued therefore that tax-motivated income shifting affects multinational investment activity as well.

2.2. Measuring the tax burden of multinational enterprises

2.2.1. Introduction

When evaluating the response of multinational enterprises to tax policy we need first a good indicator for the tax burden imposed on these firms. While theoretical work on corporate taxation is often only concerned with one measure of taxation, i.e. the statutory tax rate, empirical studies, in contrast, make use of a large number of methodologies that try to measure the burden of taxation. These methodologies differ not only significantly in the approach taken to measure taxes but they have different interpretations as well. It is therefore not clear which of these methodologies to use when comparing the tax burden imposed on firms across different countries. This chapter investigates the different methodologies to measure the burden of the tax system of a country and presents arguments for and against their use. We start with measures based on the actual tax code of a country. We then discuss the properties of tax measures that are based on the evaluation of past tax codes. We proceed in presenting a measure that combines the latter two approaches. Finally, we present tax rates calculated under different methodologies, compare them with each other, and give a conclusion.

2.2.2. Measures based on the current tax code

Statutory tax rates

The most basic measure of corporate income taxation is the statutory tax rate. A major advantage of statutory tax rates is that data are readily available, both over time and across countries. However, it has to be noted that defining this tax rate is less straightforward than might be expected: Corporate taxes are often applied at more than one level of government, i.e. central and regional governments impose their own statutory tax rate on the same investment[13].

[13] The United States and Canada are prominent examples for such a state of affairs.

There may also be temporary or permanent surcharges to these taxes which have to be taken into account[14].

A high statutory tax rate does not necessarily imply high tax payments. Statutory tax rates include neither different depreciation allowances nor any other specifics of the national tax code. Effects of the tax base are typically omitted. Therefore, statutory tax rates not more than a first indicator for the tax burden of real (productive) investments. However, there might be two possibilities why the statutory tax rate is nevertheless important: One possibility is that firms do not in fact consider the more complex measures developed below. The second and more likely possibility is that firms undertake income shifting. For a given level of allowances, the statutory tax rate equals the marginal rate of tax applied on any additional income. It is therefore likely to be relevant in determining the incentives for income shifting.

Effective marginal tax rates

More encompassing tax measures are so-called effective tax rates. Broadly speaking, effective tax rates take into account the differences between the theoretical concept of pure economic profits and the taxable income, the tax base, which firms are actually charged under the tax code of a given country. In the presence of special tax breaks, accelerated depreciation schemes and similar tax incentives, the tax base may be substantially lower than pure economic profits, leading to diverging measures for statutory tax rates on the one hand and effective tax rates on the other.

The first theoretically founded concept for effective tax rates, the effective marginal tax rate (EMTR) that is based on neoclassical investment theory, was developed by Hall and Jorgensen (1967) and later extended by King and Fullerton (1984)[15]. The EMTR measures the tax burden of an entirely new investment project that earns zero profits at the margin. To be realised, a marginal investment project has to earn a rate of return, p, that is equal to its

[14] Surtaxes are levied, e.g. in Belgium, France, Germany, Portugal and Spain.

[15] King and Fullerton extended the framework by considering debt financing and personal taxes.

costs, i.e. the interest rate r. With corporate taxation, however, the post-tax rate of return will decrease. To redeem this negative effect, the project has to earn a larger pre-tax rate of return, $\hat{p}$. The idea of the EMTR is to calculate the required pre-tax rate of return of the investment, given the tax code of the country. When calculating the pre-tax rate of return, the EMTR does not only take into account the corporate statutory tax rate, t, but also other relevant tax provisions such as taxation at the personal level and the net present value of current and future tax allowances, A (assuming future tax laws to be unchanged). Beside the information about the tax code, the calculation makes use of assumptions regarding interest rates, the financing structure of the firm and so on. Therefore, EMTRs can be calculated for different asset and financing policies. As this calculation is not only based on the current period but is also based on future periods, particularly with respect to A, the EMTR can be seen as a forward-looking tax measure.

To give an example, let us assume that a firm makes a marginal investment of 1€ and has to pay an interest rate r of eight percent[16]. In the absence of taxes, the required return of the investment project p equals r. Now, suppose the firm has to pay a statutory tax rate of $t = 0.5$ but at the same time can make use of tax allowances A. These allowances account for two cents in tax savings, e.g. half of the interest payments can be deducted. The required pre-tax rate of return $\hat{p}$ is then 12 percent:

$$\hat{p} = \frac{r - A}{(1 - t)} \tag{2.1}$$

Given that taxation increases the required pre-tax rate of return, the difference between post-tax and pre-tax rate of return, the so called "tax wedge", $\hat{p} - p$, can be thought of as a measure for the tax burden. As can be seen from equation (2.1), while a statutory tax rate will increase $\hat{p}$ and therewith the tax wedge, the opposite holds if depreciation allowances A increase. The

[16] In this simple one period example we abstract from depreciation, i.e. the only cost of the investment project is the interest paid.

proportionate difference between the pre-tax and the post-tax rate of return is then defined as the EMTR. Using this definition, the EMTR in our example becomes: $(\hat{p} - p)/\hat{p} = \frac{1}{3}$. The EMTR of 1/3 implies that the pre-tax rate of return required to achieve a zero-profitability has to be 33 percent higher than the rate necessary when the investment is untaxed. Hence, the higher the EMTR, the lower is the incentive for investment. Since the EMTR is based on the assumption of a marginal investment project, it is a good measure for the tax burden of adjustment decisions such as plant expansions. Alternatively, if a firm has already decided to invest in a country, this measure can determine the scaling of investment.

Effective average tax rates

Typically, when investing abroad, multinational firms can not split their investment across several countries but have to choose between two or more mutually exclusive locations in which the investment project gains positive profits. Examples for such discrete (or inframarginal) investment choices are alternative production locations or investments in the case of financial constraints, i.e. where only one investment project can be realised. By construction, the impact of taxes on discrete investment choices that earn a positive rent is not captured by the framework of the EMTR. As an example, think of an investment neutral cash-flow tax which is only levied on the economic rent. In this case, the EMTR would be zero, implying that there is no tax burden at all. To deal with this shortcoming, the concept of effective average tax rates has been developed.

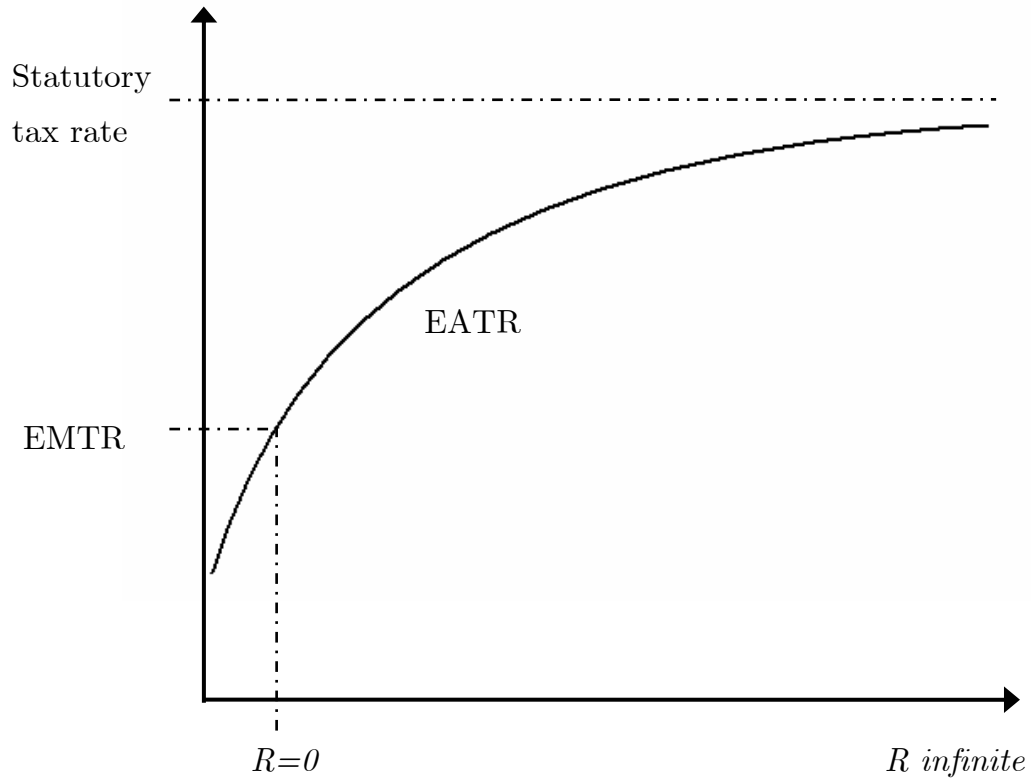
Devereux and Griffith (1998a, 1998b, 2003) extend the concept of effective marginal tax rates by allowing investments to be profitable. The main difference between their measure of an effective average tax rate (EATR) and the EMTR stems from the calculation of the required pre-tax and post-tax rate of return. Instead of calculating these rates of return for a marginal profitability of zero, they are calculated for different levels of profitability, R. For our simple example from above, profitability can be incorporated by introducing R in the numerator of equation (2.1) which leads to:

$$\hat{p} = \frac{R + r - A}{(1 - t)} \tag{2.2}$$

As depicted by Figure 2.1., and analysed in more detail algebraically by Devereux and Griffith (2003), the EATR increases with the level of profitability. For a profitability of $R = 0$, it is equal to the EMTR. For larger levels of profitability, it converges towards the statutory tax rate[17]. So, as a result, the EATR can be simply thought of as a linear combination of the latter two measures.

Figure 2.1.

Effective average tax rates at different levels of profitability



Source: Own representation, based on Devereux and Griffith (2003).

[17] In their analysis, Devereux and Griffith (2003) do also incorporate taxation at the shareholder level. With this specification of the EATR, they show that it converges to an "adjusted" statutory tax rate if profitability increases.

To give an intuition for the connection between these measures, think again of our example. If increased profitability is not affecting the level of A, then any additional profit made will be taxed at the statutory tax rate. The overall level of taxation then depends on the fraction of pre-tax profits for which the marginal tax rate is given by the EMTR and the fraction of profits for which it is given by the statutory tax rate. For a profitability of four percent, equation (2.2) calculates a pre-tax rate of return of 20 percent for our example. While 60 percent of the pre-tax profits of the firm (12 cents out of 20) are taxed with the EMTR of 33 percent, the remaining 40 percent are taxed with the statutory tax rate of 50 percent. This leads to an EATR of 40 percent. Hence, for any given level of tax allowances, the EATR will increase with the profitability of the investment project[18].

In principle, the EATR, as well as the EMTR, can be calculated for a variety of different investment projects by adjusting the model used. Taking into account the tax code of the source and the target country of an investment, it would even be possible to calculate the tax burden of international investments[19]. However, as the results are derived from models, the measured impact of taxation is only valid under the assumptions of these models. If these assumptions, i.e. on the profitability of the firm and the financing mix, are invalid, these measures will not give us a proper picture of the actual tax burden of an investment.

[18] In line with empirical findings we assume here that the marginal tax rate is lower than the actual statutory tax rate levied on pure profits. However, it may also be possible that the EMTR is higher than the statutory tax rate. In this case, the EATR will decrease with the level of profitability.

[19] An alternative method to calculate effective average tax rates that is not further pursued here is to use a model firm approach (see Jacobs and Spengel, 2000). The basic approach is to assume an industry specific mix of assets and liabilities of a firm and to calculate future pre-tax profits on the basis of estimates for future cash receipts and costs. Comparing the net present value of the firm for the case with and without taxation gives a measure for the effective tax burden.

2.2.3. Measures based on past tax codes

Implicit macroeconomic average tax rates

Given the complexity of the forward-looking tax measures described in section 2.2.2., their calculation is not an easy task. Sufficient data does only exist for a small number of countries and for some years. Since the alternative use of statutory tax rates offers only limited benefits when measuring the tax burden of investment, so called implicit average tax rates have been used often to measure tax incentives instead.

The basic idea of these measures is to express total tax payments as a proportion of a measure of (pre-tax) profits or the tax base. A particular example of such a tax rate, and one which has been widely used, was developed by Mendoza et al. (1994) for use with aggregate data. Their approach is to derive tax ratios on the basis of the OECD Revenue statistics and National Accounts. They define the tax rate on corporate income as the fraction of tax revenues from taxes on income, profits, and capital gains on corporations, to the operating surplus of the economy minus the operating surplus of private incorporated enterprises. The most serious problem with this approach comes from the definition of the tax revenue categories used in the numerator of the implicit tax measure. These categories are often broadly classified and do contain tax payments that can hardly be assigned to only one macroeconomic sector. To give an example: All of the income of the self-employed represents capital income, although this income does partly reflect the reward to their labour input as well. In this respect, it is not surprising that a number of scholars have criticised the definition of tax ratios used by Mendoza et al. (1994) and proposed their own, perhaps more sophisticated, definitions[20].

[20] Volkering and de Haan (2001) provide an extensive survey of the conceptual and practical problems when calculating implicit tax rates. Carey and Rabesona (2004), argue that the definition of the corporate tax ratio neglects a number of important categories of taxation (namely corporate recurrent taxes on net wealth and immovable property). In a subsequent study, Volkering et al. (2002), propose a refined version of the implicit tax rate. It is shown, however, that the results of several empirical studies are robust with respect to the exact definition of implicit tax rates.

The attractiveness of this approach lies in its simplicity. Aggregate data are easily available from most statistical institutes, and ratios can be calculated in a convenient and quick way for different countries and years. Moreover, such tax rates implicitly consider the entire tax code and may also reflect the enforcement policy of a country. Nevertheless, these rates suffer from a number of shortcomings. In fact, the actual tax payments used to calculate the tax ratio do not only depend on the current tax code. To a large degree, these payments are determined by the history of the tax system, the history of the investment of a firm up to this point, and by the history of the losses of the firm[21]. As historical data plays a crucial role in determining the implicit tax rate, it can be best characterized as a backward-looking concept relying on past tax codes. Consequently, this concept can give a proper picture of the tax burden of already existing capital, but it can not be used to measure the incentives of the tax system on new investment. To give an example, think of the recent German capital tax reform. With this reform, several firms were allowed to deduct losses stemming from the early eighties from their actual tax payment. In aggregate, although conditions for new investment have not been affected by this particular provision, this led to a dramatic decrease in corporate tax revenue which resulted in a sharp decline in the tax ratio.

Another fundamental problem of this measure is that it is a very broad one. With the approach taken, it is not possible to distinguish the effects of taxes on different investments, e.g. among sectors or industries. Moreover, this measure may be contaminated by the influence of foreign tax systems on the tax payments of local firms, e.g. by double taxation agreements under which foreign income of multinational enterprises is taxed/not taxed in the home country. An alternative approach that can cope with some of these difficulties is the concept of implicit microeconomic tax rates.

Implicit microeconomic tax rates

The concept of implicit microeconomic tax rates is based on firm specific data instead of revenue statistics. Similar to the macroeconomic case, tax rates are

[21] That is, firms may be carrying forward losses from previous periods.

calculated as the tax liabilities of the firm, relative to its profits. Data can either be taken from individual financial statements or consolidated returns. Country specific tax rates can then be obtained from firm specific tax rates with several techniques. For example, the tax ratio of a representative firm can be taken as a measure for the tax burden in the country. As current tax liabilities of the firm, again, do largely depend on the history of the investment, this concept shares some of the shortcomings of the macroeconomic average tax rate when determining the tax burden of new investments. However, compared with the latter approach, microeconomic tax rates offer the advantage that they can be calculated for different sectors and industries. Based on firm specific data, it is also feasible to calculate tax rates for differently sized firms[22]. Moreover, with this approach, it is also possible to cope with another problem. Tax rates can either be calculated from all firms in the sample or on the basis of national firms which do no business abroad only. If the latter method is used, tax liabilities are not influenced by foreign tax systems and the national tax system can be isolated from any interference with these systems. It is often argued that using backward-looking tax measures in empirical studies entails some problems regarding endogeneity since it is not that clear whether tax rates determine investment decisions of multinational enterprises, or, the other way round, the investment decision of multinationals determines the tax rate of a country. Calculating microeconomic implicit tax rates on the basis of purely national firms can obviously solve this problem since these rates can be assumed to be largely independent from multinational activities.

When comparing the macroeconomic with the microeconomic approach to calculate backward-looking tax rates, the advantages discussed above have to be related to the disadvantages of firm level based data. These disadvantages stem from the required efforts in data collection. Although there exist several databases which contain detailed information on the balance sheet of individual firms, e.g. the Worldscope- or the Bach-database, these efforts are relatively high when compared to the approach based on revenue statistics.

[12] By carrying our regressions, the microeconomic approach makes it also possible to identify the items of the balance sheet that determine the effective corporate tax rate of a firm.

2.2.4. Combining the neoclassical approach with historical data

In principle, forward-looking tax rates based on the current tax system may give a proper picture of the tax burden of new investment. However, as we have already noted above, this is only the case if the model used to derive these tax rates is specified correctly. Since tax laws are very complicated in practice, there is a possibility that the model used overlooks some important issues of the tax code. In this case, the parameter A used to calculate the pre-tax rate of return (compare equations (2.1) and (2.2)) is specified incorrectly. On the other hand, given the shortcomings discussed in section 2.2.3., using implicit tax rates that do automatically account for all provisions of the tax law, may involve other problems.

To overcome this dilemma, Gordon et al. (2004) propose an alternative measure that combines the two different approaches. Their basic idea is to use the theory based approach taken to derive effective marginal and effective average tax rates. However, when calculating the required pre-tax rate of return of the investment on the basis of equation (2.1) or (2.2), instead of assumptions regarding the actual tax code, their measure uses historical data to proxy the parameter A. Historical data on depreciation allowances can be assessed by comparing actual tax payments with hypothetical tax payments that would emerge if all profits are taxed with the statutory tax rate, either at the firm or at the aggregate level. This data implicitly accounts for all provisions of the tax code and, using firm level data, can be assessed in a very detailed form. As can be shown theoretically, if tax laws have not changed over time, and if the investment growth rate equals the nominal interest rate, this historical data can perfectly approximate future depreciation allowances for new investment. In this case, the backward-looking measure proposed by Gordon et al. (2004) is superior to any application of the EMTR that omits some details of the current tax code.

In reality, however, depreciation allowances are changed quite frequently in the tax code and the investment growth rate does not correspond to the nominal interest rate. In this case, the proposed measure here is as inaccurate as other

backward-looking tax rates. Becker and Fuest (2004) propose a refined version of this measure which can deal with some of these problems. They show that depreciation allowances derived under the approach of Gordon et al. (2004) can be divided into regular allowances as measured by forward-looking data and special deductions which are not captured by the latter approach. Having additional empirical information on the change in tax codes[23] and the difference between investment growth and nominal interest rates, it is then possible to correct for these inaccuracies. When applied correctly, this combined measure therefore offers an alternative that may solve some of the practical problems involved when using tax measures based on the current tax code.

2.2.5. Comparison of different measures and conclusion

The literature so far has already calculated tax rates based on the different methodologies presented here. In general, and in line with our theoretical assumptions of section 2.2.2., the statutory tax rate indicates a relatively large burden of taxation for new investment, while the burden indicated by the EMTR is relatively small. The tax burdens displayed by average tax rates are in between. However, between the three different measures for average tax rates presented here, the EATR, the macro- and the microeconomic implicit tax rate, there is large variation as well. With respect to different countries, there is variation as well.

Based on these calculations, Table 2.1. presents a ranking of nine EU countries under different measures of corporate taxation. All other things equal, the choice where to locate a discrete investment that can be realised in only one of two or more alternative, but mutually exclusive, locations, will depend on a ranking of the tax burdens at these locations. Rank one is given to the country with the lowest tax rate in the sample while rank nine labels the country with the highest tax rate. As can be seen, tax rates differ markedly with the

[23] Changes in the tax code over time can be assumed to be better observable than the tax code as a whole.

underlying tax measure. With focus on differences between the three average tax rates shown in Table 2.1., one obvious case is Germany where the average tax rate based on the backward-looking macroeconomic approach is about 20 percent, whereas the effective tax burden calculated from the backward-looking microeconomic approach is 19 percentage points higher (39.0 percent). These differences are the basis for the controversial discussion of whether Germany is a high tax country for corporations, or not. Based on implicit macroeconomic tax rates, Hettich and Schmidt (2001, 2003) conclude that Germany is a low tax country and that there is no scope to further reduce the tax burden on corporate profits. With respect to the high German EATR, Gütekunst et al. (2003) argue that this is not the case. The reverse pattern can be found in the United Kingdom, where the effective average tax rate on a hypothetical investment is rather low when compared to other countries, but the macroeconomic tax rate is the highest in our sample. There are a few countries which are ranked consistently under each of the different tax measures such as Ireland and Austria (as low tax countries) or the Netherlands (as an intermediate country). However, for most countries in the sample the evaluation of its tax burden, relative to its neighbours, differs with the tax measure used.

We have shown above that the evaluation of the tax system of a country crucially depends on the precise tax measure used. It is therefore important to use the "correct" measure in empirical studies. The correct measure depends on the relevant research question. With regard to the question where to invest, effective average tax rates are probably the best measure. If the research question is instead to determine how much to invest in a certain country, effective marginal tax rates are the most appropriate measure. Once all depreciation allowances are used by the firm, however, the statutory tax rate becomes relevant for the location decision. It is therefore a suitable measure for the incentives to engage in cross-border income shifting activities. The disadvantage of these measures lies in the fact that they are only available for a small number of countries and time periods and that the models these tax rates are based on might omit some important details of the tax code.

Table 2.1.

Country ranking by tax rate

	backward-looking (based on past tax codes)		forward-looking (based on the actual tax code)				
	average tax rates						
	[1] Macro[a] (´91-´97)	[2] Micro[b] (´98)	[3] EATR[c] (´01)	EMTR[c] (´01)	Statutory (2001 tax rate in parentheses)	Minimum of [1] – [3]	Maximum of [1] – [3]
Austria	2	1	3	3	3 (34)	10.3 (Micro)	27.0 (EATR)
Belgium	7	2	9	7	8 (40.2)	20.6 (Micro)	34.0 (EATR)
France	5	7	5	5	6 (36.4)	23.6 (Macro)	36.1 (Micro)
Germany	3	8	8	8	7 (38.3)	19.9 (Macro)	39.0 (Micro)
Ireland	1	3	1	1	1 (28/10*)	8.0 (EATR)	23.5 (Micro)
Italy	8	9	4	2	9 (40.3)	28.6 (EATR)	43.9 (Micro)
Netherlands	6	6	6	6	4 (35)	24.7 (Macro)	30,3 (EATR)
Spain	4	4	7	9	4 (35)	20.6 (Macro)	32.5 (EATR)
UK	9	5	2	4	2 (30)	25.7 (EATR)	38.4 (Macro)

Source: Adapted from Haufler and Stöwhase (2003).

* split tax rate

a. Macroeconomic tax rates based on a modified version of the Mendoza et al. (1994) methology. Taken from OECD (2000b, p.31).

b. Microeconomic tax rates based on firm level data. Taken from Büttner (2002).

c. Effective average and effective marginal tax rates – base case. Taken from Devereux et al. (2002).

The shortcomings of forward-looking tax measures can be overcome by the use of empirical (historical) data on corporate tax payments. Due to their backward-looking nature, however, these tax rates are inaccurate when measuring the incentives for new investment and, especially when based on aggregate data, should be used with due care. Although recent measures try to combine the two approaches these may have their shortcomings as well. Hence, provided the availability of sufficient data on forward-looking tax rates these should be the preferred measures to be used in an econometric analysis.

CHAPTER THREE:

Empirical evidence on the tax sensitivity of multinational enterprises

3.1. Introduction

This chapter aims to give an overview and some critique on the literature that has so far studied the impact of different international tax rules and tax burdens on the financial and real behaviour of multinational enterprises. We do so by presenting selected empirical work concerning the United States as well as Europe. Our review includes work from the early 1990s as well as more recent studies[24]. Empirical results provided by these studies, in general, indicate that taxation does influence the financing of multinational enterprises and their allocation of factors and products around the world. We reveal possible channels for the observed behaviour by taking a closer look at the data and the basic approach used by these studies. Moreover, we present results and discuss possible shortcomings which open room for further empirical work. Most of the empirical literature under review here does either investigate the question on how real investments are determined by taxation, or it investigates how

[24] Hines (1997) provides an extensive overview on the early literature with a particular focus on the United States. A more recent review, Hines (1999), also includes studies from the late 1990s. De Moiij and Ederveen (2003) provide a meta-analysis of these studies. They analyse how regression results are affected by the design of the study and the data used.

multinational activities are motivated by considerations of tax avoidance (namely income shifting). We follow this distinction made in the literature. In section 3.2. we present empirical work on the tax sensitivity of real investments. Section 3.3. is concerned with the question of whether cross-border activities of multinational enterprises are determined by strategies of income shifting or not, and how this is related to taxation. Section 3.4. concludes.

3.2 The tax sensitivity of real investment

3.2.1. Empirical evidence from the United States

The early empirical literature on the effects of taxes on investment decisions almost exclusively uses data from the United States. A simple explanation for this particular focus comes from the fact that the United States collected more and higher-quality data, e.g. on investment flows or on foreign owned capital stocks, than other countries. Studies are either concerned with the worldwide distribution of investments from the United States (outbound FDI), or they try to explain the allocation of foreign investments inside them (inbound FDI). We will focus here on three studies which we will discuss in more detail. The first is on inbound FDI, the two others are concerned with outbound FDI.

Studies that analyse the determinants of inbound FDI typically take the decision of multinational enterprises to invest in the USA as given. Conditional on a firm having decided to invest in the US, these studies examine in which US state the investment occurs. The basic idea is to estimate foreign investment as a function of tax rates and other specific variables that vary among the different target states of the investment. Tax rates between states differ since US states are allowed to impose their own taxes on corporate profits. Other provisions of the tax code such as depreciation allowances, however, do not differ across states. State specific variables may illustrate, for example, demand, factor costs and public infrastructure but also other factors that determine the attractiveness of a location. Some of these factors are easy to quantify, others

are not. In practise, controlling for these non-tax factors may be very difficult and there is a possibility that some important variables that determine the investment decision are not identified by the econometric model. An elegant method to deal with this problem is taken by Hines (1996).

The starting point for his analysis is the observation that investors from countries that exempt US profits from taxation in the home country are much more sensitive to state tax rates than investors from countries that grant a tax credit for taxes paid in the United States[25]. Investments from seven source countries, five of which exempt foreign profits and two grant a (limited) tax credit[26], act as dependent variable. Investment is measured as the value of property plant and equipment (PPE) used by foreign-owned firms in the year 1987 at the aggregate level. Hence, this is a purely cross-sectional analysis. To measure tax incentives, the study makes use of statutory tax rates calculated at the state level. With respect to section 2.2.2. above, we may argue that statutory tax rates are an incorrect measure here since they do not account for depreciation allowances. However, since depreciation allowances are equal across states, differences in statutory tax rates can be assumed to represent differences in effective taxation as well.

In principle, the estimation follows a two step procedure: In the first step it is assessed which states are attractive for investments if tax incentives play no role. To do so, the study makes use of investments from tax-credit countries only. Theoretically, these investments should be independent from tax incentives since foreign firms have to pay excess taxes at home. If this is the case, however, and states are equal in all other aspects, investment from these countries should be distributed uniformly among US states theoretically. Any deviation from this distribution then reflects the locational (dis)advantage of a

[25] For a short theoretical discussion see section 2.1.5. In fact, as Hines (1996) shows, controlling only for state size, investment from tax-exemption countries in states that levy a zero corporate tax is approximately three times larger than that in high tax states. Investments from tax-credit countries, on the other hand, are equally distributed among low and high tax states.

[26] Countries that grant a tax credit are Japan and the United Kingdom.

state, i.e. it measures to which degree one state is more attractive than the other.. This information is used to capture all non-tax variables in a single state-specific measure. In the second step, investment from tax-exemption countries is then estimated as a function of these state specific variables and taxes alone. Hence, the approach taken by Hines (1996) makes it unnecessary to include multiple control variables into the regression.

For a variety of different specifications, estimation results confirm those of other empirical studies not reported here. It is found that above average state taxes have significantly negative impacts on inbound foreign direct investment of US states: A one percent higher state tax rate reduces investment by approximately ten percent. However, there is one serious problem with the analysis that has not been discussed so far. The study implicitly assumes that investors from tax-credit countries have no tax incentive when investing in low tax states since their tax burden is effectively determined by their home tax rate. As we have already discussed in section 2.1.5. above, this is clearly not the case if taxation in the United States exceeds those at the home country. Since tax credits are limited, a larger tax burden in the US has to be fully borne by the firm then and there are disincentives for investment in high tax states. Hines (1996, p. 1080) claims that firms may use excess foreign tax credits in subsequent years or apply them towards earlier years' tax obligations. This is, however, a very strict assumption that, if not fulfilled, may potentially bias the empirical results.

The study from above was concerned with inbound FDI. We now want to turn attention to outbound investment. A study that is concerned with the question of how world-wide foreign investments of multinational enterprises with headquarters in the United States are affected by taxes comes from Grubert and Mutti (2000). Based on firm level data, their cross-sectional analysis investigates the determinants of investment from the United States into 60 countries for the year 1990. This time investment is measured as the aggregated capital stock in the manufacturing sector of a foreign country that is held by US-based firms. Foreign tax rates are calculated from the sample data by dividing income taxes paid by the firms in that country by total profits. Hence, these tax rates can be

characterised as implicit microeconomic average tax rates (see section 2.2.3). They use total GDP and GDP per capita to control for the size of foreign markets. Based on the theoretical work presented in section 2.1., it is assumed that investment will be more attractive, the larger the foreign market. As a further control variable an index for trade barriers is used. Empirical results suggest that the capital stock owned by US multinationals is negatively correlated with the average tax rate of the country and positively correlated with its market size. Moreover, it is shown that taxes interact with the openness of the country: Investments in countries with an open trade regime respond more elastically to tax rates than those to countries with a more restrictive trade regime. Presumably this reflects the fact that much of the output associated with the investment is intended for export. For countries with the most open trade regime, estimation results imply that a one percent increase in the average tax rate decreases investment in this country by three percent. However, the sample includes countries with less open trade regimes for which the tax-elasticity is smaller. Weighting each county's trade-policy-influenced elasticity by the capital invested yields to an average elasticity of two, i.e. a one percent increase in the tax rate decreases investment by two percent.

Grubert and Mutti (2000) are able to identify that average tax rates are negatively correlated to the age of the investment. So, in order to test if their results are driven by the age-composition of investment across countries, they use a modified tax rate that corrects for the age structure. Their empirical results do not change significantly for this as for other specifications of the regression. Unobserved heterogeneity between countries is accounted for by the use of four dummy variables that measure if investment in one global region will ceteris paribus be larger than those in other regions. Coefficients for these dummy variables suggest that regions which are geographically closer to the United States, i.e. North and Latin America, are more attractive for investment than those with a larger distance, i.e. Europe and Asia.

Although results are very robust to different specifications, the study suffers from the limitation that countries incorporated in the analysis are very

heterogeneous. They include tax havens as well as OECD and developing countries. This raises the problem of omitted variables. In fact, with the small number of control variables employed in the study heterogeneity between countries can hardly be accounted for. Regional dummies suggest distance to be an important determinant but it is not included as a further control variable. Moreover, political stability and risk may play a role in determining investment, especially in less developed countries. Given that these variables are omitted here, one possible solution would be to use country fixed effects. However, since Grubert and Mutti (2000) use cross-sectional data only in their analysis, this is not feasible econometrically. In fact, the analysis is based on only one observation per country. Including fixed effects for each of these would reduce degrees of freedom to zero.

A third study we want to describe here is Devereux and Griffith (1998b). Their analysis differs in many aspects from those discussed above. Instead of using capital stocks, they employ data on discrete investment decisions as dependent variable, which stem from firm level data. In contrast to capital stocks, this measure can be thought of as a better indicator for new investments. Their data comprises US outbound FDI into three European countries, Germany, France and the United Kingdom, for the years 1980 to 1994. Combining cross-sectional with time-series data their study is twofold. First, conditionally that a firm has decided to invest in Europe, they carry out a panel analysis on how the probability that this investment goes to a specific country is affected by taxation (lower level decision). Moreover, in extending the analyses from above, they examine if taxation influences the multinationals' decision to either invest in Europe or to serve the European market via export from the United States (higher level decision).

For their analysis of the lower level decision of the multinational, they employ three different measures of taxation: the statutory tax rate, effective marginal tax rates (EMTR) and effective average tax rates (EATR). As has been outlined above in Chapter 2, when compared to the measures used in Hines (1996) and Grubert and Mutti (2000), the latter two measures are more

appropriate to represent the tax burden of new investment. Heterogeneity between target countries is accounted for by the use of fixed effect and by labour costs. These fixed effects capture all those aspects that are difficult to measure. Furthermore, it is tested if agglomeration effects affect the investment decision. These agglomeration effects can either be demand, which simply reflects the size of the country, production or research agglomeration. With respect to our discussion from section 2.1.4. we suggest that these agglomeration effects have a positive impact on FDI.

Empirical results show that agglomeration does positively affect the probability for investment in a certain country. That is, larger countries, countries which have attracted US investment before and countries with higher expenditures for research and development are more likely to become the target of investment. Labour costs seem to have no effects on the location decision. However, a possible explanation for this insignificance may stem from the non-valuation of labour productivity in the labour cost variable[27]. Results for the tax variables are mixed. Marginal tax rates have no effect on investment. This mirrors that the EMTR is not appropriate to measure the tax incentives for the discrete investment decision analysed here. In contrast, the effect of EATR on the investment decision is significant under a number of specifications. Estimates suggest that a one percent increase in the German tax rate will reduce the probability of an investment there by approximately one percent. The corresponding elasticities for the UK and France are –1.3 and –0.5 respectively, confirming that higher tax rates deter investment. In an alternative specification, the authors test if statutory tax rates determine the investment decision as well. The idea here is that apart from the decision to produce in a country, income shifting may play a role in determining investment. According to the regression results this is not the case.

Concerning the higher level decision, that is to invest in Europe or to serve the market via exports, Devereux and Griffith (1998b) find no significant effect of

[27] For instance, labour productivity in the UK is smaller than in Germany. This leads to a significant bias in the labour cost variable as employed by Devereux and Griffith (1998b).

taxes. Instead, results suggest that other factors that differ among investing firms play a crucial role. So a higher capital intensity of the production process reduces the probability that a firm invests in Europe. While smaller firms tend to export goods, larger firms are more likely to invest in Europe instead. This result is consistent with theoretical assumptions: When investing abroad, the costs for setting up a new production plant and the potential loss in economies of scale in the US have to be compared with the savings in transport costs. These costs are likely to be high for small and capital intensive firms. Unfortunately, however, the authors can not control for different transport costs across firms, so that in this respect, results have to be taken with care.

3.2.2. Empirical evidence from Europe

Sufficient data on multinational investment activity inside the European Union was not available in former years. Recently, however, data availability improved. The OECD as well as EUROSTAT provides data on FDI flows and investment stocks among EU countries. What followed was a number of empirical studies concerned with the question on how taxes affect investment flows and positions inside the EU[28,29]. A first attempt was made by Bénassy-Quéré et al. (2000) who try to explain bilateral FDI flows between eleven countries (nine of which belong to the EU) for five different years[30]. The corresponding data on aggregated FDI flows used in their analysis comes from OECD data bases. Due to the panel structure of their data, tax incentives are measured as the difference between tax rates in the source and in the target country of the investment. Beside the statutory tax rate, they do also employ implicit macroeconomic tax rates for their empirical analysis. Controlling for the size of the investing country, they use data on geographical distance, bilateral

[28] A few of these studies are covered by the meta-analysis of de Mooij and Ederveen (2003).

[29] Billington (1999) studies bilateral investment flows between seven countries, including France and Germany. Since his study is neither focused on investment from/in the US nor on investment inside the EU, we do not discuss it here.

[30] Years taken into consideration are 1995, 1990 and 1992 to 1995. Countries outside the EU are the United States and Japan.

trade flows and the market potential of the target country as further explanatory variables. In contrast to other studies, their measure of market potentials does not only take into account the GDP of the target country but also the GDP of neighbouring countries which enter the market potential variable with a distance related weight.

Confirming other empirical work, estimation results suggest that FDI is positively correlated with market potentials and negatively correlated with geographic distance. Moreover, FDI seems to follow trade since it is positively correlated with trade flows. Under a number of different specifications, coefficients for the tax rate differentials have a negative sign which implies that higher taxes deter investment. While the effect for the implicit macroeconomic average tax rates is highly significant, the effect of statutory tax rates is less significant. Taking into account the different tax regimes (exemption vs. credit) of source countries they do provide estimates for corrected tax differentials as well[31]. Regression results do not show any significant difference between coefficients of corrected tax differentials and those of their original values. Based on their estimates, Bénassy-Quéré et al. (2000) simulate different scenarios concerning the harmonisation of tax rates and tax regimes inside the EU. They show that the harmonisation of tax rates will lead to a 1.4 percent increase in FDI flows between EU countries and an increase in revenue that accounts for 0.4 percent of GDP.

The most obvious shortcoming of the latter analysis is the use of implicit macroeconomic average tax rates to measure tax incentives. As we have already shown in section 2.2.3. these backward looking tax rates are an inaccurate measure of the incentives for new investment. In a subsequent study, Bénassy-Quéré et al. (2003), the authors have therefore extended the analysis. The study now comprises sixteen years instead of five, controls for further variables and does employ forward looking tax measures as well. In general, it confirms the previous result that higher tax rates decrease investment. Moreover, while

[31] The procedure to correct tax rate differentials for different tax regimes is shown in section 4.4.2. below.

quantitative results differ, qualitative results seem to be independent of the tax measure used. With respect to EATR, results imply that a one percent increase in the tax rate decreases investment by about four percent. The corresponding value for the EMTR is three. Investigating non-linearity as well, they show that the tax elasticity increases with differences in tax rates. Using dummy variables that interact with the tax rate, they do also find that the tax sensitivity of investments from tax-credit countries is similar to that of investments from tax-exemption countries. This result is in sharp contrast to Hines (1996) who assumes that the sensitivity of investments from tax-credit countries should be (near to) zero. A possible explanation, and one that supports our critique of section 3.2.1., is that credit countries do on average impose lower tax rates than exemption countries and that investors from these countries are negatively affected by higher foreign tax rates. A last result worth noting concerns the additional control variables: While public expenditures by themselves have no effect on the location decision of multinational enterprises, their composition seems to be crucial. Estimation results show, that increasing the share of public investments increases the attractiveness of a country for FDI. Moreover, including this variable in the regression decreases the tax elasticity by about 25 percent which highlights that a higher tax rate can be compensated for by more public investment expenditures.

A study that is focused on the effects of public expenditure on FDI flows is Büttner (2002). He recognises that empirical studies so far have not taken into account the effects of different measures for government expenditure and publicly provided infrastructure in detail. To do so, the analysis makes use of data on public consumption and investment as well as country rankings that measure the competitiveness of a country concerning the efficiency of the government, its infrastructure, its attractiveness for research and development and so on. For a similar data sample than those used by Bénassy-Quéré et al. (2000, 2003)[32], he presents mixed evidence concerning these variables. While

[32] The data used comprises eight years (1991-1998) and FDI flows between 14 source and 12 target countries, all in the EU. Data on FDI flows is this time obtained from EUROSTAT instead from the OECD. Controlling for the size of source and target country of the investment

public consumption and investment seem to have no influence on the location decision, more efficient government attract FDI. Quite counterintuitive, results imply that investment is higher if the competitiveness of the source country with regard to its infrastructure and its research potential is strong when compared to those of the target country.

With regard to the tax measures used, however, it has to be noted that the study differs from those discussed above. Inconclusive results for the public expenditure variables may stem from problems related with these measures. Büttner (2002) makes use of three different tax variables, implicit microeconomic average tax rates, statutory tax rates and effective marginal tax rates (EMTR) which, taking into account the tax code of the source and the target country of the investment, have been derived for the case of international investments. Although the use of the latter measure offers the advantage that it correctly accounts for the incentives multinational firms face for a marginal investment decision, this measure has some disadvantages. Unfortunately, tax rates are only available for the years 1991 and 1999. For the intervening years, tax rates have been calculated by means of interpolation, assuming a gradual development over time. The assumption of a gradual development, however, ignores the possibility of discrete tax reforms in the time under consideration. Tax rates for the intervening years may therefore be incorrect. Moreover, the use of marginal tax rates may be incorrect here since it can be assumed that most of the investment comes in a discrete form for which average tax rates are important determinants. However, in line with our discussion of section 2.2.2., Büttner (2002) argues that since the EATR is a weighted function of the EMTR and the statutory tax rate, the joint estimation of EMTR with the statutory tax rate may capture the effect of the EATR.

Regression results show that the implicit average tax rate employed here does not affect investment while they show a significantly negative effect for the

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he does also employ data on distance and trade flows in the analysis. As in Bénassy-Quéré et al. (2000, 2003), these variables are negatively receptively positively correlated with investment flows.

statutory as well as for the marginal tax rates. Results concerning tax measures are robust to different specification. Coefficients presented for the baseline regression imply that a ten percentage point increase in the bilateral EMTR decreases investment by approximately three percent. The corresponding decrease in investment for the statutory tax rate is five percent.

While the studies discussed so far in this section have focused on the determinants of investment flows, Gorter and Parikh (2003) argue that FDI positions are less volatile and should therefore be the preferred measure to use in an econometric analysis. Accordingly, they use bilateral FDI positions from eight EU countries in fifteen European target countries as dependent variable. Instead of including multiple control variables, they follow the approach taken by Hines (1996) to isolate country specific effects by using investment positions from tax-credit countries (this time only the UK) as a benchmark to measure non-tax incentives. To do so, the tax coefficient of for investment from the UK is restricted to zero. They employ data on implicit microeconomic average tax rates as well as on EMTR and provide tax coefficients for all seven source countries that follow the exemption system. For both tax measures, these coefficients imply a negative correlation between tax rates and FDI positions in these countries, whereby coefficients vary significantly across source countries[33]. The mean elasticity calculated for the average tax rate is –5, the corresponding value for the EMTR is –6. So, a EU member state will typically increase its FDI position in a country by five to six percent if this country decreases its corporate tax rate by one percentage point relative to the EU mean.

Clearly, the same critiques apply here as for the analysis of Hines (1996) since the estimation procedure used does not take into account the asymmetric incentives for investment from the UK. However, the authors do also present results for a different specification, where the coefficient for investment from the

[33] For example, with respect to the implicit tax measure, the coefficient for Austria is approximately fourteen times smaller than those for investment from Portugal, implying that Austrian investors are much less sensitive to taxes than investors from Portugal. It has to be noted, however, that some coefficients are insignificant.

UK is not restricted to zero. Qualitative results are robust to this specification but the negative effect of higher tax rates is reduced this time. Another point for critique comes from the data used. Gorter and Parikh (2003) use FDI positions in the years 1995 and 1996 as dependent variable. FDI positions of subsequent years do largely depend on actual FDI positions. With the approach taken, the authors can not control for this interdependence. Therefore, it would be more promising to use investment flows as dependent variable instead. Alternatively, if it is the main intention to estimate the determinants of foreign capital stocks, it would be more promising to use data from more distant years.

Although data availability on foreign investment activity has improved, all studies on the determinants of FDI inside the EU so far suffer from one severe limitation: Data is only available on the aggregated level which does not allow accounting for heterogeneity across different firms. The last analysis we want to report here makes use of a new database which allows studying the investment decisions of German multinational firms on the microeconomic level. Büttner and Ruf (2004) investigate how the probability that a German parent holds one or more than one affiliate in a country is affected by the tax burden imposed by this country. The tax burden is thereby measured either by the use of EMTR, EATR, or the statutory tax rate. Additionally to firm and country specific fixed effects, their study does control for differences in target countries size and labour costs. The study comprises investment into twelve EU countries plus the United States, Canada and Japan for the years 1996 to 2001. Results for the baseline regression, either obtained from probit- or logit-estimations, suggest that a higher EATR as well as a higher statutory tax rate decrease the probability that a German parent holds an affiliate in that country. Coefficients for the EMTR are insignificant. Control variables are not significant in all cases and do show an unexpected sign sometimes[34].

[34] While country size, which has been proved to have a strong impact on FDI in other studies, is sometimes insignificant, labour costs show an unexpected positive sign indicating that higher labour costs increase the probability for investment.

As for the study of Gorter and Parikh (2003), one may argue that the dependent variable used here is problematic. In fact, the data does also comprise previous investment decisions which may be determined independently from the present valuation of the attractiveness of a country. Büttner and Ruf (2004) control for this possibility by focussing only on these cases where (dis)investments have been taken place during the time period under consideration. These decisions, in contrast, can be assumed to be largely dependent on the present valuation of a country. The tax sensitivity among this subsample of location decisions is much stronger than those derived for all decisions of German multinationals. Coefficients for the statutory tax rate translate into an elasticity of –2.0 while those for the EATR translate to –1.25. This implies that a ten percentage point increase in the tax rate reduces the probability that a firm holds one or more affiliates in a country by twenty, respectively twelve and a half percent. It has to be noted, however, that the empirical analysis omits a number of control variables which have, according to our discussions from above, proved to be significant determinants of foreign activities. Omitting these variables may therefore have a negative effect of the quality of the analysis.

3.2.3. Industry and transaction-type specific results

Estimation results presented above may provide a comprehensive description on how overall investment activities are determined by taxes. However, as we have shown in section 1.2.3., investment is a very heterogeneous measure that can be disaggregated in many ways. Firms might be affected differently by the same tax rules and their investment behaviour might do so, too. This issue has been analysed by only two studies so far.

In an early study, Papke (1991) analyses on how the number of firm births among US states is affected by differences in state tax rates. Count data on the number of firm births in a specific state comes from a micro database which allows distinguishing between the organisational status, the number of employees and the industrial sector of the firm. Data is available for the period

from 1975 to 1982 and for investment in 22 states. With this detailed information, it is possible to account for several forms of heterogeneity between firms. The approach taken by Papke (1991) is to distinguish between firm births in five industries of the manufacturing sector: "Women's Outerwear", "Household Furniture", "Book Printing", "Radio and Communication Equipment", and "Electronic Components". Firm births in these industries are assumed to be a function of state specific variables such as population, public expenditures, energy costs, labour costs and taxes. To measure taxation at the state level, the study employs data on industry specific effective average tax rates. Under the assumption of a pre-tax profitability of 20 percent, these tax rates are calculated using a model firm approach. Hence, these tax rates can be interpreted as EATR[35].

For the pooled sample, estimation of the baseline regression confirms the negative correlation between state tax rates and new firm births. Additionally, it is shown that more public expenditures and a higher population increase the number of firm births in a state. While the labour cost variable is insignificant, energy costs show an unexpected positive sign. Comparing different industries, however, results indicate a considerable inter-industry variation. Concerning taxation, coefficients vary from insignificance for "Household Furniture" and "Radio and Communication Equipment" to –0.26 for "Women's Outerwear", implying that a one percentage point increase in the state tax rate reduces firm births in this very state and industry by approximately one fourth. In a different specification, the author allows for state fixed effects. Controlling for unobserved heterogeneity between states has a remarkable effect on estimation results. The EATR is only significant in two of five industries in this case. Significant coefficients for this specification are much smaller than those obtained from the baseline regression.

[35] Note that the author herself labels tax rates as "marginal effective tax rates". Taking a closer look at the procedure to calculate these tax rates, however, it becomes evident that tax rates are "average" instead.

Although a general statement on the effect of taxes on new firm births is difficult with the sensitive results obtained from above, the study shows the importance to distinguish between investment decisions in different industries. However, with respect to the question on how multinational enterprises are sensitive to taxes, it has to be noted here that the data used may be insufficient to measure investment incentives for these multinationals. This is the case, simply because firm births do not measure international but to a large degree also national (entrepreneurial) activities.

The second study we want to report here is Swenson (2001a). In contrast to Papke (1991), her data does only comprise multinational activities. She has information on discrete investment choices made by multinational enterprises from seven countries in different states of the US for the years 1984 to 1994. The data allows her to distinguish between the nationality of the investor, the industry the investment takes place in and the type of investment. These transaction types are: "New Plant", "Plant Expansion", "Merger & Acquisition", "Joint Venture", "Equity Increase" and "Other". The approach taken in this study is to analyse how transactions of the different types are affected by taxation. To do so, the study uses statutory tax rates at the state level. Furthermore, to control for state heterogeneity, the study makes use of state fixed effects and two measures of agglomeration. Agglomeration is assumed to have a positive impact on the probability a transaction takes place in a state. It is either measured as the number of all firms in a specific industry that are located in that state, or it is measured as the number of foreign firms in this industry located in that state. Moreover, having information on the source country of the investment, Swenson (2001a) tries to distinguish between tax-exemption and tax-credit countries.

First of all, regression results confirm the conjecture that higher agglomeration has a positive effect on investment. However, the distinction between different tax regimes in the home country of investment leads to inconclusive results. Contrary to theoretical assumptions, investors from tax credit countries are negatively affected by taxes, while the investment decision of those from tax

exemption countries seems to be independent. With focus on different transaction types, there are two specifications of the regression. One in which tax coefficients are estimated separately for each transaction type and one in which coefficients are estimated in one single regression by means of transaction type dummies linked to the tax rate variable. For both of these specifications, the study shows significant variation in tax coefficients among transaction types: While higher state tax rates decrease the probability of building a new or expanding an existing plant, it increases the probability of a merger or an acquisition[36]. Coefficients translate into elasticities that vary between -0.11 for "New Plant" to 0.06 for "Merger & Acquisition"[37]. Again, results indicate that various types of investment activities are differently affected by tax policy.

It has to be noted however, that the latter study has some shortcomings as well. First of all, state heterogeneity is only accounted for by fixed effects and agglomeration variables. Other studies have shows that the size/population of a state is a quite strong determinant for investment and that other variables may play a role as well. Although state size may be captured by fixed effects and the agglomeration variables[38], this may lead to some inaccuracies. Moreover, the study employs only one measure of taxation. It may be possible that effective taxation differs between the several types of transaction, e.g. since depreciation allowances are different. In this case, results can be explained by differences in taxation.

[36] The effects for the other three transaction types under consideration are not robust to the use of the two specifications.

[37] Swenson (2001a) fails to give a sufficient explanation for the observed positive effect of state taxes on mergers and acquisitions. A possible explanation could be the fact that multinational firms may depreciate some of the costs associated with a merger or acquisition in the target state of the investment. In this case, higher statutory state taxes imply more tax savings due to depreciation.

[38] Note that the agglomeration variables are constructed with disregard to state size so they may be biased by size differences between states. Alternatively, agglomeration variables may be interpreted as indirect measures for the size of a state.

3.2.4. Summary

We have discussed a number of studies that analyse how the investment decision of multinational enterprises is determined by taxes here. We have focused on three main areas, studies exclusively concerned with data for the US, more recent studies on investment decisions in Europe, and finally two studies that follow a more disaggregated approach in comparing the effects of taxes on investment in different industries and by different transaction types. Table 3.1. gives a short summary of each study discussed, presenting the general methodology and data, the tax measure used and the estimation results of the analysis. To sum up, empirical studies concerning investments into or from the US suggest that investments are significantly negative correlated with tax rates. It is shown, moreover, that the more general decision to invest, or to export instead, depends on other factors than taxes. Concerning discrete investment choices, it is shown that average and not marginal tax rates determine investment decisions. Although each of the studies discussed here suffer from some shortcomings, taken together, their results give a coherent picture. This implies that multinational enterprises are indeed very sensitive to tax differentials across possible target countries of investment.

The recent studies presented here for the case of investment within the European Union confirm the results of earlier work for the United States. Taxes seem to have a negative impact on the investment decision of multinational enterprises. As has been shown, for the types of investment analysed here, particularly the statutory tax rate and effective average tax rates determine the investment decision. While we suggested a significant effect for the effective average tax rate, with respect to our discussion from Chapter 2, results for the statutory tax rate are somehow surprising. A possible explanation for the significant effects observed may come from income shifting activities. We will discuss this issue in more detail in the subsequent section. While most of the studies discussed here use aggregated data, the study by Büttner and Ruf (2004) suggests that results obtained from these studies do also carry over to the analysis of firm-level data. Moreover, as the studies by Papke (1991) and Swenson (2001a) demonstrate, using data at a more disaggregated level opens

possibility for new research questions. Accounting for heterogeneity between different forms of investment seems to be important. These studies, again, focus on US data only and studies so far have not proved the relevance of their results for investment decisions in Europe[39]. We will make a contribution to fill this particular gap in Chapter 4 where we estimate sector-specific tax-sensitivities of FDI in the European Union.

[39] A first study analysing the determinants of German outward FDI in more detail is Buch et al. (2005). Using microdata, they show that the determinants of FDI differ with the size and the sector of the firm. Unfortunately, however, this study does not control for the effects of taxes.

Table 3.1.

Empirical studies on the tax sensitivity of investment

study	method and data used	tax measure used	estimates
Hines (1996)	Cross sectional data on the distribution of FDI positions among US states. Distinguishing between investments from tax-exemption vs. tax-credit countries to measure state fixed effects.	state statutory	A 1% point higher state tax rate reduces investment by approximately 10%.
Grubert and Mutti (2000)	Cross sectional data on aggregated outward FDI in 60 countries. Controlling for the impact of trade openness.	implicit micro	A 1% increase in the tax rate reduces investment by 2%.
Devereux and Griffith (1998b)	Panel data on the decision of US firms whether to invest in Europe or not and if so, in which specific country to invest.	EMTR, EATR and statutory	No effect for the higher level decision. A 1% increase in the EATR decreases the probability of an investment by 0.5% to 1.3%.
Bénassy-Quéré et al. (2000)	Panel data on aggregated FDI flows within the European Union plus the US and Japan. 5 Years. OECD data.	implicit macro	Not reported. Coefficient of -0.3 implies a negative impact of the tax rate.
Bénassy-Quéré et al. (2003)	Panel data on aggregated FDI flows within the European Union plus the US and Japan. 16 Years. OECD data.	EMTR, EATR, statutory and implicit macro	A 1% increase in the EATR (EMTR) decreases investment by 4% (3%).

Table 3.1. (continued)

study	method and data used	tax measure used	estimates
Büttner (2002)	Panel data on aggregated FDI flows within the European Union. 8 Years. EUROSTAT data. Controlling for the impact of public expenditures.	statutory, implicit micro and approximated bilateral EMTR	A 10% point increase in the bilateral EMTR (statutory tax rate) decreases investment by 3% (5%).
Gorter and Parikh (2003)	Panel data on the distribution of FDI positions within the European Union for the years 1995 and 1996 at the aggregate level. EUROSTAT data. Distinguishing between investments from tax-exemption vs. tax-credit countries to measure country fixed effects.	EMTR and implicit micro	A 10% point increase in the average tax rate (EMTR) decreases FDI positions by 5% (6%).
Büttner and Ruf (2004)	Panel data on the discrete decision of German multinationals whether to invest in a country or not.	EMTR, EATR and statutory	A 10% point increase in the statutory tax rate (EATR) reduces the probability that a firm holds an investment by 20% (12.5%).
Papke (1991)	Count data on new firm births among US states between 1975 and 1982. Differentiating between five distinct industries of the manufacturing sector.	similar to EATR	A 1% point increase in the tax rate leads to a 9% decline in firm births. Results do vary significantly among industries (from insignificant to –26%).
Swenson (2001a)	Panel data on the number of discrete investments among US states between 1984 and 1994. Seven source countries. Differentiating between six categories of transaction types.	state statutory	Overall, a 1% increase in the tax rate reduces the probability of an investment by 0.1%. Effect varies significantly among transaction types: Negative for "New Plants", positive for "Merger and Acquisition".

3.3. Incentives to engage in income shifting activities

As we have noted above in section 2.5.1., additionally to locating real activity in low tax countries, multinational firms may avoid taxes by reallocating taxable income from high tax countries to low tax countries. Firms may use various methods including the allocation of debt and the manipulation of intra-company transfer prices. We will present empirical work on these activities in the subsequent sections.

3.3.1. Transfer pricing strategies

It has to be noted first, that income shifting (in general) can not be observed directly since this would require detailed information on intra-company transactions of the multinational firm[40]. Instead, evidence for income shifting comes only in an indirect form. Moreover, as for the question on how taxes determine multinational investment decisions, most of the empirical literature on income shifting is concerned with the United States. The empirical literature on income shifting starts with the work of Grubert and Mutti (1991). Using cross-sectional data on reported profits of US multinationals abroad, they show that these are negatively correlated to foreign tax rates, i.e. affiliates in low tax countries report more pre-tax profits than those located in high tax countries. They do, however, not identify the specific channels through which income is shifted[41].

In a subsequent study Hines and Rice (1994) extend the latter analysis. They observe that US multinationals report approximately thirty percent of their total profits in tax havens (while these do only account for three percent of

[40] An exception is the study by Clausing (2003) - presented below - which reports direct evidence for income shifting activities.

[41] The rudimentary estimation of Grubert and Mutti (1991) has some obvious shortcomings. For example, they control for differences in the profitability of countries by means of one variable only.

world-wide GDP[42]) and interpret this as a sign for income shifting. In the following, they analyse on how the income reporting of US multinationals abroad is shaped by taxes. If tax induced income shifting is the motive for the observed pattern of income reporting, then tax rates should be negatively correlated with the reported income in a country. To separate between transfer pricing and financial channels[43] for income shifting, the authors do use only non-financial pre-tax income as dependent variable. Consequently, the focus is on transfer pricing strategies: Income can be shifted by under-invoicing the price of goods sold from an affiliate in a high tax country to an affiliate in a low tax country and over-invoicing vice versa (see section 2.1.5).

Using data on the aggregated non-financial pre-tax income reported by US multinationals in 59 countries abroad (including tax havens, OECD and developing countries) for the year 1982 and controlling for aggregated capital and labour inputs[44], the authors do not only show that the reported income in a country increases with the real activity located there, but they do also show that taxes have a significant effect on income reporting. For various specifications the tax coefficient shows the predicted negative sign, implying that higher taxes reduce the reported pre-tax income. The corresponding elasticity is –3.2 such that a one percent higher tax rate abroad is associated with a reported profitability that is approximately three percent lower. This is taken as indirect evidence for income shifting. However, results of this purely cross-sectional analysis should be interpreted with care. First, the study does only control for differences in the profitability between countries by means of GDP per capita, assuming that a firm has higher profits in "rich" countries. So results may be biased by some low (high) tax countries in which firm profitability is high (low). Moreover, the tax measure used is problematic. Hines

[42] With focus on "small" tax havens, i.e. excluding countries such as Ireland and Switzerland, the observed discrepancy between economic size of these countries and profits reported there is even larger.

[43] See section 3.3.2. for empirical studies concerning the financing strategies of multinational enterprises.

[44] They do also control for the overall profitability of the country by means of GDP per capita. Results show that this variable is insignificant.

and Rice (1994) employ implicit microeconomic average tax rates derived from the actual tax payments of the firms. These may be already biased by income shifting activities. In some cases effective tax rates are also biased by firms with negative income. Hines and Rice (1994) assume effective tax rates to be imprecise measures for income shifting incentives in these cases and use the statutory tax rate instead.

Following the approach above to rely on statistical relationships between country tax rates and affiliates' reported profitability, there is a large literature that has considered indirect evidence for income shifting. The only study so far that finds direct evidence for tax induced transfer pricing strategies is Clausing (2003). The basic feature of this analysis is that it makes use of detailed information on US import and export prices. Data comes from the Bureau of Labor Statistics and covers monthly trade prices of 22.000 goods in the period between 1997 and 1999. This data does not only allow to differentiate the prices charged for imports/exports of the same good in different countries, but also for different prices charged for this good in intrafirm and non-intrafirm trade. If tax motivated transfer pricing takes place, then we should observe differences in the prices observed for intrafirm and non-intrafirm trade. While trade prices between non-related parties are assumed to be independent from taxes in the partner country of the transaction, prices for trade between related parties should be correlated with taxes, instead. More specifically, to be consistent with the incentives for income shifting, export prices should be positively correlated while import prices should be negatively correlated with the tax rate of the trading partner[45].

This assumption is tested by separately estimating observed import and export trade prices as a function of tax rates and other potential determinants such as

[45] A study that takes a similar approach is Swenson (2001b). She analyses on how US import prices are affected by the tax rate of the partner country. However, since she can not distinguish between intrafirm and non-intrafirm trade, her results have to be interpreted with care.

exchange rate effects or the GDP of the partner country[46]. Moreover, the regression also controls for industry heterogeneity and the possibility that differences in prices for intrafirm and non-intrafirm trade are due to other reasons than income shifting. The study employs two alternative measures of taxation, an implicit microeconomic average tax rate and the statutory tax rate.

To distinguish between intrafirm and non-intrafirm trade, there are two different specifications of the regression. A first specification estimates coefficients separately for both types of trade relation. A second specification estimates coefficients in one single regression by means of intrafirm dummy variables linked to the tax rate variable. As the results of both specifications show, there are large differences among the determinants of intrafirm and non-intrafirm trade prices. While they get mixed results for the correlation between taxes and non-intrafirm export prices, regression results confirm the assumption that the higher the taxes in the partner country, the higher the export prices in intrafirm trade[47]. Concerning import prices, these are positively correlated to the foreign tax rate in the case of non-intrafirm trade, but are negatively correlated to the foreign tax rate in the case of intrafirm trade. These results imply that US firms manipulate transfer prices in a way that is consistent with tax minimisation strategies. With respect to the tax measure used, regression results are robust. However, in line with the assumption that the statutory tax rate is more appropriate to measure incentives for income shifting, regressions with this measure show more explanatory power. Coefficients presented translate into an elasticity of 1.8 and -2.0. A one percent higher tax rate associated with intrafirm export prices that are approximately two percent higher and intrafirm import prices that are two percent lower, relative to the trade prices for non-intrafirm trade. In sum, using detailed data on differences in trade prices,

[46] It can be assumed, for instance, that export and import prices are lower as the dollar is strong. They should be higher in the case the trading partner is a rich country. Empirical results confirm the latter assumption.

[47] Note that taxes enter negatively in the regression originally presented by Clausing (2003). Therefore, a negative coefficient implies a positive correlation between trade prices and taxes.

Clausing (2003) present direct evidence on tax motivated transfer pricing strategies of multinationals located in the United States.

A final paper we want to describe here is Bartelsman and Beetsma (2003). Differing in many aspects from previous literature, their analysis shows indirect evidence for transfer pricing among OECD countries. They assume that if tax motivated transfer pricing takes place, this will affect the reported nominal value-added by firms, i.e. sales revenue less intermediate purchases, in a country[48]. The value added reported in a country should be negatively correlated with its tax rate in this case. In contrast to data on profits, data for reported value-added is available for a number of countries and sectors. The approach taken by Bartelsman and Beetsma (2003) is to estimate this observable as a function of tax rates and the actual value-added of the country. Data comprises information on 22 OECD countries for the years between 1979 and 1997. However, what makes their analysis difficult is the fact that the actual value-added of a country is not observable and has to be estimated first from other observable variables.

The authors employ data on the long term interest rate of a country, its real wage rate and on total labour compensation to estimate the actual value-added from a CES production function simultaneously to the effect of tax rates. Incentives for transfer pricing are measured as the difference between the statutory tax rate of the country reporting value-added and the weighted average of the statutory tax rates of all other countries included in the study. Controlling for country and sector effects, coefficients reported for different econometric specifications do all show a significant negative sign implying that a higher tax rate of a country will lead to a decrease in its value-added reported. With some reasonable assumptions on the estimated production function and on statutory tax rates, estimation results suggest that 65 percent of additional revenue from a one percentage point increase in the statutory tax rate is lost because of income shifting.

[48] Intermediate purchases in particular will be over-invoiced in high tax countries and under-invoiced in low tax countries.

However, this indirect evidence for income shifting should be interpreted with care. The procedure to estimate the effect of taxes simultaneously to the current value-added of a country is very difficult and relies on specific assumptions regarding the production function. Moreover, it is questionable whether multinational enterprises alone can manipulate the reported value-added of a country or sector to such a significant extent given that there may be a number of national firms which can not make use of transfer pricing strategies. From this perspective, the reported effects of transfer pricing on marginal tax revenue seem to be very high.

3.3.2. Financing strategies

Apart from transfer pricing, other strategies may be used for the purpose of income shifting. These do include, for example, the allocation of R&D expenses, the size and scope of intra-firm dividend payments, or other specific incentives[49]. More recent studies focus on the effect of taxes on the financing strategies of multinational firms. Mills and Newberry (2004) use confidential tax return data of foreign controlled firms in the United States to analyse how their debt policy is determined by differences in tax rates[50]. Their data does not only comprise detailed information on the firm itself but also provides information on various aspects of the parent company, e.g. the home country of the parent, the world-wide use of debt of the multinational and its profitability. The analysis covers a ten year period between 1987 and 1996. Typically, national tax laws allow deducting interest payments of a firm from taxable profits. A possible strategy for income shifting would then be to locate these costs in high tax countries where the tax savings of the deduction are highest. Having information on the debt ratio of the foreign controlled US firm, this can be tested for.

[49] See the review by Hines (1997).

[50] Another recent study that is not covered by the reviews of Hines (1997, 1999) is Jog and Tang (2001). They analyse on how debt allocation among Canadian multinationals is affected by tax rates.

To do so, the study employs two different measures for taxation. The first measure is the difference between the US statutory tax rate and the statutory tax rate of the parent company. The second and more complex measure is the difference between the US statutory tax rate and the world-wide average effective tax rate of the multinational enterprise. The latter measure is directly calculated from firm data[51] and is used to account for the possibility that income is not only shifted between the US affiliate and the parent but also between the US affiliate and any other affiliate of the multinational enterprise. If the world-wide allocation of debt is subject to income shifting strategies, then the debt reported by the multinational in the US should be higher, the higher the US tax rate when compared to the tax rate the multinational faces in other countries. Controlling for firm heterogeneity in the debt policy, the authors show that this is indeed the case. According to their estimation results, the lower the taxes a multinational faces outside the US, the higher is the debt ratio of its US affiliate. The coefficients found imply that a ten percentage point lower tax differential reduces the debt ratio of US affiliates by about 1.2 percentage points. So, the results of Mills and Newberry (2004) suggest that foreign multinationals follow tax-motivated US income reporting strategies and that these strategies are particularly reflected by their US debt policy.

With respect to financial strategies, it can be assumed that it is especially the banking sector that can take advantage of these in order to minimise their world-wide tax liabilities. In contrast to non-financial firms, profits in the banking sector are less determined by real economic activity and there exist ample possibilities to shift income between countries. The study by Demirgüc-Kunt and Huizinga (2001) is concerned with this issue. Their data set comprises firm-level information on individual banks in 80 countries for the years 1988 to 1995 and allows to distinguish between home-owned (national) and foreign-owned (multinational) banks[52]. They observe quite significant differences in the

[51] In this respect, the tax rate is best characterised as an implicit microeconomic average tax rate.

[52] The data set used is very comprehensive. For most countries it covers about 90 percent of bank assets.

pre-tax profitability as well as in the tax payments of national and multinational banks across countries. In their study, they analyse if there is a systematic relationship between the observed differences in profitability and tax rates across countries, and if this is the case, if this is consistent with income shifting. To do so, they estimate the pre-tax profitability of a bank in a specific country as a function of bank and country specific characteristics. While country characteristics control for heterogeneity across countries concerning the overall profitability of business, bank characteristics control for heterogeneity across banks and include information on whether the bank is national or multinational.

Estimation results indicate that bank and country characteristics are important in determining profitability[53]. To account for taxes, the study employs statutory tax rates as well as a measure on the banks' average tax rate implicitly calculated from the balance sheet of the bank. For both these measures, estimation results show significantly positive coefficients implying that banking in high tax countries is more profitable than banking in low tax countries. The authors interpret this as evidence that the tax burden of banks is to some extend passed on to bank customers. However, when distinguishing between national and multinational banks, estimation results do change: Interacting the tax rate variable with a dummy indicating whether the bank is national or multinational, we get the result that the pre-tax profitability of multinational banks instead is negatively correlated with the tax rate. This negative correlation is consistent with income shifting.

Having information on the tax payments of banks, the authors do also provide estimates on how these are affected by tax rates. It is found that increasing the statutory tax rate enlarges tax revenue collected from national banks[54]. In the

[53] Banks that use relatively more equity are found to be more profitable while those who achieve more non-interest earnings are found to be less profitable. The real interest rates of a country or its per capita GDP does also determine reported pre-tax profitability of a bank.

[54] This implies a position left to the maximum of the Laffer-curve. It has to be noted, however, that the corresponding coefficient is not significantly different from zero.

case of multinational banks, however, although in general these pay higher taxes than national banks, increasing statutory taxation will unambiguously reduce tax revenue collected. Of course, the strong effects found here for the banking sector can not be carried over to other sectors, such as manufacturing, where possibilities for income shifting are limited. However, it demonstrates that income shifting may have a significant effect on tax revenue collected and may explain why several countries have created special tax incentives tailored to multinational banks.

Having shown evidence for income shifting in the United States and other OECD countries, we will now turn to Germany. As Germany had the highest statutory tax rate on retained corporate profits among OECD countries during the 1990s it is likely that the country is particularly prone to income shifting. Ramb and Weichenrieder (2004) use microdata on the financial structure of foreign owned affiliates in Germany to analyse this issue in more detail. Their data comprises information on the debt (including intra-company loans), and on the profits of foreign owned affiliates as well as on the total balance sheet and on the location of their parent company. Their panel analysis covers the years from 1996 to 2001. As in the study by Mills and Newberry (2004), it is tested if the German affiliate uses more debt if its parent company is located in a low tax country. Additionally, it is tested whether there is a similar relationship for intra-company loans received. To control for firm heterogeneity, the authors employ several variables that may explain differences in the financing structure of the firm, e.g. firm size and borrowing costs. Tax incentives are measured by the statutory tax rate. However, since these incentives are only available for firms with positive profits[55], the study does also control for the profitability of the German affiliate, i.e. if it has positive or negative profits.

With respect to intra-company loans granted by the parent, estimation results are inconclusive. While more profitable firms receive fewer loans from its parent,

[55] Since firms with non-positive profits will typically pay no taxes in Germany, cost deduction is not possible. Hence, there is no incentive to use debt for purposes of income shifting.

a significant correlation with taxes is only found for some affiliates[56]. Regression results suggest that a ten percentage point increase in the German tax rate enlarges intra-company loans received by directly held affiliates by approximately 1.4 percent and decreases those received by indirectly held affiliates by some 0.1 percent. With respect to (third-party) debt, results are mixed as well. The suggested positive relationship between tax incentives and debt is only significant in two of four specifications of the empirical model. Moreover, the coefficients reported for these regressions are very small. So, while the analysis of Ramb and Weichenrieder (2004) provides some weak evidence on the use of financial instruments to undertake income shifting, the results presented here for the German case are less clear-cut than those of other studies concerned with US data. Among others, one possible reason for (partly) inconclusive results may stem from inaccuracies in measuring tax incentives. The authors themselves note that they can only account for tax differences between Germany and the location of the parent company. If, instead, the average tax rate the multination firm faces on its world-wide operations plays a role, then the used measure is incorrect.

3.3.3. Joint decisions on investment and income shifting activities

So far, the empirical literature reviewed in this chapter has analysed two questions separately: To what extend do taxes determine real investment of multinational enterprises and to what extent do taxes affect multinationals to engage in income shifting. However, in practise, these two aspects can be assumed to be interrelated. On the one hand, opportunities for income shifting will decrease the effective tax rate a firm has to pay in a certain country. On the other hand, to make use of income shifting strategies, a multinational enterprise needs an affiliate in a low tax country to which income can be shifted. Until now, there exist only two studies which deal explicitly with this

[56] As the authors argue, a possible explanation for insignificant results may stem from the fact that foreign multinationals cover losses of their German affiliates in large parts with intra-company loans.

issue. One is by Grubert and Slemrod (1998). Their general idea is that a tax haven will be a more attractive location for real investment if a multinational firm can make use of ample income shifting possibilities. Moreover, they assume that income shifting may be limited by national tax laws in the high tax country, i.e. by formula apportionment. Under formula apportionment, world-wide income of multinational enterprises has to be allocated according to some measure of real activity (see section 2.1.5). Increasing real activity in the low tax country will then allow firms to increase income shifting into this country as well. Consequently, income shifting will not only increase the number of affiliates in a tax haven (i.e. small mailbox companies) but also the total capital stock in this country.

Using firm level data on approximately 4000 US multinationals for the year 1987, Grubert and Slemrod (1998) analyse how real investment in Puerto Rico is affected by differences in the opportunities for income shifting among these firms[57]. Profits can be assumed to be a function of variables that determine real economic profitability and of variables that determine the amount of tax savings that stem from income shifting. The study employs data on firm characteristics to measure how these determine profitability and the investment decision. It is assumed that firms which are more profitable in the US are profitable in Puerto Rico as well and that firms with high trade costs will be less profitable there. Incentives for income shifting are measured by the parents' expenses on research and development and on advertisement. Firms with large expenses in these categories are assumed to engage more in income shifting than other firms since this offers ample opportunities for income shifting. Under the realistic assumption that Puerto Rico does not offer any real locational advantage that makes it relatively more attractive for research and development or advertising than the US, any positive correlation between the expenses of the parent in these categories and the probability it locates in Puerto Rico has then to be interpreted as indicating income shifting.

[57] Puerto Rico is chosen since there exist some specific US tax laws that make income shifting in this tax haven extremely beneficial.

Regression results show a significantly positive correlation with the firms' profitability at home and a negative correlation with trade costs. Moreover, estimation results suggest that the probability to locate in Puerto Rico increases with the firms' opportunities for income shifting. In a different specification, the authors do also test if the variables used do have an impact on the size of real investment as well. Estimation results are similar to those obtained for location probabilities and confirm that income shifting is a potential reason for real investment. Based on these estimates, Grubert and Slemrod (1998) calculate the effects of income shifting on the location decision. They show that in the absence of any gains from income shifting, the number of affiliates of US multinationals in Puerto Rico would almost halve and the capital employed would be about 70 percent lower. So, the authors are able to identify income shifting as a predominant reason for real investment of US multinationals in Puerto Rico.

Naturally, income shifting to Puerto Rico is a very special case that may be governed by the specific rules that apply to US multinationals. Hence, generalising results for the case of other countries may be difficult. A second study that deals jointly with the effect of taxes on income shifting and real investment is provided by Mintz and Smart (2004). They analyse income shifting among Canadian provinces. The general idea is to separate firms into subsets that differ with respect to the firms' possibilities for income shifting and mobility of real economic activity, and to estimate for each of these categories how taxable income of firms in a certain province is affected by statutory tax rates. Three broad categories are distinguished: Large firms, which may engage in income shifting since they are subsidiaries of other Canadian corporations, other large firms for which income shifting is not possible and small firms which can not make use of income shifting strategies at all. Their dataset comprises aggregated information on taxable income reported in Canadian provinces by firms in each of these categories for the years 1986 to 1999 which acts as dependent variable. The tax measure used is the provincial total statutory tax rate which consists of the statutory tax rate levied by the central government and the statutory tax rate levied by the province.

Controlling for differences in the size and the overall profitability among provinces, empirical results suggest that taxable income reported in high tax provinces is generally lower than those reported in low tax provinces. This qualitative result is independent from firm categories. With respect to the quantitative results of the analysis, however, they find significant differences. While the effect of taxes is insignificant for small firms, the effect for large firms that may engage in income shifting is about two times larger than for those firms which are not able to shift income. Results are robust to different specifications of the model as well as to alternative classifications of firms into the shifting and non-shifting categories and imply that increasing the tax rate by one percentage point will decrease taxable income reported by shifting firms by about 8.5 percent. Observed dissimilarities among categories can be assumed to represent differences in real mobility as well as in mobility of income: While small firms are immobile across provinces, the observed effect for large non-shifting firms represents their opportunity to locate real economic activity in low tax provinces. The somewhat larger effect for shifting firms represents both, their opportunity to locate real activity in low tax provinces and their opportunities to shift income. So, the result that these firms which are able to shift income do reply more heavily to tax rates is taken as evidence for income shifting.

However, this result has to be interpreted with care. Mintz and Smart (2004), use information on provincial sales and real assets of the firms to account for their real economic activity across provinces. Using data on real assets as dependent variable instead of taxable income should give some indication of how taxes affect real investment of firms, in contrast to their tax planing decision. Estimation results show that while the location of real economic activity by non-shifting firms is independent from tax rates, shifting firms do also locate their real activity in low tax provinces. This is somehow inconsistent with the assumptions made. Concerning real activity, one would suggest that firms in the two categories are similarly affected by provincial taxes. Moreover, if we interpret the correlation between tax rates and taxable income of non-shifting firms as indicating mobility of real activity, then we would suggest

finding a similar correlation between a direct measure of real activity and tax rates as well.

3.3.4. Summary

We have discussed a number of studies that analyse how tax motivated income shifting affects the behaviour of multinational enterprises here. In particular, we focused on the effect of cross country differences in tax rates on intra-company transfer prices and on the world-wide allocation of debt. Table 3.2. gives a summary of each study discussed, presenting the general methodology and data, the tax measure used and the estimation results of the analysis. Most of the studies are concerned with US data, either on US based multinationals or on the US affiliates of foreign multinationals. They provide indirect evidence that income shifting determines multinational behaviour. Using data on differences in trade prices among related and non-related parties, however, Clausing (2003) is able to present direct evidence on transfer pricing. With respect to countries other than the US, empirical evidence is rather scarce. There exist only two studies on income shifting between OECD countries. These either use a very complex approach to gain results (Bartelsman and Beetsma, 2003) or they are limited to a particular sector in which income shifting is assumed to be a common strategy (Demirgüc-Kunt and Huizinga, 2001). The only study so far concerning Germany (Ramb and Weichenrieder, 2004) presents only limited evidence for the possibility that debt allocation by multinational firms is used to shift income.

Table 3.2.

Empirical studies on tax motivated income shifting

study	method and data used	tax measure used	estimates
Hines and Rice (1994)	Cross sectional data on reported non-financial income of US multinationals in 59 countries for the year 1982. Analysing the impact of taxes on income reporting.	measure constructed from implicit micro and statutory tax rates	A 1% point higher tax rate in the foreign country reduces income reported there by 3.2%.
Clausing (2003)	Detailed information on the import and export prices of US based firms between 1997 and 1999. Distinguishing between prices charged for intrafirm and non-intrafirm transactions.	statutory and implicit micro	A 1% point higher tax rate in the foreign country increases (decreases) export (import) prices in intrafirm trade by 2%.
Bartelsman and Beetsma (2003)	Measuring the difference between value–added reported in an economy and the non observable real value-added in the absence of income shifting. Panel data on 22 OECD countries and 19 years. Jointly estimating real value-added and the impact of taxes.	statutory	65% of additional revenue from a 1% point increase in the local tax rate is lost due to transfer pricing.
Mills and Newberry (2004)	Firm level data on the debt allocation of foreign held affiliates in the US between 1987 and 1996. Analysing the impact of taxes on the use of debt.	statutory and implicit micro	A 10% point increase in the US tax rate increases in use of debt among foreign held affiliates by 1.2%.

Table 3.2. (continued)

study	method and data used	tax measure used	estimates
Demirgüc-Kunt and Huizinga (2001)	Firm level data on reported income in the banking sector. 80 countries for the years 1988 to 1995. Distinguishing between reported pre-tax profitability and tax payments of national and multinational banks.	statutory and implicit micro	Elasticity not reported. Higher tax rates increase tax revenue collected from national banks and decrease revenue collected from multinational banks.
Ramb and Weichenrieder (2004)	Firm level data on foreign held affiliates in Germany for the years 1995 to 2001. Analysing on how intra-company loans received (debt used) by the affiliate is affected by taxes.	statutory	A 10% point increase in the German tax rate increases intra-company loans received by the affiliate by 1.4 %. It increases the use of debt of affiliates by 0.4%.
Grubert and Slemrod (1998)	Firm level data on the incentives for US multinationals to invest in Puerto Rico. Analysing the joint effect on real activity and shifting income.	no measure used	Firms that have more opportunities for income shifting, i.e. that are research intensive and have high expenses on advertising, are more likely to locate in Puerto Rico. Without possibility for income shifting, investment in Puerto Rico would be 50% to 70% lower.
Mintz and Smart (2004)	Aggregated data on taxable income of Canadian firms among provinces. Distinguishing between firms that are able to shift income and those who are not.	provincial statutory	Effect of taxes on income shifting firms is twice as large as the effect for non-shifting firms. A 1% point increase in the provincial tax rate reduces taxable income of shifting firms by 8.5%.

3.4. Conclusion

The empirical evidence reviewed here shows that investment, financing and other activities of multinational enterprises are quite sensitive to their tax treatment. This finding provides numerous implications for tax policy. Concerning real investment, the sensitivity found opens the possibility for governments to compete with each other to offer multinationals ever lower tax rates. However, results also show that non-tax incentives, in particular market size and agglomeration effects, are important determinants of multinationals investment decisions as well. Consequently, although tax competition can be assumed to decrease equilibrium tax rates, fears concerning a "race to the bottom" may go too far.

With respect to income shifting, the same problems may apply. By decreasing their tax rate governments can attract substantial amounts of taxable income and thereby increase their total tax revenue. Given the large effects reported by some studies, this may indeed result in a race to the bottom in statutory tax rates. To prevent multinational firms from income shifting, high tax countries have therefore to develop appropriate instruments. However, as has been shown in particular by the study of Grubert and Slemrod (1998), the use of these instruments may increase incentives for multinational enterprises to locate their real activity in low tax countries as well.

Although there does exist quite a large literature on these issues, some questions are still open for future research. Especially with focus on the European Union, empirical evidence is only very general or weak. While US studies have emphasized the importance to distinguish several types of investment, the same has not been done so far by studies concerned with the EU. More importantly, evidence for income shifting is rather scarce or indirect, and most the empirical literature has analysed investment decisions and incentives for income shifting separately by now. We make a contribution to fill these gaps in the next two chapters where we analyse incentives for investment and income shifting in more detail.

CHAPTER FOUR:

The tax-elasticity of FDI between different economic sectors

4.1. Introduction

Globalization of economies and growing factor mobility has led to a substantial increase in foreign direct investment (FDI) during the last decades (see Chapter 1). Such investment is in general associated with benefits for the host country, e.g. more employment, economic growth and tax revenues. Consequently it is not surprising that some countries try to induce foreign direct investment by the use of tax instruments, particularly the corporate tax rate, that reduce the effective tax burden of the investment. As argued by the Ruding Report (1992) and the Commission of the European Communities (2001), uncoordinated fiscal policy of EU members could then lead to an undertaxation of the mobile factor, namely capital, at the expense of the immobile factor, namely labour. Compared with the case of tax harmonisation, this will lead to losses of aggregate welfare in the union. Any proposal for the "optimal" tax policy within the union, however, requires sufficient knowledge about the tax-sensitivity of foreign direct investment. As we have already shown in section 3.2. there exists a large literature concerning the United States and recently there emerged a few empirical studies analysing the tax-sensitivity of foreign investment inside the

European Union as well. With respect to the EU, although the econometric models in these studies are specified differently, they all find a significantly negative correlation between tax rates and foreign direct investment on the basis of bilateral country-to-country data.

The motivation of this paper comes from the fact that most studies, independent of their geographical focus, rely on aggregate data describing overall investment activities. Papke (1991) and Swenson (2001a) have already shown that results may differ with respect to investment in different industries and among different types of investment[58]. Having these empirical findings in mind, it is reasonable to assume that the response of FDI to differences in tax rates may also differ between economic sectors. A welfare maximizing government then has two different options: A first-best solution would be to set different tax rates in each sector, according to the investment elasticity in this specific sector. In practice, this means to charge a high tax rate for investment in sectors with a relatively low mobility of capital, while taxing investment in sectors with a relatively high mobility of capital with a low rate[59]. Weichenrieder (1996) gives two prominent examples of such preferential taxation within the European Union: In Ireland, until recently, FDI in the secondary and tertiary sector was taxed with a lower corporate tax rate than investment in the primary sector. In the Belgium-Luxembourg economic union and in the Netherlands, such tax incentives are limited to those multinational firms that provide intra-company financial services or act as financial holdings. This preferential taxation of the secondary and tertiary sector is then a visible response to differences in capital mobility throughout the sectors.

[58] For a more detailed discussion of these studies see section 3.2.3.

[59] This mobility can be related to the location rents that the firm earns in the taxing country. In a theoretical model, Haufler and Wooton (2004) show that EU countries may be able to raise tax rates and increase tax revenue without losing attractiveness for FDI. This is the case when the firm's location rent in the EU is large. On the other hand, if the firm is indifferent between locating within the EU and a third country, then EU countries may attract additional (welfare enhancing) investments by a co-ordinated decrease in tax rates for these firms.

When setting their tax rates, governments have to take into account the effects of FDI on the local economy. Empirically, the existence of spillovers is documented (see Görg and Ströbel, 2001)[60]. Even though empirical work on the possible transmission channels for these spillovers has only just begun, most observers argue that investments in the primary sector have fewer positive spillovers onto the rest of the economy than FDI in the other sectors, and that technological spillovers are particulary high and growth enhancing in the service sector (see e.g. Elfring, 1989, Fagerberg, 1994). If, however, preferential taxation is not possible or allowed, e.g. for reasons of equity[61], a welfare maximizing government has to choose a tax rate which accounts for the importance of sector specific investment on the aggregate level of (inter-temporal) welfare. This strategy implies to set the tax rate such that the FDI attracted maximizes national welfare and economic growth. Following this argument, it seems that the aggregated tax-elasticities reported by most empirical studies[62] are of only limited help for policy purposes, since they combine data from sectors and industries with a relatively small mobility of capital, e.g. the agricultural sector, with data from sectors in which capital is almost perfectly mobile, e.g. transport and communication. If it is particularly the tertiary sector that determines the economic performance, then aggregate tax-elasticities may underestimate the economic effects of tax incentives.

The purpose of this chapter is to estimate tax elasticities for outward foreign direct investment of three major members of the European Union (Germany, the United Kingdom and the Netherlands[63]) differentiating between the three

[60] Most often, these spillover effects are positive. However, for less developed countries, some studies, as for example Gazioglou and McCausland (2002), report negative effects of FDI.

[61] Although the attention lies on the discrimination of non-residents versus residents, one can argue that such sector specific tax incentives are in conflict with the EU Code of Conduct for Business Taxation as it is proposed by the Commission of the European Union (1997).

[62] De Mooij and Ederveen (2003) 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% reduction of foreign direct investment.

[63] Although the Netherlands are small in (economic) size, they are an important source and destination of foreign direct investment.

main industrial sectors. The chapter is organised as follows: Section 4.2. presents the econometric model used to estimate the tax-elasticities of the three sectors. Section 4.3. gives a description of the data used in the empirical analysis. Results are shown in Section 4.4. Section 4.5. concludes.

4.2. Investigation approach

A firm that can decide between investments in alternative countries abroad will typically choose to locate where expected profits are highest. Thus, the profits each firm derives from locating in a country j are a function of the characteristics of that location $\pi_j = \pi_j(\phi_j)$ where ϕ_j is a vector of the characteristics in country j. Generally speaking, this vector comprises measures of the costs and accessibility of production factors, public policies such as basic infrastructure and tax rates, the size and characteristics of nearby markets, and so on[64].

Inspecting investment flows, it becomes obvious that a firm originally located in country i will only invest in the foreign country j if this foreign country offers better characteristics than the home country does. Therefore, we can define foreign direct investment from country i to country j as a function of differences in country characteristics. Denoting by ϕ^n, $n \in \{1, N\}$, the n-th element of the vector ϕ_j and ϕ_i, this function can be written as:

$$FDI_{i,j} = f(\Delta\phi^1_{i,j}, \Delta\phi^2_{i,j}, ..., \Delta\phi^{n-1}_{i,j}, \Delta\phi^n_{i,j}, \Delta\phi^{n+1}_{i,j}, ..., \Delta\phi^{N-1}_{i,j}, \Delta\phi^N_{i,j}) \quad (4.1)$$

where $\Delta\phi^n_{i,j}$ is equal to $\phi^n_j - \phi^n_i$.

[64] Apart from the above-listed variables, location characteristics may include, for example, barriers to trade, domestic inflation, the political system and language. Some of these variables are negligible for FDI inside the European Union. Other variables, such as language, can be captured with fixed effects.

Among the main factors determining FDI in Dunning´s OLI-Framework, we focus on locational advantages, in our case measured as the difference between ϕ_j^n and ϕ_i^n. Of course, this approach can not capture all determinants of FDI in detail. Dunning (1977, 1981) explores not only locational but also ownership and internalization advantages as sources for multinational activity. The reason why we concentrate on locational advantages is that our data, which is in general on a macroeconomic basis and therefore not firm specific, does not allow us to account for advantages that are due to ownership and internalization. As we are merely trying to explain the general determinants of aggregated FDI among sectors, a detailed analysis at the firm level is beyond the scope of this analysis.

Equation (4.1), does not take into account the economic and geographic distance between the two countries. It is frequently observed that FDI between two countries decreases with the distance, such as trade does[65]. This can be due to the fact that a longer distance makes a foreign operation more difficult and expensive to supervise, which might therefore deter investment. Assuming linearity, a possible specification for the relation between country characteristics and FDI could therefore be:

$$FDI_{i,j} = \frac{\sum_{n=1}^{N} \Delta\phi_{i,j}^n}{\delta} \tag{4.2}$$

where the parameter δ measures the distance between the two countries. At first sight, it is suggestive to use geographical distance here, but this measure is of course not always a reliable indicator of the mutual openness of two countries. Instead, it may be preferable to use a more simple to measure proxy

[65] According to our discussion from section 2.1.2.and 2.1.3, the effect of distance is ambiguous since it is not clear whether FDI is a complement or a substitute for trade. The empirical studies discussed in section 3.2., however, present some first evidence that FDI is deterred by distance. A detailed discussion on the theoretical and empirical work concerning the relationship between FDI and trade goes beyond the scope of this work. The interested reader is therefore referred to Markusen (1995).

for distance. Good indicators for distance are trade flows such as country-to-country exports. Theory as well as empirics predicts that exports (Exp.) will decrease with distance. Assuming an inverse relationship between distance and exports, we can then rewrite equation (4.2) as:

$$\frac{FDI_{i,j}}{Exp_{i,j}} = \sum_{n=1}^{N} \Delta\phi_{i,j}^{n} \tag{4.3}$$

Note that the approach taken by equation (4.3) is very similar to a standard gravity equation approach. Thereby, we assume a positive correlation between FDI and trade. Available empirical evidence supports this assumption[66]. This could be due to the fact that the problems of information and monitoring in multinational corporations investing abroad can be reduced by maintaining trade relations[67]. The volume of trade is also a good indicator for the openness of a country. One would expect that footloose manufacturing, that is, production of intermediate and final goods that are mainly intended for export, takes place only in countries with the most open trade regime and therefore trade and investment activities are complementary. Grubert and Mutti (2000) present empirical evidence which shows a strong positive correlation between openness and foreign investment stocks[68,69]. However, as our sensitivity analysis will show, relaxing the assumption of a positive correlation between FDI and trade will not change the general results of our empirical analysis.

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[66] See for example Deutsche Bundesbank (1997). According to this study, there is a positive correlation between German exports and German outward FDI.

[67] Gordon and Bovenberg (1996) see asymmetric information across countries as one possible explanation for observed capital immobility. With (long-term) trade relations this information gap can be narrowed and hence capital mobility increases.

[68] This study is discussed in more detail in section 3.2.1.

[69] Obviously this contradicts the argument that FDI is a substitute for trade because of increasing transport costs which make it more profitable to produce abroad than to produce at home and export to the foreign market. As we have discussed in section 2.1.3., however, it can be alternatively assumed that FDI follows trade. In our sample data and exports are positively correlated.

As mentioned above, it is crucial to make a distinction between foreign direct investments in different economic sectors, since the mobility of capital may differ between them. Therefore we run separate regressions for the sectors of the economy under consideration. Building on equation (4.3), we estimate the following baseline regression for all three sectors:

$$\frac{FDI_{i,j,t}}{Exp_{i,j,t}} = \alpha_{i,j} + \alpha_t + \beta_1 \cdot \Delta\tau_{i,j,t} + \beta_2 \cdot \Delta q^l_{i,j,t} + \beta_3 \cdot \Delta q^e_{i,j,t} + \beta_4 \cdot y_{j,t} + \varepsilon_{i,j,t} \qquad (4.4)$$

with

$$\Delta\tau_{i,j,t} = \tau_{j,t} - \tau_{i,t} \quad ; \quad \Delta q^l_{i,j,t} = q^l_{j,t} - q^l_{i,t} \quad \text{and} \quad \Delta q^e_{i,j,t} = q^e_{j,t} - q^e_{i,t}$$

According to equation (4.4), the ratio of FDI to exports in each time period t primarily depends on the difference in factor costs and tax rates. While $\Delta\tau_{i,j,t}$ characterizes the tax rate differential, $\Delta q^l_{i,j,t}$ and $\Delta q^e_{i,j,t}$ are the labour cost, respectively energy price, differential between the two countries[70]. Since any increase in these differentials make country j less attractive, we would assume the coefficients β_1, β_2 and β_3 to be negative. Note that tax rates may either be statutory or effective. In subsequent chapters we will distinguish between the statutory tax rate t[71] and a measure of effective taxation T. However, as long as we do not explicitly refer to one of these concepts we label tax rates by τ.

The additional variable $y_{j,t}$ was introduced into this pooled cross-section and time-series regression to control for differences in the size of the target country. As mentioned above, the size of foreign markets may play a role in the location decision of a firm since a larger market offers more market potentials. Therefore, we expect that investment into a small economy like Greece is lower than

[70] We do not use cost of capital as an alternative factor price variable. We assume that a multinational corporation faces only the world interest rate r.

[71] For the econometric parts of this work we will sometimes refer to t as an index for time. However, when t is not used as a subscript, it will always correspond to the statutory tax rate.

investment into France or Italy[72]. So the expected sign of β_4 should be positive. To further control for other common effects among source and target country of investment, we introduced the bilateral constant $\alpha_{i,j}$. Particularly, it captures the specific economical, political and cultural relations of the two countries[73]. In addition, α_t is a time dummy that controls for common shocks to all countries influencing the quantity of investment. The residual term is given by $\varepsilon_{i,j,t}$.

The parameter of interest, β_1, captures the relationship between tax incentives and foreign direct investment. Linearizing the correlation between tax differentials and FDI, the partial derivative of (4.4) can be written as:

$$\beta_1 = d\frac{FDI}{Exp} \cdot \frac{1}{\Delta\tau_{i,j}} = d\frac{FDI}{Exp} \cdot \frac{1}{d(\tau_j - \tau_i)} \tag{4.5}$$

The parameter β_1 measures the response of foreign direct investment flows from country i to country j (scaled by exports) in absolute terms. Rearranging equation (4.5), this is easy to see:

$$dFDI = \beta_1 \cdot d(\tau_j - \tau_i) \cdot Exp \tag{4.6}$$

Absolute changes in FDI are given by the changes in tax rate differentials between the two countries multiplied with β_1 times the exports. Bear in mind that this is not the elasticity of FDI with respect to the tax differential since it says nothing about the percentage change of investment flows. Other studies use log-linear regressions to estimate the impact of taxes on international investment. The advantage of log-linear regressions is that β is equal to the semi-elasticity of the explanatory variable since all variables are independent of their size. We use a non-logarithmic regression here since some of our variables, e.g. investment flows, tax rate and factor cost differentials are negative in

[72] See also our discussion in section 2.1.

[73] Egger and Pfaffermayr (2003) argue that in a gravity model, the use of bilateral constants is preferable to the more common method where there are fixed effects for each home and/or host country.

several cases. A logarithmic regression is therefore not possible. Nonetheless, elasticities can be easily computed when evaluating the result of equation (4.6) with the mean values of FDI, exports and tax rates.

4.3. Data sources and description

4.3.1 Data on foreign direct investment

Data on foreign direct investment flows comes from EUROSTAT, the statistical office of the European Commission. According to the OECD benchmark definition FDI occurs when an investor owns more than 10% of a foreign firm (compare section 1.2.1.). The advantage of EUROSTAT data, compared with that of the OECD, lies in the fact that it accounts for differences in national statistics and is therefore harmonized for the purpose of international comparisons[74]. Note that the OECD definition allows only to distinguish between direct and portfolio investment, but not, for example, between setting up an entirely new plant (greenfield investment) and acquiring an existing indigenous firm (brownfield investment).

Another possibility is to differentiate foreign direct investment flows concerning the three economic sectors. EUROSTAT provides us with sector specific data on foreign direct investment on a bilateral basis. FDI in the primary sector consists of agriculture, fishing, mining and quarrying. Investment in the secondary sector covers all manufacturing industries. And finally, FDI in the tertiary sector refers to all investment in transport, communication and financial intermediation. The dependent variable used in this analysis is the value of bilateral FDI flows as provided by EUROSTAT. These flows are expressed with current market prices and current exchange rates and do comprise investment that is financed with equity as well as investment financed with retained earnings. Due to limited availability of data there are only three

[74] Note that, although the data is harmonised, there can still occur substantial measurement errors.

reporting economies; Germany, the United Kingdom and the Netherlands. These countries report annual exports of FDI into several European partner countries, namely Austria, the Belgium-Luxembourg economic union (BLEU), France, Germany, Greece, Italy, the Netherlands, Spain and the UK. This leaves us with 3*(9-1)=24 observations for each year and sector. As the UK and the Netherlands report annual foreign direct investment only since 1995, the analysis covers the years 1995 to 1999.

Table 4.1.

*Aggregated outflows of FDI to eight EU countries by source country and sector**

	Germany		Netherlands		UK	
	1995	1999	1995	1999	1995	1999
Primary Sector (Agriculture/Mining)	100	-907**	139	97	1175	-461**
Secondary Sector (Manufacturing)	5088	6044	-787**	12132	1427	12167
Tertiary Sector (Transport/Telecommunication/ Financial Intermediation)	4759	20381	3795	9118	2402	682

Source: EUROSTAT New Cronos Database, own computations.

** All values in mill. Euros.*

*** A negative sign means that disinvestments are higher than investments.*

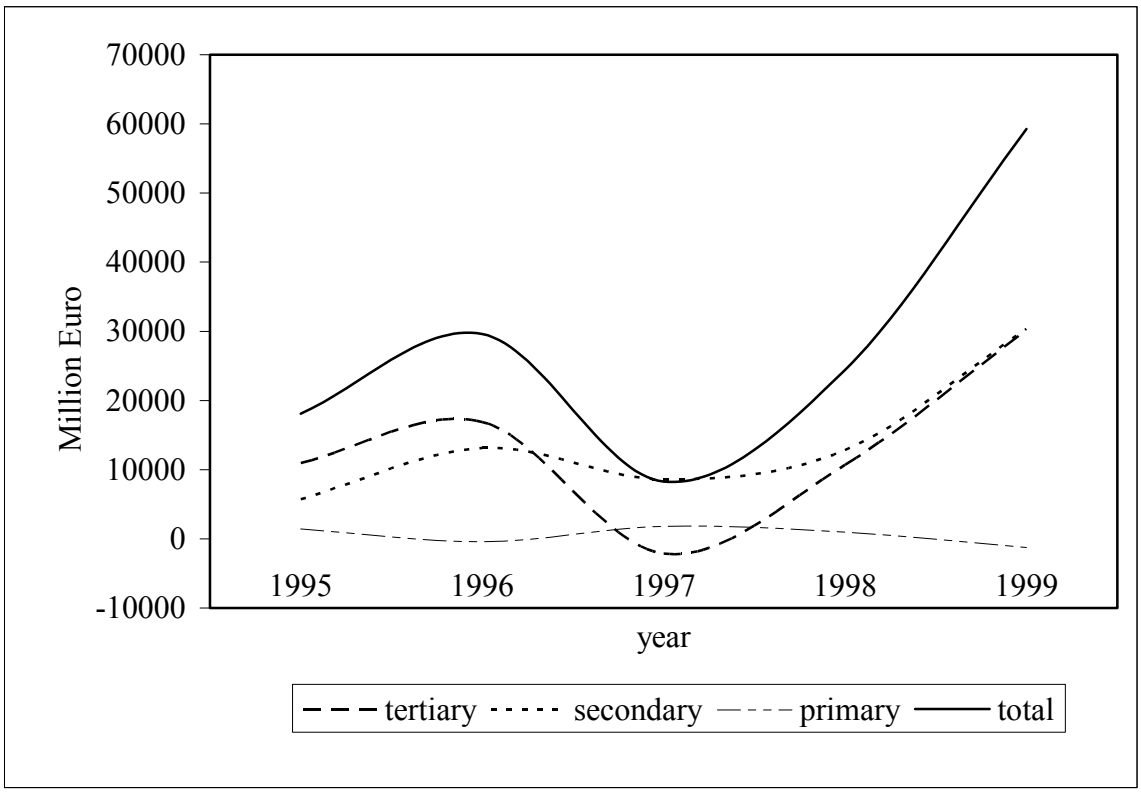
Table 4.1. gives a short summary of the observed FDI flows. As we can see, the level of FDI depends not only on the reporting economy but is typically different between the three sectors, e.g. FDI into the primary sector is typically ten or more times smaller than FDI into the other sectors. It is also interesting to see that the remarkable increase in the absolute level of FDI mainly occurs in the secondary and tertiary sector while foreign direct investment in the primary sector is decreasing over time and even turns negative in 1999. These facts can best be demonstrated from Figure 4.1.[75]: Except for the year 1997, where large

[75] Here we simply aggregated the data for 1995 to 1999 over the three countries and smoothed the corresponding graphs.

disinvestments in the tertiary sector from the United Kingdom took place, there is a high and increasing level of FDI in the manufacturing as well as in the service sector while investment into agriculture and mining fluctuates in a range between 2.000 and –1.000 Million Euro with a slight downward trend. The exceptional effects we observe for the year 1997 can hardly be explained by our econometric model presented in the previous section. Only one observation is responsible for the relatively low sum of investments for the tertiary sector in 1997 – in fact there was a large sum of disinvestments (around 7.300 Million Euro) from the UK in the Netherlands. Data for our explanatory variables, however, has not changed that significantly for this year and bilateral relation. Since we can neither control for this outlier with country-to-country nor with time dummies, we excluded this year from our data sample. Using the years 1995 to 1996 and 1998 to 1999 we have 4*24=96 observations for each sector.

Figure 4.1.

Development of sector specific FDI flows in time



Source: EUROSTAT New Cronos Database, own computations

4.3.2. Data on tax rates

In the theoretical as well as in the empirical literature there exist a large number of tax measures. As we have already argued in Chapter 2, there is general agreement that the statutory tax rate may be a misleading indicator for tax incentives and that it is more promising to use effective tax rates instead. This raises the question on which effective tax rate to use. As one may expect that most of the cross-border investment observed by our dependent variable comes in a discrete form, effective average tax rates are more likely than marginal tax rates to give a proper picture of the actual tax burden levied on these investments. Consequently, we use effective average tax rates to measure tax incentives.

Our discussion in Chapter 2 has revealed that even among the measures of effective taxation there exist important differences. Having in mind these differences, we use two different tax measures. First, our analysis makes use of the EATR as proposed by Devereux and Griffith. While it is often argued that this measure is the most preferable, we also consider a backward looking microeconomic tax rate, from now on referred to as average tax rate (ATR). The advantage of the latter measure is that it incorporates all elements of the tax code, including special tax rebates/incentives. ATRs are taken from Büttner (2002) and were also used in the analysis of Gorter and Parikh (2003). Using a sample of approximately six thousand companies, this measure is developed in a first step by dividing the corporate income tax paid by each firm through the pre-tax corporate income. Multinational companies are excluded from the sample[76]. In a second step the effective average tax rate for each country is set equal to the median tax rate paid by its corporations. Table 4.2. gives a short overview for the tax rate differentials calculated for EATRs and ATRs. In same cases these differentials are significantly different from each other. For example, the first column reveals that in 1995 the EATR for German corporations was 10

[76] There are at least two reasons to exclude multinational corporations. First, it is difficult to divide the aggregate income of the corporation into income from several source countries. Secondly, these corporations can easily shift income from one country to another and consequently bias our results. For further discussion see section 2.2.3.

percentage points higher than that of Italian corporations. The third column shows us a different result: Using ATRs, the tax burden of German corporations was 6.4 percentage points lower than that of Italian corporations in this year.

Table 4.2.

*Tax rate differentials between source and target countries**

	EATR		ATR	
Source Country: Germany	1995	1999	1995	1999
Austria	-18	-12	-28,5	-16,7
Belgium/Luxembourg	-15	-9	-15,5	-22,6
France	-20	-11	-4,6	-3,5
Greece	-13	-7	-8,7	-13,2
Italy	-10	-2	6,4	0,3
Netherlands	-19	-13	-8,8	-9,2
Spain	-18	-11	-15,3	-9,8
United Kingdom	-21	-17	-8,3	-10,8
Source Country: Netherlands	1995	1999	1995	1999
Austria	1	1	-19,7	-7,5
Belgium/Luxembourg	4	4	-6,7	-13,4
France	-1	2	4,2	5,7
Germany	19	13	8,8	9,2
Greece	6	6	0,1	-4
Italy	17	1	15,2	9,5
Spain	1	2	-6,5	-0,6
United Kingdom	-2	-4	0,5	-1,6
Source Country: UK	1995	1999	1995	1999
Austria	3	5	-20,2	-5,9
Belgium/Luxembourg	6	8	-7,2	-11,8
France	1	6	3,7	7,3
Germany	21	17	8,3	10,8
Greece	8	10	-0,4	-2,4
Italy	19	5	16,7	11,1
Netherlands	2	4	-0,5	1,6
Spain	3	6	-7	1

Source: Institute for Fiscal Studies, London; Büttner (2002); own computations.

* Positive values indicate that taxes in the target country are higher than taxes in the source country. Negative values indicate that taxes in the target country are lower than taxes in the source country.

4.3.3. Data on other explanatory variables

In order to measure the investment potential of the different target countries, $y_{j,t}$, we employ data on their economic size as approximated by GDP. This data is taken from OECD databases and measures GDP at 1995 prices and exchange rates quoted in billion dollars. Data on bilateral trade relations between source and target country of the investment are from the OECD as well. Here we use the exports from country i to country j, quoted in billion dollars, to measure the volume of trade, and therewith the distance between the two countries. To account for the possibility that the approximation of distance with exports gives us incorrect results, we will employ a direct measure for distance in our sensitivity analysis, as well. We measure geographic distance between countries, δ, as the distance between their capital cities.

Even though most empirical studies report mixed or insignificant results for the effect of labour costs on foreign direct investment, we include this data as a measure for differences in factor prices, $\Delta q_{i,j}$. Information is taken from the US Bureau of Labour Statistics that collects data from national surveys of employment, hours and earnings in the manufacturing sector and harmonizes them. Table 4.3. shows an index of hourly direct pay in manufacturing[77], where labour costs in Germany act as a benchmark. Note, that the data used here is different from unit labour costs since it reveals nothing about labour-productivity. Indices for unit labour costs, again, were not available for all countries and years investigated. Analogous to the tax rate differential we constructed a labour cost differential, $\Delta q^{l}_{i,j,t} = q^{l}_{j,t} - q^{l}_{i,t}$, showing the divergence in factor prices of the two countries.

[77] Under the definition of the U.S. Department of Labour, hourly direct pay includes pay for time worked (basic time and piece rates plus overtime premiums, shift differentials, other premiums and bonuses paid regularly each pay period, and cost-of-living adjustments) and other direct pay (pay for time not worked (vacations, holidays, and other leave, except sick leave), seasonal or irregular bonuses and other special payments, selected social allowances, and the cost of payments in kind), before payroll deductions of any kind.

Table 4.3.

Indexes of hourly direct pay in manufacturing; Germany=100

	1995	1996	1998	1999
Austria	84	75	85	85
Belgium/Luxemburg	91	92	93	93
France	66	67	70	70
Germany	100	100	100	100
Greece	30	32	34	36
Italy	53	60	65	65
Netherlands	80	78	82	84
Spain	43	45	46	47
United Kingdom	46	48	62	64

Source: U.S. Department of Labour, Bureau of Labour Statistics, own computations.

Given the problem associated with the labour cost variable in most studies, we use energy prices as an additional measure for factor prices. For example, differences in energy prices between countries may stem from monopolistic competition in local markets or green taxes imposed by the government. The use of energy as a factor of production is at least well-founded in the secondary sector where a high share of production output stems from the use of heavy machinery. If we bear in mind that FDI in the tertiary sector contains investment in transport, then it is appropriate to use energy prices as a determinant of investment in this sector as well. To quantify the effect of energy prices on the firm's location decision, we use industry electricity prices per Kilowatt-hour as a further variable in our regression. Data stems from the International Energy Agency[78] and reports prices measured in dollars for all the countries in our sample. From this data we constructed an energy price differential $\Delta q^e_{i,j,t} = q^e_{j,t} - q^e_{i,t}$, illustrating differences in energy prices between the source and the target countries of the investment.

[78] The data can be found in the volume: Energy Prices & Taxes – Quarterly Statistics, International Energy Agency, 2001, Paris. Data for the year 1999 was in some cases missing. Using the trend for the years 1994 to 1998, missing values where approximated.

4.4. Empirical Results

4.4.1. Baseline regression

The econometric approach chosen is Weighted Least Squares (WLS) instead of Ordinary Least Squares (OLS). Using a cross-section weighted regression we are able to eliminate cross-section heteroskedasticity in a two stage process. In a first step the cross section weights are computed. They are proportional to the reciprocals of the standard deviation of the disturbances observed in an OLS regression. In a second step, the regression is performed using these weighting factors[79]. All regressions are performed using dummy variables for time and country-to-country fixed effects.

Results using a baseline regression of equation (4.4) are shown in Table 4.4. Columns (1) and (2) present results for the primary sector. In this sector, investment seems to be independent of both tax rates used. Neither the coefficient of the EATR in column (1) nor the coefficient of the ATR in column (2) is significantly different from zero. The same holds for energy prices. This result is plausible when we think of location rents arising from specific resources. In the primary sector, investment is mostly resource driven, and it is thus plausible that it is unrelated to the explanatory variables used in the analysis. For instance, think about the petroleum and natural gas industry in the European Union. FDI in this industry is bound for locations where the corresponding resources are available[80]. But as investment is limited to a particular location, tax rates and other economic parameters become non-relevant[81]. Contrary to this argumentation, not only the size of the target country

[79] In our main analysis, we do not estimate country specific tax-coefficients. Using seemingly unrelated regressions (SURE), it would be possible to estimate coefficients that are country specific. We do not follow the latter approach since country specific coefficients would only rest on very few observations. However, in section 4.4.2. we perform a robustness test using SURE to account for the tax credit status of investment from the UK.

[80] In the sample under consideration this is primarily the United Kingdom.

[81] In a recent study, Dahl (2002) comes to the result that foreign direct investment during the 1990´s into southern African (which is dominated by the primary sector) was independent of

but also labour costs show the expected positive, respectively negative, effect on foreign investment. Different results appear when we look at columns (3) to (6). For both the secondary and the tertiary sector tax rate differentials have a significantly negative impact on foreign direct investment. The coefficient for the secondary sector is somewhat lower than that for investment in the tertiary sector and the latter one also shows a higher level of significance. The interpretation of these findings is that with a given tax rate in the source country, τ_i, a rise in the target country's tax rate, τ_j, increases the tax differential $\Delta\tau_{i,j}$ and reduces the incentives to invest in country j. Results are robust with respect to the tax measure used.

The sign of y_j is significantly positive in all cases, indicating that FDI is positively correlated to the GDP of the target country. This is consistent with the hypothesis that the capacity for investment is higher for a large country than for a small one. Concerning labour costs and energy prices we get mixed results. Both coefficients are insignificant when we use the EATR to measure tax rate differentials. When the ATR measures are used instead, coefficients are significant, but some of them have an unexpected sign. While we can not offer an ad hoc explanation for the unexpected sign concerning energy prices there may be several reasons for the unexpected sign of the labour cost variable. First of all, this could be due to the fact that we can not account for the productivity of labour with the measure used here. Moreover, we may face a considerable measurement error when using average labour costs of the manufacturing sector to explain FDI in the tertiary sector. Likewise, higher labour costs may indicate a better availability of skilled labour. As investment in the tertiary sector is often associated with skilled labour, e.g. in the financial service sector, this may then explain the observed positive correlation.

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the economical and political performance of the host country. Moreover, Angola, a country with plenty of economical and political problems, was the largest beneficiary from FDI due to its large mineral resources.

Table 4.4.

Regressions by sector: Base case

	primary sector		secondary sector		tertiary sector	
	(1)	(2)	(3)	(4)	(5)	(6)
Forward looking tax rate (EATR)	0.555		-8.854*		-13.254***	
	(1.45)		(1.98)		(5.27)	
Backward looking tax rate (ATR)		-0.537		-17.614***		-27.364***
		(0.827)		(4.46)		(16.25)
Target countries economic size	0.876***	0.827***	3.646***	5.007***	1.613***	3.813***
	(5.43)	(5.00)	(3.22)	(5.41)	(3.19)	(7.83)
Labour costs	-1.515***	-1.167***	0.360	-7.077***	0.383	9.935***
	(6.03)	(4.32)	(0.10)	(5.29)	(0.31)	(9.17)
Energy prices	0.176	-0.0378	-5.87	4.480***	-2.445	-13.030***
	(0.44)	(0.10)	(1.37)	(2.77)	(1.51)	(6.98)
R-Squared	0.45	0.39	0.43	0.78	0.58	0.67
Adjusted R-Squared	0.20	0.11	0.17	0.68	0.38	0.52
Observations	96	96	96	96	96	96

Regressions include time and country-to-country specific fixed effects.

Heteroscedasticity robust t-statistics are given in brackets; *, ** and *** indicates significance at the level of 10%, 5% and 1%.

To make the outcome of this baseline regression comparable with other studies, elasticities have to be calculated. Sector specific relative changes in FDI can easily be computed when dividing the outcome of equation (4.6) by the total amount of FDI in each sector. Using EATRs, β_1 transforms into an elasticity of -0.3 for the secondary sector and -0.43 for the tertiary sector. For the ATRs, coefficients transform into a tax-elasticity of -1.4 in the secondary sector and -2.3 in the tertiary sector. In this scenario, the difference between the tax-elasticities is thus notable and the use of aggregated data underestimates the tax-elasticity for the tertiary sector by about 20 to 30 percent[82]. Moreover, we will see below that this difference even intensifies when we extend our model.

4.4.2. Model extension: Controlling for home countries' tax system

Up to this point of our analysis we have not considered the different tax systems of the three source countries of investment. As we have already shown in section 2.1.5., there exist two alternative methods to avoid double taxation of foreign corporate income which have different effects on the incentives to invest abroad. One is to exempt foreign income from taxation in the source country. If the method of tax exemption is applied in the source country, the tax rate differentials used in the analysis give a proper picture of tax incentives. Another way to avoid double taxation of foreign income is to grant a tax credit. In this case, if profits are instantly repatriated, any taxes paid abroad are deducted from overall liabilities in the source country and the difference between the source and target countries' tax rates may become irrelevant for investment decisions. While Germany and the Netherlands follow the exemption method, the UK grants tax credits.

Accordingly, some authors argue that investors from tax credit countries generally have no tax incentive when investing abroad because target countries'

[82] Weighting each sector specific elasticity with the volume of FDI (under the simplified assumption that FDI in the primary sector is close to zero and FDI in the secondary and tertiary sector is approximately the same) leads to: $\beta_1^{mean} = \beta_1^{primary} * 0 + 0.5 * \beta_1^{secondary} + 0.5 * \beta_1^{tertiary}$. The resulting coefficient is -0.365 in case of the EATR and -1.85 in case of the ATR.

tax rates do not matter. For example, Hines (1996) uses investment from the United Kingdom into the United States as a benchmark to capture state fixed effects[83]. We take the difference between credit and exemption systems into account in a Seemingly Unrelated Regression Equation (SURE) where the tax elasticity of investment from the UK is constrained to zero. Results are reported in columns (1) to (6) of Table 4.5. As can be seen, the effects on FDI point in the same direction as before[84]. Notably however, using constraints on the tax incentives, the coefficients for the tax rate differential increase significantly. We can interpret these results as follows: A fraction of foreign direct investment that can not be explained with tax rate differentials (in the situation where the source country's tax system is not considered) turns out to be dependent on tax rates when we take tax credits into account. So, the elasticity of FDI with respect to tax rates is generally underestimated when not accounting for the different tax systems[85].

Moreover, the tax coefficient for the tertiary sector is still much higher than that of the secondary sector, indicating that investment into telecommunication, transport and financial intermediation is more sensitive to tax rate differentials than investment in the manufacturing sector. A comparison with Table 4.5. shows one more result that is remarkable: The difference between the estimators for the secondary and the tertiary sector even increased in our extended model. While the coefficients regarding the EATR, as shown in column (3) and (5), now transform into tax-elasticities of -0.6 and -1.4, those for the ATR are given by -0.7 and -3.3. Again, there is a notable difference of 40 to about 200 percent between the overall elasticity based on aggregated data and the sector specific

[83] For a detailed discussion of this study see section 3.2.1.

[84] The only exception is the coefficient for the ATRs which just become insignificant for investment in the secondary sector.

[85] The effect is quite intuitive. In our baseline regression we face a situation where our data suggests a positive tax rate differential between the United Kingdom and some other countries. Actual FDI flows, however, are not influenced by this tax rate differential since tax credits apply. Hence, our baseline regression undervalues the correlation between tax rate differentials and foreign direct investment that exists in the remaining observations.

tax-elasticity for the tertiary sector[86]. This difference even exceeds the difference we observed in our baseline regression. The procedure above, however, does not take into account that there may be situations in which the tax rate differential matters even with tax credits. Although minimum taxes are limited by the source country's tax rate, taxes can indeed be higher. This is the case whenever the target country levies higher taxes than the source country does. Since the tax credit is limited, any tax payment that is above the tax liability in the home country has to be fully borne by the firm (see section 2.5.1.).

Accordingly, to account for these differences, we set the tax rate differential $\Delta\tau_{i,j}$ equal to zero whenever $\Delta\tau_{i,j}$ is negative and investment comes from the UK. This procedure is in line with the asymmetric incentives investors from the tax credit country face. Using EATRs, the UK has the lowest tax rates of all countries under consideration. Tax rate differentials for the UK are always positive in this case and, accordingly, there will be no changes to our baseline regressions presented in columns (1), (3) and (5) of Table 4. Using ATRs, however, regression results will change. Columns (7) to (9) report regression results that account for limited tax credits. Again, coefficients show the expected negative sign for investment in the secondary and tertiary sector. When compared to our previous results, coefficients (at least in the tertiary sector where a comparison is valid) are in between to what was reported in Table 4 and 5. Hence, one can argue that the elasticity of FDI with respect to tax rates is generally overestimated when the coefficients for tax credit countries are unconditionally constrained to zero.

[86] For the ATRs, the rather large difference between elasticities should not be overvalued since the corresponding coefficient for the secondary sector is not significantly different from zero.

Table 4.5.

Controlling for home countries' tax system

	SURE – tax coefficient for investment from the UK is zero						Accounting for limited tax credit in the UK		
	primary sector		secondary sector		tertiary sector		primary sector	secondary sector	tertiary sector
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Forward looking tax rate (EATR)	-0.014 (0.06)		-18.517*** (4.17)		-39.49*** (6.51)				
Backward looking tax rate (ATR)		-0.131 (0.21)		-9.171 (1.25)		-38.895*** (15.64)	-0.106 (0.19)	-25.606*** (4.87)	-35.247*** (21.06)
Target countries economic size	0.876*** (5.46)	0.888*** (5.52)	4.251*** (4.92)	4.831*** (4.43)	2.787*** (6.00)	3.551*** (7.37)	0.953*** (5.85)	5.058*** (3.33)	2.342*** (5.45)
Labour costs	-1.59*** (6.39)	-1.41*** (5.78)	-5.014** (2.33)	-6.432*** (3.81)	6.846*** (5.70)	8.427*** (7.38)	-1.923*** (8.17)	-5.966* (1.76)	2.482** (2.23)
Energy prices	0.130 (0.33)	-0.842 (0.22)	2.972 (1.37)	4.789*** (3.09)	-14.098*** (6.82)	-11.980*** (6.99)	0.180 (0.43)	0.167 (0.00)	-3.047** (2.21)
R-Squared	0.46	0.44	0.71	0.88	0.62	0.72	0.57	0.42	0.72
Adj. R-Squared	0.21	0.19	0.58	0.83	0.44	0.65	0.37	0.15	0.59
Observations	96	96	96	96	96	96	96	96	96

Regressions include time and country-to-country specific fixed effects.

Heteroscedasticity robust t-statistics are given in brackets; *, ** and *** indicates significance at the level of 10%, 5% and 1%.

4.4.3. Specification Test

To test whether the results obtained above are robust to changes in our econometric specification, we make use of two additional variables. One of them is public inputs. As a proxy for public inputs we use data on annual public investment expenditures as provided by the OECD National Accounts. Public investment expenditures are expected to have a strong impact on the level of public infrastructure and therefore on the production costs of a multinational firm. These expenditures, expressed in terms of national currency and at 1995 prices, are normalized by GDP in order to make countries comparable. The second variable tries to measure agglomeration effects. As has been shown in the previous literature, agglomeration effects, i.e. the proximity to other firms, may have a strong positive impact on FDI. As a measure for agglomeration effects, we use the capital stock from country i in country j in each time period. Data comes again from EUROSTAT. This approach is in line with the empirical findings. For investment into the US, Head et al. (1999) show that the location decision of Japanese firms is strongly determined by the number of already existing Japanese firms at a certain location. For investment into France, Crozet et al. (2004) show that proximity to other firms from the same source country makes a location more attractive.

Columns (1) to (4) of Table 4.6. report coefficients when public infrastructure and agglomeration effects are considered in our regression analysis. As tax coefficients for the primary sector are insignificant in the regressions above, we will concentrate our analysis on the secondary and tertiary sector. As expected, agglomeration effects, approximated by the stock of FDI from country i in country j, promote further investment flows. While the coefficient is insignificant for the secondary sector, it is significant for the tertiary sector. This result holds irrespective of whether we control for the tax system of the home country, or not. For public inputs, we get ambiguous results. As Table 4.6. shows, only investment in the tertiary sector is positively correlated with public investment expenditures. Although the introduction of these additional variables has some weak influence on the size of tax coefficients, our qualitative result, that tax rate coefficients differ significantly between sectors, is confirmed.

Table 4.6.

Regressions by sector: Sensitivity analysis

	Dependent Variable: FDI/EXP				Dependent Variable: FDI*Distance			
	Not Controlled		Controlled		Controlled			
	secondary sector	tertiary sector	secondary sector	tertiary sector	secondary sector		tertiary sector	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forward looking	-10.984*	-19.636***	-16.42***	-49.789***	1.419		-7.216***	
tax rate (EATR)	(1.87)	(6.334)	(2.80)	(11.35)	(0.28)		(3.98)	
Backward looking						-8.727***		-36.226***
tax rate (ATR)						(5.82)		(29.89)
Target countries	3.201	1.252*	3.920***	2.413**	6.996***	6.182***	2.867***	2.929***
economic size	(1.47)	(1.65)	(2.88)	(2.45)	(7.13)	(6.32)	(3.84)	(4.08)
Labour costs	-4.008	4.199***	-5.870***	7.203***	-0.251	-1.251	3.71***	4.911***
	(0.89)	(2.52)	(2.69)	(6.62)	(0.21)	(1.21)	(4.03)	(5.53)
Energy prices	-1.299	-6.503***	3.723	-14.863***	-23.73**	0.461	-9.193***	-5.044***
	(0.24)	(2.77)	(1.22)	(7.49)	(2.33)	(0.36)	(6.35)	(3.40)
Public inputs	-15.501	31.650***	-0.865	35.075***				
	(1.46)	(19.37)	(0.27)	(23.21)				
Agglomeration	0.070	0.045***	0.046	0.050***				
effects	(0.32)	(2.77)	(0.27)	(2.75)				
R-Squared	0.39	0.80	0.71	0.84	0.82	0.80	0.72	0.85
Adj. R-Squared	0.07	0.69	0.56	0.76	0.74	0.70	0.59	0.78

Number of observations: 96; regressions include time and country-to-country specific fixed effects.

Heteroscedasticity robust t-statistics are given in brackets; *, ** and *** indicates significance at the level of 10%, 5% and 1%.

Finally, it may be questioned whether the approximation of distance with exports is correct. Multiplying equation (4.2) with distance, distance weighted FDI can be expressed as a function of our explanatory variables. Columns (5) to (8) of Table 4.6. report regression results for a corresponding specification of equation (4.4) where distance weighted FDI acts as dependent variable[87]. As can be seen, our general results do not change significantly when we use geographic distance instead of exports. Coefficients for both tax variables are still negative and significant[88]. Moreover, our general result of larger tax-elasticities in the tertiary sector carries over to this specification. Given these results, it seems appropriate to use bilateral exports as an approximation for distance.

4.5. Conclusion

At the most basic level, the results derived in this chapter confirm previous empirical work showing that bilateral foreign direct investment in the European Union is deterred by high taxes. The analysis goes further however, in demonstrating that the tax-sensitivity of foreign direct investment flows crucially depends on the economic sector in which the investment takes place. Differentiating FDI flows from Germany, the United Kingdom and the Netherlands by the three main economic sectors, we find that investment in agriculture and mining is not driven by tax incentives. Taxes matter, however, when we analyse FDI flows into the manufacturing and the service sector. Especially investment in the tertiary sector, which is thought to be associated with large spillover effects concerning employment and economic growth, reacts very sensitively to tax rate changes. As our regressions show, these result hold for the case of forward as well as for backward-looking tax measures. For both measures, the tax elasticity of the tertiary sector is 20% to 40% above the aggregate elasticity. Therefore, if one is primarily concerned about FDI in the

[87] We also tested for a linear specification where FDI is the dependent variable and distance enters the right hand side of equation (4). Since results are analogous to those shown in Table 6, but have less explanatory power, they are not presented here.

[88] The coefficient for EATRs in the secondary sector is the only exception.

tertiary sector, then using aggregate elasticities underestimates the effect of taxes on foreign investment.

Clearly, these results have to be interpreted with care, especially because the analysis is based on a relatively small sample size. As in the related studies discussed in section 3.2.2., our data does not allow us to distinguish between greenfield and brownfield investment. Moreover, as FDI seems to be determined by characteristics of individual firms, the available data set does not allow us to explore the determinants of FDI in all details. However, our results indicate important differences in the mobility of FDI for different sector aggregates. We believe that further empirical work at a disaggregated level is needed in order to help governments devise tax policies that do not deter FDI while at the same time ensuring that countries get a fair share of the locational rents a multinational firm earns.

The analysis of the following chapter will make use of the results derived here. If the sensitivity of FDI with respect to one measure of taxation (i.e. the effective average tax rate) is different among sectors, this raises the question whether different types of investment are sensitive to different measures of taxation (e.g. the statutory tax rate) as well. Variation in the tax-sensitivity among investment would imply that these investments are motivated for different reasons. We will use this approach to show that the location decision of German multinational enterprises may be partly determined by income shifting strategies.

CHAPTER FIVE:

Distinguishing tax incentives for real investment and income shifting

5.1. 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 issue concerns the possibility to attract foreign direct investment in the form of physical capital, creating positive spillover effects to the local economy such as increased demand for labour. The other issue is profit shifting, mostly affecting tax revenues. The latter 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 5.1.), they declined from 0.96 percent of GDP to 0.57 percent of GDP in Germany, which equals a decrease of 40 percent[89]. A considerable proportion of

[89] Given this short period of time, there is the possibility that the revenue figures presented in Table 5.1. are simply influenced by changes in the tax code or by the business cycle. German revenue may also be influenced by the process of unification. However, the figures presented here are part of a long time trend that holds for more than twenty five years. We took the figures for 1990 and 1996 since they best cover the period of our econometric analysis.

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 (Weichenrieder, 1996).

Table 5.1.

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.

This problem is certainly not confined to German corporations, but the German case is perhaps 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 which is a traditional instrument for income shifting from one country to another, is the most important future international tax issue for multinational corporations (61%), followed by double taxation relief and foreign tax credits (10% and 13%). While transfer pricing 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 (Ruding Report, 1992, Devereux, 1992). 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; an indicator for income shifting.

While the results of these business surveys indicate that transfer pricing and income shifting actually take place in the European Union, empirical evidence is rather scarce. As has been shown in section 3.3., most studies concern the United States and there exist only two studies so far concerned with the EU.

As the studies by Grubert and Slemrod (1998) and Mintz and Smart (2004) have shown, incentives for real investment and income shifting may be interrelated. A location that otherwise would be unattractive for real investment may become attractive if locating there enables the multinational enterprise to engage in income shifting activities. Other studies, primarily focusing on the determinants of multinationals' location of production, rather than on income shifting, find a significant correlation between effective tax rates and location decisions (see section 3.2.). Like others, Devereux and Griffith (1998b) further control for the possibility of income 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 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 more clear-cut 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 chapter. In the theoretical part of this chapter we argue that investment of firms that face lower transaction costs

when shifting income 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 income shifting. As Wildasin (1986) and Zodrow and Mieszkowski (1986) have pointed out in their theoretical work, public inputs may also play a crucial role in tax competition. To account for their important role in determining the location decision of a multinational firm, we included public inputs as a further variable in both our theoretical and econometric model. Our econometric results show that FDI associated with little opportunities for income shifting (production) is correlated to effective tax rates while FDI that we associated with more opportunities for income shifting (service, finance, R&D) is correlated with the statutory tax rate instead.

A simple and intuitive model of income shifting and location decisions is provided in section 5.2. of this chapter. In section 5.3., we take a closer look at the sources and definitions of the variables used in the econometric analysis. Section 5.4. gives an overview of the econometric approach and presents the empirical results. Section 5.5. concludes.

5.2. Theoretical background

5.2.1. Optimal behaviour of multinationals without income 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[90]. We further assume that the home country is a high tax country and the foreign location is a low tax country. Capital, k_i, is the only variable factor of production and output is

[90] The theoretical analysis is adapted from Haufler and Schjelderup (1999, 2000).

given by the production function $f(k_i)$, which is identical across countries and has the usual properties $f'(k_i) > 0$, $f''(k_i) < 0$. Both countries provide the multinational enterprise with a given level of public inputs g_i. As a public input, we can simply think of infrastructure which the multinational uses proportional to the capital employed and which reduces production costs[91]. By setting output prices to unity, gross profits in country i can then be written as $\pi_i = f(k_i) - c(g_i)k_i r$, where r equals the world interest rate and $c(g_i)$ is a function describing the cost reducing effect of public inputs. Since an increase in g_i will reduce costs, we have $c'(g_i) < 0$. Moreover, assuming decreasing returns to scale in the public input, we have $c''(g_i) > 0$.

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, firms can claim special tax breaks, accelerated deduction, and so on. The tax base the corporate tax rate t_i, is applied on is therefore different from gross profits. Net profits are given by

$$\pi_i = f(k_i) - c(g_i)k_i r - t_i[f(k_i) - \varepsilon_i c(g_i)k_i r] \tag{5.1}$$

where ε_i is a positive parameter describing the deductibility of investment costs. For $\varepsilon_i < 1$ the corporate tax system permits only an incomplete deduction of investment costs while we have accelerated deduction for $\varepsilon_i > 1$. Throughout the rest of the chapter, we will refer to ε_i as a tax-base parameter.

We further assume that taxation follows the source principle. Then all foreign profits are exempted from taxation in the home country, such that total profits of the multinational are given by

[91] Note that the cost decreasing effect of public inputs modelled here is equivalent to the positive output effect of public inputs modelled in other studies. This equivalence follows from the "dual approach of production theory" as proposed by Fuss and McFadden (1978). Proportionality between capital and infrastructure used is introduced for simplicity only. Indeed, our theoretical results hold for any positive relationship between capital and infrastructure used.

$$\begin{aligned}\Pi &= \pi_F + \pi_H \\ &= f(k_F) - c(g_F)k_F r - t_F[f(k_F) - \varepsilon_F c(g_F)k_F r] \\ &+ f(k_H) - c(g_H)k_H r - t_H[f(k_H) - \varepsilon_H c(g_H)k_H r]\end{aligned} \tag{5.2}$$

Maximizing equation (5.2) with respect to the optimal level of capital in each country, we are left with the following first-order conditions:

$$(1-t_F)f'(k_F) + (t_F\varepsilon_F - 1)c(g_F)r = 0 \tag{5.3a}$$

$$(1-t_H)f'(k_H) + (t_H\varepsilon_H - 1)c(g_H)r = 0 \tag{5.3b}$$

Rearranging (5.3a) and (5.3b) to $[(1-t_i)f'(k_i)]/[(1-t_i\varepsilon_i)c(g_i)] = r$, the first-order conditions 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 gross cost of capital.

5.2.2. Optimal behaviour of multinationals with income shifting

We now introduce the possibility to shift income 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 the level of income that is transferred between the two establishments of the multinational by manipulating internal trade prices for final and intermediate goods, interest rates and royalties. As in the related literature (Kant, 1988, Haufler and Schjelderup, 2000), we assume that this strategy generates (non deductible) costs since there are additional efforts that need to be taken in order to conceal the transfer pricing activity from tax authorities. For this purpose we define concealment costs of the following form:

$$\omega = \frac{\theta_j \cdot Q^2}{f(k_F)}$$

The convexity assumed generates an interior solution in which a positive but finite level of income is shifted. We use a quadratic form here for simplicity only. Including production output $f(k_F)$ in the denominator of the cost function takes into account the fact that concealment is less costly the higher the volume of sales in a country[92] and makes the decisions of real investment and income 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 $\theta_j^{\min}$ and infinity[93]. If, for instance, income is shifted from one location to the other by manipulating 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 income shifting, total after tax profits of the multinational are given by

$$\begin{aligned}\Pi &= f(k_F) - c(g_F)k_F r + Q - t_F[f(k_F) - \varepsilon_F c(g_F)k_F r + Q] \\ &\quad + f(k_H) - c(g_H)k_H r - Q - t_H[f(k_H) - \varepsilon_H c(g_H)k_H r - Q] - \omega \\ &= f(k_F) - c(g_F)k_F r - t_F[f(k_F) - \varepsilon_F c(g_F)k_F r] \\ &\quad + f(k_H) - c(g_H)k_H r - t_H[f(k_H) - \varepsilon_H c(g_H)k_H r] \\ &\quad + (t_H - t_F)Q - \omega\end{aligned} \tag{5.4}$$

In this case the multinational can not only decide about k_F and k_H but also about the amount of income shifted from H to F. Differentiating equation (5.4) with respect to Q gives us the optimal level of profit shifting:

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[92] Grubert and Slemrod (1998) argue in a similar way. They assume that the presence of intangible assets decreases the cost of profit shifting. Since our study often refers to transfer pricing, however, the size of output produced abroad seems to be a more convincing measure affecting concealment costs. See section 3.3.3. for a detailed discussion on their analysis.

[93] The minimum value of θ_j ensures that profit shifting is limited in any case.

$$\tilde{Q} = \frac{(t_H - t_F) f(k_F)}{2\theta_j} \tag{5.5}$$

From equation (5.5) it is straightforward to see that, with a lower corporate tax rate t_F, incentives for income shifting increase. The maximum level of $\tilde{Q}$, however, is limited by the gross profits obtained in country H[94]. Substituting (5.5) in (5.4) and differentiating with respect to k_F and k_H, we get the first-order conditions under a strategy including income shifting:

$$(1 - t_F + \frac{(t_H - t_F)^2}{4\theta_j}) f'(k_F) + (t_F \varepsilon_F - 1) c(g_F) r = 0 \tag{5.6a}$$

$$(1 - t_H) f'(k_H) + (t_H \varepsilon_H - 1) c(g_H) r = 0 \tag{5.6b}$$

Comparing (5.3) with (5.6), it becomes obvious that investment is distorted by the term $(t_H - t_F)^2 f'(k_F) / 4\theta_j$ towards the low tax country F if income 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 concealment costs θ_j.

Using equation (5.6a), we can derive the minimum level of concealment costs $\theta_j^{\min}$ which ensures that investment in the foreign country is finite. This is the case as long as the marginal cost of capital $(t_F \varepsilon_F - 1) c(g_F) r$ is higher than the marginal gain from income shifting $(t_H - t_F)^2 f'(k_F) / 4\theta_j$. Solving this condition for $\theta_j^{\min}$, we get the minimum specific concealment costs $\theta_j^{\min} = [(t_H - t_F)^2 f'(k_F)] / [(4(t_F \varepsilon_F - 1) c(g_F) r)]$ that assures an interior solution.

[94] In the following we will assume that $\tilde{Q}$ is always lower than profits in the high tax country H. First of all, profit shifting is limited by the concealment costs. Additionally, due to a home bias, we can assume investment in the home country to be relatively high as compared to investment in the foreign country. Finally, we can argue that F is only a small tax haven whereas H is the rest of the world. In this case, gross profits in H are rather high and should therefore exceed $\tilde{Q}$.

5.2.3. Concealment costs and the importance of alternative tax measures

In a next step, we want to show that either the statutory tax rate or the effective tax rate, which is a function of the tax-base parameter and the statutory tax rate, is the predominant variable determining investment in country F. Furthermore, we want to show that it is the concealment cost θ_j that determines which of the two tax measures mentioned above is predominant for the multinationals investment decision. Therefore we have to define an effective tax rate T_F, which measures marginal taxes paid by the firm as a fraction of marginal pre-tax profits:

$$T_F = \frac{(t_F - (t_H - t_F)^2 / 4\theta_j) f'(k_F) - t_F \varepsilon_F c(g_F) r}{f'(k_F) - c(g_F) r} \tag{5.7}$$

Note that the second term in the numerator depicts the tax savings that stem from cost deductions and is therefore comparable to the parameter A employed in section 2.2. Hence, equation (5.7) is comparable to the EMTR of section 2.2.2. Using equation (5.7), we can rewrite equation (5.6a) as

$$(1 - T_F) \cdot [f'(k_F) - c(g_F) r] = 0 \tag{5.8}$$

Concentrating our analysis on the foreign country we take all other variables as given, but note that we assume positive income in country H that can be shifted to country F. As we can see from (5.7) and (5.8), investment in country F is a function of three different country specific variables: the foreign statutory tax rate, the level of public inputs offered by the foreign country, and the foreign tax-base parameter ε_F. Note that, all other things equal, the effective tax rate is negatively correlated with the tax-base parameter ε_F; a decrease in ε_F which reduces the deductibility in investment costs will in any case result in a higher effective tax rate. We now implicitly differentiate equation (5.8) with respect to the effective tax rate, public inputs and the statutory tax rate. We get the following elasticities:

$$\eta_{k,T} = \frac{dk_F}{dT_F}\Big|_{\Pi=const.} = -\frac{\partial T_F}{\partial k_F} = \frac{f'(k_F) - c(g_F)r}{S} < 0 \tag{5.9a}$$

$$\eta_{k,g} = \frac{dk_F}{dg_F}\Big|_{\Pi=const.} = -\frac{\partial g_F}{\partial k_F} = \frac{(1 - t_F\varepsilon_F)c'(g_F)r}{S} > 0 \tag{5.9b}$$

$$\eta_{k,t} = \frac{dk_F}{dt_F}\Big|_{\Pi=const.} = -\frac{\partial t_F}{\partial k_F} = \frac{\left[1 - \frac{(t_F - t_H)}{2\theta_j}\right] f'(k_F) - \varepsilon_F c(g_F)r}{S} \gtreqless 0 \tag{5.9c}$$

where S equals the second order condition for optimal investment in country F:

$$S = \left[1 - t_F + \frac{(t_F - t_H)^2}{4\theta_j}\right] f''(k_F) < 0$$

The negative sign of equation (5.9a) reveals that the investment elasticity with respect to the effective tax rate is negative. Hence, any decrease in effective taxation will encourage investment. Since $\partial T_F / \partial \varepsilon_F < 0$ from equation (5.7), equation (5.9a) then implies that more generous deductibility of investment costs that decreases effective taxation will lead to more investment. From equation (5.9b) we can observe that an increase in public inputs will promote investment. The sign of equation (5.9c) is ambiguous. As long as the firm pays positive taxes, $\left[1 - (t_F - t_H)/2\theta_j\right] f'(k_F) > \varepsilon_F c(g_F)r$, a higher statutory tax rate will reduce investments[95].

It is straightforward to see from equations (5.9a) to (5.9c) that concealment costs have a different impact on the size of the investment elasticity with respect to the effective tax rate and public inputs on the one hand and the statutory tax rate on the other. Differentiating elasticities with respect to concealment costs we get:

[95] Our last results turn around if the tax base parameter ε_F is rather large. In this case, it is possible that the firm has negative tax payments such that investment is subsidised. In this case, any increase in the statutory tax rate will further increase the subsidy and hence promote investment.

$$\frac{\partial|\eta_{k,T}|}{\partial\theta_j}=\frac{\left[f'(k_F)-c(g_F)r\right]\left[-(t_H-t_F)^2/4\theta_j^2\right]}{\left[1-t_F+\frac{(t_F-t_H)^2}{4\theta_j}\right]^2 f''(k_F)}>0 \tag{5.10a}$$

$$\frac{\partial|\eta_{k,g}|}{\partial\theta_j}=\frac{(1-t_F\varepsilon_F)c'(g_F)r(t_H-t_F)^2/4\theta_j^2}{\left[1-t_F+\frac{(t_F-t_H)^2}{4\theta_j}\right]^2 f''(k_F)}>0 \tag{5.10b}$$

$$\frac{\partial|\eta_{k,t}|}{\partial\theta_j}=\frac{\left[-\left[1-(\frac{t_F-t_H}{2\theta_j})\right]f'(k_F)-\varepsilon_F c(g_F)r\right]\left[-(t_H-t_F)^2/4\theta_j^2\right]}{\left[1-t_F+\frac{(t_F-t_H)^2}{4\theta_j}\right]^2 f''(k_F)}$$

$$<0 \tag{5.10c}$$

$$\cdot\frac{(\frac{t_F-t_H}{2\theta_j^2})f'(k_F)S-\left[-\frac{(t_F-t_H)^2}{4\theta_j}f''(k_F)\left[1-(\frac{t_F-t_H}{2\theta_j})\right]f'(k_F)\right]+\frac{(t_F-t_H)^2}{4\theta_j}\varepsilon_F c(g_F)rf''(k_F)}{S^2}$$

Both equations, (5.10a) and (5.10b), are obviously positive since we have negative numerators and denominators. Consequently, higher concealment costs will increase the elasticity with which investment reacts to changes in depreciation allowances and the supply of public inputs. The derivation of equation (5.10c) is shown in the Appendix 5.A.1. This equation has a negative sign since the positive numerator is divided by a negative denominator. The negative sign of (5.10c) implies that the higher are concealment costs, the lower is the elasticity with which investment reacts to changes in the statutory tax rate. In fact, equation (5.9c) describes a negatively sloped function in θ_j, such that $|\eta_{k,t}(\theta_j)|$ converges to $-f'(k_F)/f''(k_F)$ for $\theta_j \rightarrow \theta_j^{\min}$ and to $\left|\left[f'(k_F)-\varepsilon_F c(g_F)r\right]/(1-t_F)f''(k_F)\right|$ for $\theta_j \rightarrow \infty$.

As Appendix 5.A.2. shows, there exists a point of intersection between $|\eta_{k,t}(\theta_j)|$ and either $|\eta_{k,T}(\theta_j)|$ or $|\eta_{k,g}(\theta_j)|$ at $\widetilde{\theta}_j$ for any ε_F above one. Note that a value for ε_F above one implies that the effective tax rate the firm has to pay is lower than the statutory tax rate. Hence, there always exists a point of intersection if the

effective tax rate is lower than the statutory tax rate. We can summarize these results in:

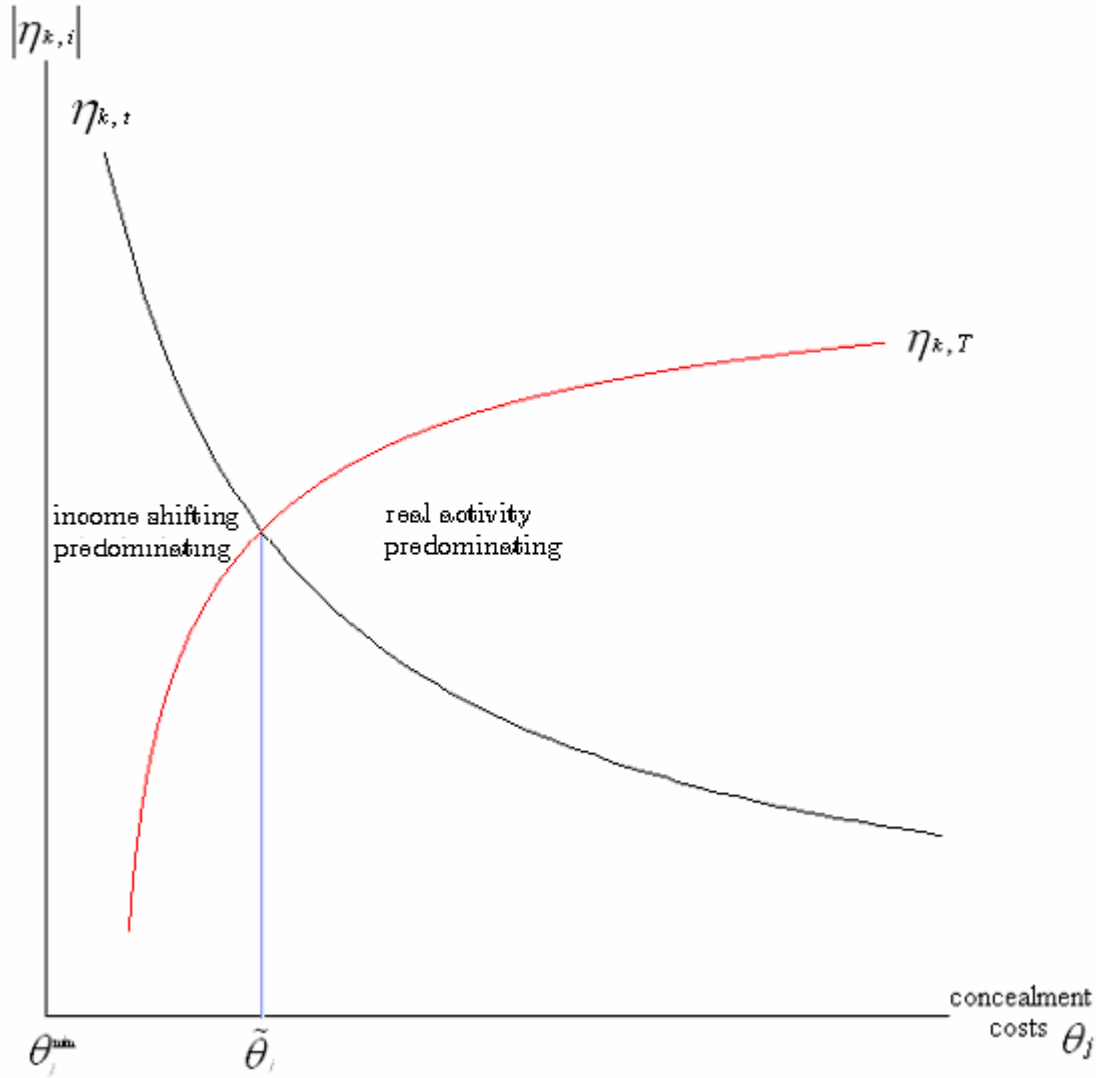
Proposition 5.1.: *As long as it holds that* $t_F > T_F$*, there exists a point of intersection* $\widetilde{\theta}_j$*. For* $\tilde{\theta}_j < \theta_j$ *investment decisions react more sensitively to changes in the effective tax rate. For* $\tilde{\theta}_j > \theta_j$ *investment decisions react more sensitively to changes in the statutory tax rate.*

Proposition 5.1. can be best illustrated graphically with Figure 5.1. where the sensitivity of investment with respect to statutory and effective taxation is plotted as a function of the firm specific transaction cost parameter θ_j. One can argue that while the statutory tax rate is predominant for investment decisions as long as the firm specific transaction costs are lower than $\widetilde{\theta}_j$, the tax-base parameter (respectively public inputs) is predominant if θ_j is higher than $\widetilde{\theta}_j$.

This result is quite intuitive, since net profits in country F come from two different sources. One of them is real economic activity, affected by $(1-t_F)f'(k_F)+(t_F\varepsilon_F-1)c(g_F)r$, the other source is tax savings through income shifting, affected by $(t_H-t_F)^2 f'(k_F)/4\theta_j$. 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, income shifting is the driving force inducing investments in country F for $\theta_j < \widetilde{\theta}_j$ and real economic activity is the main determinant of investment as long as $\theta_j > \widetilde{\theta}_j$. In the extreme case where θ_j is equal to infinity, such that income shifting is prohibited and real activity is the only source of income, investment depends on the effective tax rate, which incorporates the statutory tax rate, the tax-base parameter, 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.

Figure 5.1.

Firm specific concealment costs and dominating economic activity



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

and hence less income shifting, the influence of effective taxes and local inputs grows, while the influence of statutory 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 the effective tax rates or public inputs and investment, we have (indirect) evidence for income shifting.

5.3. Data Sources and description

5.3.1 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 globalisation 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 approximately 15% of German outward FDI[96].

Built on these annual reports a panel-like dataset of time series for individual companies is constructed[97]. 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

[96] The database indirectly covers almost one seventh of FDI stocks under review by the Deutsche Bundesbank for the balance of payments statistics. When we 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.

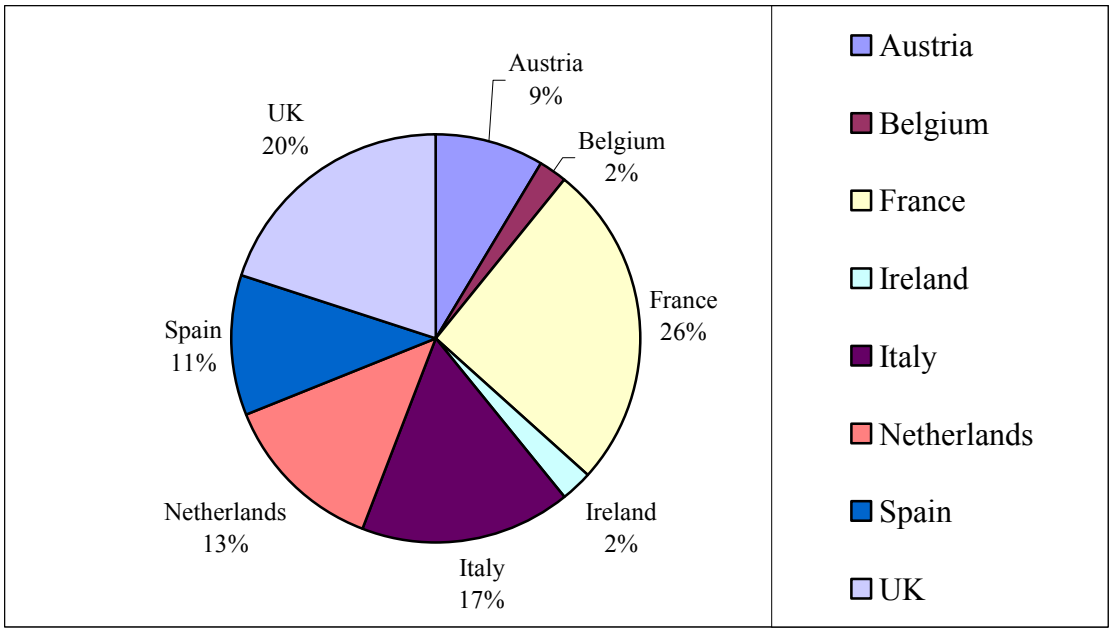
[97] A detailed description of the database is given by Döhrn (2001) or Döhrn and Radmacher-Nottelmann (2000). The interested reader is referred to these papers.

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. Note that the definition of a "foreign activity" here is far less specific than that laid down in section 1.2.1.: A "foreign activity" is defined as any kind of investment of a German multinational abroad. There is no threshold applied neither on the share of equity nor on the total sum of the investment. Moreover, foreign activities do not only comprise investments but also co-operations with foreign enterprises. Count data on the economic function of the activity acts as dependent variable in our econometric analysis. Sufficient data is available for the years 1991 to 1998 and eight European host countries, Austria, Belgium, France, Ireland, Italy, the Netherlands, Spain and the United Kingdom, leaving us with 64 different counts.

Figure 5.2.

Share of German multinationals' foreign activities, 1991 to 1998



Source: RWI-Database Globalization, own calculations.

As shown in Figure 5.2., 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. We separate count data by the economic function of the activity. Due to the specific methods involved in the process of data collection, however, detailed data about the economic function of an affiliate has to be interpreted with caution. Therefore, we concentrate our analysis on a distinction between two broad categories of economic activities, "service" and "production".

Figure 5.3.

Composition of FDI subsets

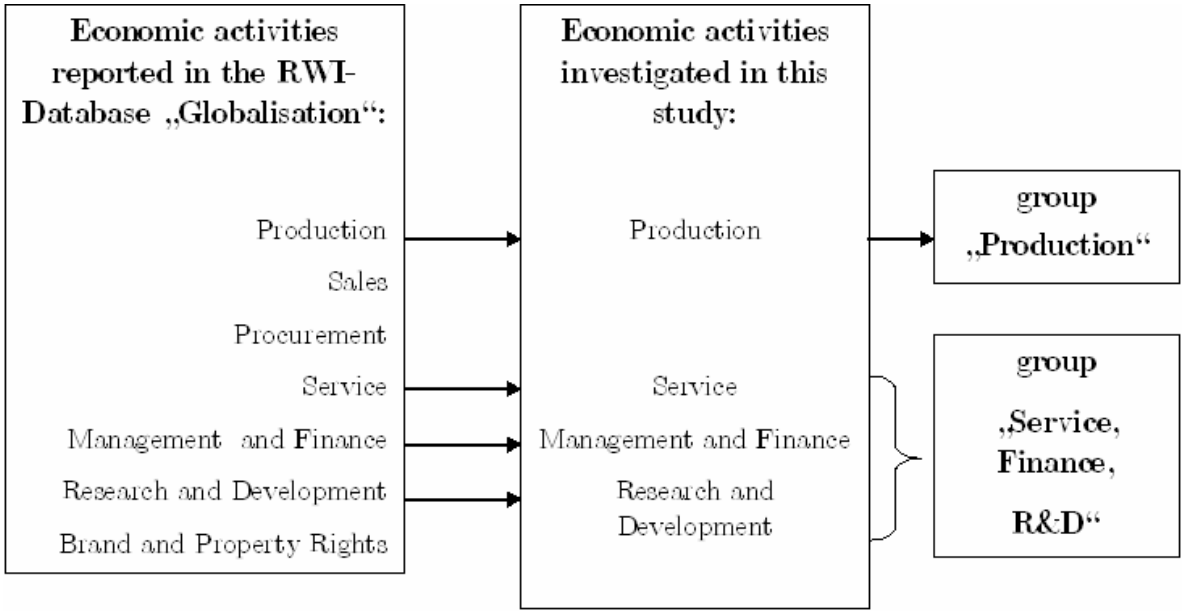


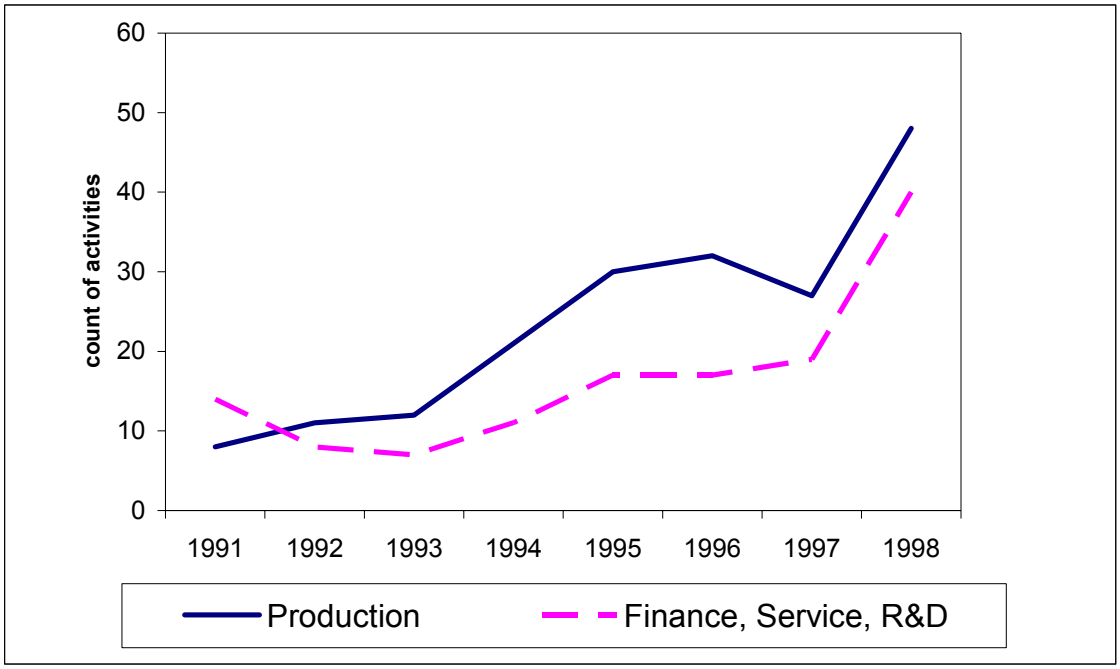
Figure 5.3. provides an overview of the selection process: on the one hand we have a group including activities within the functional area of management and finance, research and development and services. We associate all these activities with the provision of some kind of overhead services to the parent company. On the other hand we have a group consisting of engagements which are only undertaken in purpose of production. Activities which can not be clearly assigned to one of these two categories were excluded from the database.

The number of activities in each group is roughly the same. 189 of 322 activities observed between 1991 and 1998 were 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 5.4. 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.

Figure 5.4.

German multinationals' foreign activities by economic function, 1991 to 1998



Source: RWI-Database Globalization, own calculations.

The fundamental idea of this chapter is that these two groups differ from each other in the degree profits can be shifted between countries[98] 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.

[98] Genschel (2002) expects the costs for profit shifting into firms located in the second group (production) to be much higher than that for the first group.

5.3.2. Data on tax rates

There are two different measures of corporate taxation used in the analysis. One is the effective average tax rate T_i, which is a function of the corporate tax rate and the tax base. Clearly, following our theoretical model presented in section 4.2., the use of marginal effective tax rates seems to be appropriate. However, as our dependent variable consists of count data on the number of activities of German multinationals abroad, which are of a discrete nature, an effective average tax rate should be the preferred measure for our empirical analysis. We use here the implicit microeconomic measure (ATR) which we have already employed in Chapter 4. Since multinational enterprises are excluded from the calculation of tax rates, these measures can be assumed to be independent from income shifting activities[99].

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 5.2. presents figures for effective and statutory tax rates. Note that we do not incorporate tax rates for Germany in our analysis. Differences in the German tax rate over time will be captured by time fixed effects[100]. While the statutory tax rate is very stable over time (most of the variance comes from the implementation or abolishment

[99] Nevertheless, tax rates can be biased by other forms of income shifting such as shifting between corporate and personal income. This possibility is recently under discussed by Lindhe et al. (2002) in the context of the Nordic Dual income tax. Empirical evidence for income 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 income shifting activities.

[100] Theoretically, to make use of cost depreciations in high tax countries, German multinationals may locate there as well. In this case, tax incentives have to be measured as the absolute value of the difference between the foreign and the German statutory tax rate so the latter has to be considered as well. However, for the time period analysed here, the German tax rate is the highest in our sample. Such "symmetric" incentives for income shifting do therefore not exist and the German tax rate is not required.

of several surtaxes), there is a relatively high variance in the effective tax rates. Also, effective tax rates are often lower than statutory tax rates. 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%. However, for our empirical analysis, we need a measure of the effective tax rate of multinational firms which face only the reduced statutory tax rate of 10%. We take account of this problem in the robustness check in section 5.4.3.

Table 5.2.

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.*

5.3.3 Data on other explanatory variables

Beside the two measures of taxation, we are most interested in a measure of public inputs g_i. As a proxy for public inputs we use data on annual public investment expenditures as provided by the OECD National Accounts. Public investment expenditures are expected to have a strong impact on the level of public infrastructure and therefore on the production costs of a multinational firm. 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 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 a proxy for market size[101]. Finally, labour costs as measured by hourly direct pay in the manufacturing sector are included to control for country differences in factor costs[102].

5.4 Econometric approach and empirical results

5.4.1. Econometric approach

For count data, like the number of engagements used in our analysis, the Poisson distribution is the standard reference since it describes phenomena with

[101] 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. A close link between German exports and FDI was observed in an empirical study of the Deutsche Bundesbank (1997). It would be promising, therefore, to include German exports in the econometric analysis, but GDP and exports are in fact strongly correlated with each other. A simultaneous use of both these variables in the econometric analysis would therefore cause a problem of multicollinearity. However, using German exports instead of host countries GDP as independent variable in the regression does not change the results reported below.

[102] A detailed description on the source and properties of the labour costs variable is given in section 4.3.3.

non-negative integer outcomes where zero is a frequent observation. The Poisson model, however, relies on some very restrictive assumptions and is especially invalid in the case of overdispersion, i.e. if the variance exceeds the mean of the random variable. An alternative distribution that accounts for the possibility of overdispersion is the negative Binomial distribution. So, the number of engagements n is modelled as a negative binomially distributed random variable[103]. The likelihood of observing a count n of engagements in country i in year t is:

$$P(n_{i,t}) = \frac{\Gamma(a + n_{i,t})}{\Gamma(a)\Gamma(n_{i,t})}\left(\frac{1}{1+\kappa}\right)^{a}\left(\frac{\Psi}{1+\Psi}\right)^{n_{i,t}} \tag{5.11}$$

where $\Gamma(\cdot)$ denotes the gamma function. The two parameters a and κ determine the mean and the variance of the random variable: $E(n_{i,t}) = a \cdot \Psi = \lambda_{i,t}$ and $Var(n_{i,t}) = \lambda_{i,t}(1+\Psi)$.

The corresponding link-function 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

$$\lambda_{i,t} = \exp(\beta X_{i,t}) \tag{5.12}$$

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[104]. With tax rates, public inputs, GDP and labour costs as exogenous variables, our baseline regression can be written as:

$$\lambda_{i,t} = \exp(\alpha_i + \alpha_t + \beta_1 T_{i,t} + \beta_2 t_{i,t} + \beta_3 g_{i,t} + \beta_4 y_{i,t} + \beta_5 w_{i,t} + e_{i,t}) \tag{5.13}$$

---

[103] We did perform regressions based on the Poisson distribution as well. Although the choice of the underlying distribution affects our quantitative results to some degree, qualitative results are similar for the Poisson distribution and are therefore not reported here.

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

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 $e_{i,t}$ is the error term.

The parameter β_i estimated from regression (5.13) 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.

5.4.2. Results for the baseline regression

Table 5.3. shows the econometric results based on regression (5.13). 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 public infrastructure investment. Empirical results do not support our theoretical finding that public inputs have a positive impact on the location decision of German multinationals. The coefficient has a positive sign, indicating that an increase in infrastructure investment attracts multinational activities, but it is not significantly different from zero (shown by the small z-value). As indicated by the positive parameter for GDP, market potentials may also play an important role in determining investment decisions. This result is plausible since locational advantages appear when production takes place in a large country and transport costs almost disappear.

Completely different results appear 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, it is the statutory tax rate and not the effective tax rate which significantly influences the location decision. Variation in the dependent variable

can not be explained by the effective tax rate, public inputs and 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 5.2. where either the statutory tax rate or the effective tax rate and public inputs determine the investment decision. The only exception here is public infrastructure investment which acts as a proxy for public inputs. However, measuring public inputs is a very difficult task and public infrastructure investments are obviously a very rough approximation for public provided goods and services that reduce firms' production costs. 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 income shifting is almost prohibitive so that locational advantages such as the effective tax rate and market size 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 income 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 parameters relating to locational advantages are insignificant since these parameters do not directly influence the decision on income 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 income. Our results therefore give us indirect evidence for income shifting. Furthermore, the analysis shows us that shifting is limited to the kind of firms that face low transaction costs for this activity and are more independent from location specific factors of production.

Table 5.3.

Regressions by economic function: Base case

	Production		Service, Finance, R&D			Pooled Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Effective tax rate, T_i	-1.945**	-2.015**		0.065	-0.007		-0.515
	(-2.021)	(-1.893)		(0.090)	(-0.010)		(-0.973)
Statutory tax rate, t_i	2.663		1.755	-6.544**		-6.540**	-1.645
	(1.156)		(0.787)	(-2.406)		(-2.403)	(-0.948)
Public inputs, g_i	0.673	0.723	0.483	0.764	0.588	0.782	0.522
	(0.845)	(0.924)	(0.612)	(0.843)	(0.676)	(0.885)	(0.899)
GDP, y_i	5.796*	5.567*	5.777*	-4.614	-2.122	-4.624	0.117
	(1.844)	(1.823)	(1.816)	(-1.568)	(-0.788)	(-1.570)	(0.055)
Labour costs, w_i	-0.420	-0.368	-0.798	0.807	0.128	0.796	0.113
	(-0.398)	(-0.353)	(-0.729)	(0.951)	(0.158)	(0.947)	(0.175)
Pseudo-R-Squared	0.84	0.84	0.83	0.75	0.65	0.75	0.87
Adj. R-Squared	0.76	0.76	0.75	0.63	0.50	0.64	0.80
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.

Note, however, that this interpretation of the qualitative effects is only valid under the assumption that firms in both groups face the same effective tax rate. Suppose, for example, that firms in the service group can not make use of the generous depreciation allowances of a host country, simply because there is "nothing to deduct". The effective tax rate of these firms would be equal to the statutory tax rate. Therefore, we can not argue unambiguously that the observed qualitative differences between the two groups stem from income shifting in this case[105]. Testing for this possibility is very difficult in practise since our data does not allow us to distinguish tax rates across groups. One may argue, however, that there is anecdotal evidence that at least firms with large R&D activities make use of generous cost deductions. Moreover, Clark (2004) presents implicit microeconomic effective average tax rates for different industries in Belgium for the year 1998. Although there is variation in the tax rate among industries, his figures do not show that the effective tax rate faced by industries we may assign to our service group, i.e. financial services, are closer to the statutory rate than those of manufacturing industries.

However, despite this remaining ambiguity there are remarkable quantitative differences in the response of investments to changes in the tax parameters. Since we have expressed all our variables in logarithmic terms, the observed regression parameters shown in Table 5.2. 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. 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 more than six percent. A comparison of the two elasticities reveals that the response to changes of the tax parameters in the service group is approximately 300 percent higher than the response in the production group.

[105] I thank Clemens Fuest for pointing this out.

In Chapter 4 we investigated the effect of changes in effective taxation of capital across economic sectors. Not distinguishing between firms with low and high opportunities for income shifting, our findings suggest that the tax-elasticity of firms in the service and transportation sector is only 50 percent higher than that in the manufacturing sector. The difference between the 50 percent obtained in Chapter 4 and the 300 percent obtained here are a further sign for income shifting.

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. Although they have the expected sign, all tax related 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[106].

In the remaining columns of Table 5.3. we tested whether the simultaneous use of the two tax measures in one regression biases our results. Since the effective tax rate is a function of the statutory tax rate there is a high possibility that it is not exogenous, but endogenously given by the statutory tax rate. Using the effective and statutory tax rate in one regression may result in multicollinearity. Although observed correlation between the two variables is almost negligible in our sample[107], we tested for this possibility. Therefore we ran two additional

[106] 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, it can be assumed that 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 (1998b): 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.

[107] $\mathrm{Cov}[\log(T_i),\log(t_i)]=0.09$.

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: while the effective tax rate is significant for the production group, the statutory tax rate is significant for the service group.

5.4.3. Specification 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 columns (1) to (3) of Table 5.4. 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 grows after exclusion in the first group (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 25 percent and loses significance)

One explanation for observed changes in the first group could be the fact that the effective tax rates of Ireland and Italy used in the econometric analysis are too "high". Tax induced investments in these countries are not treated as tax induced and are 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 10 percent[108]. Because of this low tax rate the multinational decides to locate in Ireland. Our econometric model, however,

[108] Assuming equal treatment of multinational and local firms concerning depreciation allowances we get an effective tax rate of approximately 5 percent (dividing the effective tax rate of 15 to 20 percent by the regular statutory tax rate of 35 to 40 percent we get a ratio of approximately 0.5. Multiplying this ratio with the statutory tax rate for multinational firms we get an effective tax rate of about 5 percent).

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 to 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[109]. As expected, the tax sensitivity of investment in the second group declines after adjusting our sample.

Furthermore, we tested if the composition of the service category, which is an aggregate of activities underdone for three different purposes, influences our results. Therefore we changed the composition of the service category by excluding either Finance or Research and Development from the service category. As we can see from the two regressions reported in columns (4) and (5) of Table 5.4., results for service based activities are robust to changes in the composition of the category.

Certainly, the counts of activities used in the analysis differ substantially in many dimensions. One of them is the type of transaction, i.e. if the activity is a merger, the start-up of a new company, et cetera. Taking a closer look at the data, we are able to identify some heterogeneity between the production and the service category: the relative share of mergers is substantially higher in the production category than in the service category. As Swenson (2001a) finds for the United States, the tax-sensitivity of FDI crucially depends on the type of FDI. Her results indicate that new plants and plant expansions appear to be

[109] As 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.

deterred by high state taxes, while mergers and acquisitions are instead positively correlated with tax rates (compare section 3.2.3.). Consequently, results for our two categories could be determined by differences in transaction types rather than by differences in the functional form of the activity. Using dummy variables for the different shares of mergers in the two groups, we controlled for this possibility. With *trans_p* we measure the share of mergers and acquisitions in the production group while *trans_s* measures the same share in the service group. We test for two possible relations between these shares and the exogenous variables. In column (6) and (8) of Table 5.4. we included the dummy as a further explanatory variable to test if the type of transaction has an effect on all variables that determine the count of activities. In column (7) and (9) we linked the transaction type dummy to the significant tax variable assuming that differences with respect to the type of transaction are limited to taxation only. Results to not change significantly (there is only a 10 percent increase in the observed elasticity of the service group) if we include the dummy variables which are themselves insignificant. Thus, it must indeed be the distinction between production and service that drives the different results for the two categories. 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 qualitative results derived from our database are robust with respect to the exact specification of the model.

Table 5.4.

Regressions by economic function: Sensitivity analysis

	Exclusion of Ireland and Italy			Changes in the composition of the service category		Including transaction type dummies			
	Production	Service, Finance, R&D		R&D excluded	Finance excluded	Production		Service, Finance, R&D	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Effective tax rate	-2.667**	0.924		-0.540	0.239	-1.922**	-1.945**	-0.070	-0.067
	(-2.222)	(1.067)		(-0.692)	(0.312)	(-1.988)	(-2.011)	(-0.094)	(-0.089)
Effective tax rate * trans_p							0.001		
							(0.203)		
Statutory tax rate	3.433	-5.244*	-5.080*	-6.604**	-6.408**	2.591	2.645	-7.224**	-7.274**
	(1.241)	(-1.816)	(-1.744)	(-2.254)	(-2.287)	(1.127)	(1.149)	(-2.555)	(-2.573)
Statutory tax rate * trans_s									0.038
									(0.782)
Public inputs	0.971	-0.256	-0.068	1.237	0.760	0.672	0.675	0.945	0.953
	(0.664)	(-0.243)	(-0.066)	(1.266)	(0.807)	(0.842)	(0.832)	(0.907)	(0.914)
GDP	7.323**	-3.972	-4.859	-4.747	-4.181	5.537*	5.796*	-4.727	-4.706
	(2.031)	(-0.941)	(-1.165)	(-1.534)	(-1.329)	(1.748)	(1.840)	(-1.614)	(-1.604)
Labour costs	-0.657	1.376	1.221	0.654	0.879	-0.429	-0.420	0.882	0.882
	(-0.633)	(1.512)	(1.358)	(0.753)	(0.952)	(-0.405)	(-0.398)	(1.064)	(1.065)
trans_p						0.085			
						(0.541)			
trans_s								0.130	
								(0.771)	
Pseudo-R-Squared	0.87	0.74	0.72	0.71	0.75	0.84	0.84	0.75	0.74
Adj. R-Squared	0.79	0.58	0.57	0.58	0.64	0.76	0.76	0.61	0.61
Observations	48	48	48	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.

5.5. Conclusion

In this chapter we have analysed count data on foreign engagements of German multinationals differentiated by their economic function. This is done in order to investigate if there is substantial variation in the determinants of FDI between functional groups. Results indicate that foreign engagements in real activity depend on variables that refer to locational advantages, e.g. GDP or the effective tax rate, measuring the actual rather than the statutory burden of taxation. Completely different outcomes appear when we focus on 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) income shifting. Instead of locational advantages, investments in these groups only follow the statutory tax rate. Under the assumption that firms in both groups face the same effective tax rate this gives us indirect evidence for income 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.

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 elements 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.

As we have seen in the analysis, a larger statutory tax rate for investments undertaken in purpose of real activity (production) can be balanced by other location factors such as GDP which acts as a proxy for market potentials. Consequently, from this point of view, there is only limited scope for a "race to the bottom" in effective corporate tax rates across Europe, as is feared by many scholars. On the other hand, income 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. This confirms previous results already presented in Chapter 3. In particular high tax countries, which are harmed from decreasing tax revenue, may react to income shifting with the use of strategies that limit these activities. However, as we will see in our theoretical analysis of Chapter 6 below, the use of such strategies may reinforce the decrease in tax revenue.

5.A. Appendix to Chapter 5

5.A.1. Deriving of the sign of equation (5.10c)

Rearranging equation (5.10c) we get:

$$\frac{\partial|\eta_{k,t}|}{\partial\theta_j}=\frac{\overbrace{\left[-\left[1-(\frac{t_F-t_H)}{2\theta_j})\right]f'(k_F)-\varepsilon_F c(g_F)r\right]\left[-(t_H-t_F)^2/4\theta_j^2\right]}^{(I)}}{\underbrace{\left[1-t_F+\frac{(t_F-t_H)^2}{4\theta_j}\right]^2 f''(k_F)S^2}_{(II)}}$$

$$\cdot\overbrace{(\frac{t_F-t_H)}{2\theta_j^2})f'(k_F)S}^{(III)}-\overbrace{\left[-\frac{(t_F-t_H)^2}{4\theta_j}f''(k_F)\left[1-(\frac{t_F-t_H)}{2\theta_j})\right]f'(k_F)\right]+\frac{(t_F-t_H)^2}{4\theta_j}\varepsilon_F c(g_F)rf''(k_F)}^{(IV)} \tag{A.5.1}$$

The denominator of equation (A.5.1), (II), is clearly negative. While the first term (I) of the numerator shows a positive sign, this is the case for the terms (III) and (IV) as well. So, the numerator will be positive as long as it holds that $(III)>(IV)$.

Substitution of S in (III) and dividing by $f'(k_F)$, $f''(k_F)$ and θ_j gives:

$$\left[\frac{(t_F-t_H)}{2\theta_j}-t_F\frac{(t_F-t_H)}{2\theta_j}+\frac{(t_F-t_H)^3}{8\theta_j^2}\right]>\left[-\frac{(t_F-t_H)^2}{4}+\frac{(t_F-t_H)^3}{8\theta_j}+\frac{(t_F-t_H)^2\varepsilon_F c(g_F)r}{4f'(k_F)}\right] \tag{A.5.2}$$

Rearranging yields:

$$\frac{(1-t_F)}{2\theta_j(t_F-t_H)}+\frac{(t_F-t_H)}{2\theta_j^2}-+\frac{(t_F-t_H)}{2\theta_j}>\frac{\varepsilon_F c(g_F)r}{f'(k_F)}-1 \tag{A.5.3}$$

Since it follows from a positive effective marginal tax rate that $f'(k_F)>\varepsilon_F c(g_F)r$, the right hand side of equation (A.5.3) has to be negative. Hence, to have $(III)>(IV)$ it is sufficient that the left hand side of (A.5.3) is positive. Multiplying the left hand side with $2\theta_j(t_F-t_H)$, we get:

$$\left[1-t_F-\left(t_F-t_H\right)^2\right]\theta_j+\left(t_F-t_H\right)^2>0 \tag{A.5.4}$$

Since $\left(t_F-t_H\right)^2>0$, equation (A.5.4) will hold as long as $\left[1-t_F-\left(t_F-t_H\right)^2\right]>0$. Since tax rates can only vary between zero and one and we know that t_H is an upper bound for t_F, this is the case for any possible combination of statutory tax rates. Hence, the numerator of (5.10c) will be positive. Given the negative sign of the denominator, equation (5.10c) shows a negative sign.

5.A.2. The existence of $\widetilde{\theta}_j$

Inserting $\theta_j \rightarrow \theta_j^{\min}$ in equations (5.9a) and (5.9b), the investment sensitivity with respect to effective taxation and public inputs gets zero since the numerator is divided by an infinite value for *S*. Since we know from equations (5.10a) to (5.10c) that the sensitivity with respect to effective taxation and public inputs increases in θ_j while those with respect to the statutory tax rate decreases, we only have to show that the former two sensitivities are higher in absolute value for the case of $\theta_j \rightarrow \infty$. Inserting $\theta_j=\infty$ in equations (5.9a) to (5.9c) and multiplying with *S* we get:

$$\left|\eta_{k,T}\right|=\left|f'(k_F)-c(g_F)r\right| \tag{A.5.5}$$

$$\left|\eta_{k,g}\right|=\left|(1-t_F\varepsilon_F)c'(g_F)r\right| \tag{A.5.6}$$

$$\left|\eta_{k,t}\right|=\left|f'(k_F)-\varepsilon_F c(g_F)r\right| \tag{A.5.7}$$

To have a point of intersection for the comparison between statutory and effective taxes, it has to hold from (A.5.5) and (A.5.7) that $\varepsilon_F c(g_F)r>c(g_F)r$ and hence that $\varepsilon_F>1$.

Analogically, we can derive a value for ε_F which ensures the existence of the intersection between $\left|\eta_{k,t}(\theta_j)\right|$ and $\left|\eta_{k,g}(\theta_j)\right|$. We get $\varepsilon_F=1-\left|c'(g_F)/c(g_F)\right|$.

CHAPTER SIX:

Asymmetric capital tax competition in the presence of income shifting

6.1. Introduction

As our empirical results from Chapter 5 suggest, income shifting is indeed a relevant issue for multinational enterprises. By shifting income from one jurisdiction to the other, multinational enterprises have the opportunity to minimise their overall tax payments. Although some minimum investment in the low tax country may be needed, in principle this can be done without affecting any decision on real investment. The multinational firm can thus benefit from location advantages in one jurisdiction while transferring the economic rent of the investment to the jurisdiction with the lowest tax rate. Clearly, from the point of view of tax authorities in high tax countries, this strategy will lead to substantial losses in revenue.

Against this background, the Commission of the European Communities (2001) presents a strategy that would allow multinational firms to create a consolidated corporate tax base for their EU-wide activities. This proposed change from the current system of separate accounting to either a "Common Consolidated Base Taxation" or a "Home State Taxation" would make income shifting more difficult or even impossible. These two policy alternatives do,

however, have a number of shortcomings and their implementation faces several difficulties[110]. It therefore seems to be important to evaluate the effects of income shifting on inter-jurisdictional tax competition in more detail before concluding whether this proposal can improve upon the current method of separate accounting.

In the theoretical literature on tax competition with income shifting, several authors stressed that the strategic choice of income shifting regulations may lead to a double taxation of corporate income and hence higher effective tax rates (Mansori and Weichenrieder, 2001, Raimondos-Møller and Scharf, 2002). In opposition, others suggest that income shifting may spur tax competition between governments and exert further downward pressure on statutory tax rates (Gordon and McKie-Mason, 1995, Haufler and Schjelderup, 2000). All these papers model competition between regions of similar size. Clearly, the assumption of symmetric regions is not that realistic: Since tax rates will be equal among regions, there will be no income shifting in the symmetric equilibrium. To have a more realistic case, as that in Chapter 5 in which income shifting takes place, we have to introduce some asymmetries that lead to differences in corporate taxation between regions.

The literature on asymmetric tax competition goes back to the work of Bucovetsky (1991) and Wilson (1991). They show that tax competition between small and large jurisdictions with identical relative endowments of capital and labour leads to a Nash equilibrium in which tax rates, capital-labour ratios and revenue differ among jurisdictions. Their findings lead to an interesting conclusion about "smallness" in tax competition. Since there are capital exports from the large to the small jurisdiction in equilibrium, residents of the small jurisdiction are better off than residents of the large jurisdiction. Although tax competition is harmful for world welfare as a whole, Wilson (1991) shows that the small jurisdiction may benefit from tax competition if differences between

[110] Mintz and Weiner (2003) discuss this issue in more detail. They conclude that allocation rules may introduce distortions concerning the real activity of multinational firms.

jurisdictions are sufficiently large. Therefore, the small jurisdiction is unwilling to harmonize tax rates.

There exist a number of contributions that extend the basic model of asymmetric tax competition[111]. Other papers, like Kanbur and Keen (1993), readdress the issue of asymmetries to other fields of taxation. However, none of the literature on asymmetric tax competition has considered income shifting so far. This is the aim of the present chapter where we incorporate competition for taxable income into a framework of asymmetric capital tax competition. Even with income shifting, equilibrium tax rates for the small jurisdiction will be lower than that for the large jurisdiction. Our main result is that continuing economic integration, modelled as a reduction in the costs of income shifting, may lead the low-tax (small) jurisdiction to increase its tax rate. This implies that tax competition may become less severe if the competition for physical capital and paper profits are simultaneously allowed for.

The plan of the chapter is as follows. Section 6.2. lays out a theoretical model of income shifting between asymmetric jurisdictions. In section 6.3. we compare our results with that of the basic model where there is no possibility for income shifting. Based on this comparison we conclude how equilibrium tax rates will change with the introduction of income shifting. Possible extensions and shortcomings of the model are discussed in section 6.4. Section 6.5. concludes.

6.2. The Model

6.2.1. General Framework

The model used here starts from the work of Bucovetsky (1991). The world consists of two jurisdictions labelled A and B which are identical in all respects except for population size. Each jurisdiction has a fixed population which is

[111] It is beyond the scope of this work to discuss this literature in more detail. An extensive review is provided by Wilson (1999).

immobile internationally. A representative individual in each jurisdiction inelastically supplies one unit of labour and owns $\bar{k}$ units of capital. Thus, $\bar{k}$ is also the average capital-labour ratio in the world if we assume that capital is fully employed[112]. Since capital is perfectly mobile among jurisdictions, it is possible that the capital-labour ratio employed in each country k_i differs from the world average capital-labour ratio. Denoting by s_i the exogenous share of country i on the world's population such that

$$s_A + s_B = 1 \tag{6.1}$$

the world average capital-labour ratio is given by

$$\bar{k} = s_A k_A + s_B k_B \tag{6.2}$$

Both jurisdictions produce a single, homogenous output whose price is normalized to unity. The production function is identical for the two jurisdictions and given by $f(k_i)$. Furthermore, it is concave in its input, twice differentiable and exhibits constant returns to scale such that $f'(k_i) > 0$ and $f''(k_i) < 0$. Following Bucovetsky (1991), we assume a quadratic specification of the production function, which permits us to introduce several convenient simplifications[113]. Output and factor markets are perfectly competitive.

Output in both jurisdictions is produced by one single representative multinational firm which operates a subsidiary in each jurisdiction. Both jurisdictions levy a source tax at rate t_i on each unit of capital employed within its boundaries. With identical per capita endowments of capital, identical production technologies and identical preferences across jurisdictions, differences in tax rates are the only possible reason for capital flows in equilibrium. For the rest of this chapter, and without loss of generality, we assume that $t_A \geq t_B$. As a result, there will be capital exports from the high tax jurisdiction A to the low tax jurisdiction B.

[112] Of course, this is the case as long as the interest rate on capital r is positive.

[113] Relaxing this assumption does not affect our qualitative results in a substantial way.

6.2.2. Firm behaviour

The representative firm tries to maximize its overall net profits by choosing the optimal levels of k_A and k_B taking into account the different tax rates and the interest rate r, which is endogenously determined and equal across jurisdictions. In addition, the firm has an opportunity for income shifting activities.

To achieve comparable results to the standard model of Bucovetsky (1991), we model income shifting in a way that appears to be very simple: in order to avoid capital taxes in the high tax jurisdiction, the firm may underreport the amount of capital employed in jurisdiction A to the tax authorities. However, tax authorities in both jurisdictions can observe the total amount of capital (which is, by assumption, equal to the world population). Consequently, if information on tax payments is revealed in the public, e.g. through the balance sheet, a firm that underreports capital in jurisdiction A by a certain amount, has to overreport its use of capital in the low tax jurisdiction B by the same amount. Otherwise, tax authorities would observe tax evasion[114]. This view of income shifting captures one central strategy of multinational firms when minimising their overall tax burden - the allocation of debt (compare section 3.3.2). If, for example, the multinational firm can (partially) deduct its interest payments from the tax base, then it will allocate the largest possible share of its debt in the high tax jurisdiction. As a consequence, when compared to that of a national firm of equal size, the tax base of the multinational will be relatively low in the high tax jurisdiction and it will be relatively high in the low tax jurisdiction. Our model captures this situation by using the amount of capital declared in each country as a proxy for the tax base[115].

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[114] If information on firm's tax payments in the foreign jurisdiction is not accessible, one may alternatively assume that tax authorities voluntary exchange this information in order to fight tax evasion.

[115] Therefore, this work is in line with other recent papers that use a similar approach (see e.g. the study by Mintz and Smart, 2004, discussed in section 3.3.3.). Moreover, it is in line with empirical findings, too. As Grubert (2003) points out, almost one half of income shifting is done with financing strategies including debt allocation. According to his results, transfer pricing

To limit the extent of income shifting in our model, from now on also referred to as "misreporting", we assume that these activities involve resource costs to the firm. We assume that the total costs of misreporting increase linearly with the tax base[116] and are given by:

$$\theta(\alpha,\beta)\ k_A$$

where the function $\theta(\alpha,\beta)$ is defined as:

$$\theta(\alpha,\beta)=\frac{\beta}{2}\alpha^2 \tag{6.3}$$

The parameter $\beta\in[0,\infty]$ is exogenously given and describes the general costs for misreporting activities. This parameter can be related to the degree of globalisation or to the tax code of the high tax jurisdiction. As can be seen from (6.3), costs increase with β. Accordingly, low values of β may either depict a situation in which increased globalisation creates generous opportunities for the firm to undertake misreporting activities or a situation where there exist a number of loopholes in the national tax code that make it rather easy to shift income. The parameter $\alpha\in[0,1]$ is defined as the fraction of the tax base that is misreported. We assume that resource costs are a convex function of this parameter. This assumption is standard in the literature on both tax evasion and income shifting (compare Chapter 5) and is justified by additional efforts that need to be taken in order to conceal the misreporting activity from tax authorities.

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techniques, which are often used in the related literature and which require to model a tax on profits, are not that commonly used in practise.

[116] Assuming that the costs of misreporting increase linear in the tax base considerably simplifies our analysis. As will be shown below in equation (6.5), the firm's choice of α then will be independent of the capital allocation between the two jurisdictions. Alternatively, one could consider the case where concealment costs are independent from the amount of capital invested in jurisdiction A. Then, the optimal level of misreporting would also depend on k_A. In this case, more capital would be allocated in the high tax jurisdiction in order to decrease concealment costs. As will be discussed in section 6.4 below, using this alternative function does not affect our qualitative results in a substantial way.

With these specifications, the overall net profits of the multinational firm are given by:

$$\prod = f(k_A) + f(k_B) - t_A k_A - t_B k_B - (k_A + k_B)r + (t_A - t_B)\alpha k_A - \theta(\alpha, \beta)k_A \tag{6.4}$$

The firm maximises equation (6.4) by choosing k_A, k_B and α. In a first step, we derive the optimal fraction of k_A to be misreported by differentiating (6.4) with respect to α [117]:

$$(t_A - t_B)k_A - \theta_\alpha(\alpha, \beta)k_A = 0 = t_A - t_B - \theta_\alpha(\alpha, \beta) \tag{6.5}$$

Solving for $\theta_\alpha(\alpha, \beta)$ and rearranging, we get:

$$\alpha = \frac{t_A - t_B}{\beta}$$

As can bee seen from (6.5), misreporting only depends on the difference in tax rates between jurisdictions and on the exogenous parameter β. While an increase in t_A will ceteris paribus increase the misreporting activities, an increase in t_B will decrease misreporting. Implicitly differentiating (6.5), we get:

$$\frac{d\alpha}{dt_A} = \frac{1}{\theta_{\alpha\alpha}(\alpha, \beta)} \;,\; \frac{d\alpha}{dt_B} = -\frac{1}{\theta_{\alpha\alpha}(\alpha, \beta)} = -\frac{d\alpha}{dt_A} \tag{6.6}$$

In a second step, we derive the allocation of capital between the two jurisdictions by differentiating equation (4) with respect to k_A and k_B. Since the net return to capital r must be equal among jurisdictions, we get:

$$f'(k_A) - t_A(1-\alpha) - t_B\alpha - \theta(\alpha, \beta) = r = f'(k_B) - t_B$$

which simplifies to:

[117] Subscripts denote the partial derivative of the concealment cost function with respect to the corresponding parameter.

$$f'(k_A) - f'(k_B) + (t_B - t_A)(1-\alpha) - \theta(\alpha, \beta) = 0 \tag{6.7}$$

For a given tax pair (t_A, t_B), equation (6.5) and (6.7) completely determine the allocation of capital to the two jurisdictions, and its net return r. Note that, for the case where α is zero, such that there is no misreporting, equation (6.7) reduces to $f'(k_A) - t_A = r = f'(k_B) - t_B$. In this case, we are back in the model of asymmetric tax competition by Bucovetsky (1991). Introducing misreporting activities now has the effect that the differences in the capital-labour ratio between the two jurisdictions are smaller. This effect is intuitive as misreporting decreases the effective tax rate the firm has to pay in the high tax jurisdiction and makes investment there more attractive. This is because the fraction α of capital invested in A is effectively taxed at the lower tax rate of jurisdiction B. Since it is not the nominal tax rate t_i but the effective tax rate that determines the degree of capital flows, this decrease in effective taxation reduces capital outflows from the high tax to the low tax jurisdiction. So, with misreporting, real capital mobility is partly substituted by "paper" mobility. That is, capital that would be reallocated from one jurisdiction to the other in the absence of misreporting opportunities now stays at its origin while the firm still reports an export/import of capital to the local tax authorities[118].

The next step is to determine the effect of changes in the tax rates on the allocation of capital: Solving equation (6.2) for k_A and k_B, substituting in (6.7), implicitly differentiating and using (6.5) gives the change in each jurisdiction's capital-labour ratio in response to a domestic and a foreign tax increase.

$$\frac{dk_i}{dt_i} = \frac{(1-\alpha)s_j}{s_i f''(k_j) + s_j f''(k_i)} < 0 \qquad i, j \in \{A, B\};\ i \neq j \tag{6.8a}$$

$$\frac{dk_i}{dt_j} = -\frac{(1-\alpha)s_j}{s_i f''(k_j) + s_j f''(k_i)} = -\frac{dk_i}{dt_i} > 0 \tag{6.8b}$$

[118] In the extreme case where the costs for misreporting are zero and hence all capital is reported in the low tax country, there would be no capital flows at all. In this case, however, the equilibrium tax rates for both jurisdictions would be the same.

As can be seen, while an increase in the domestic tax rate will drive away capital, an increase in the foreign tax rate will attract capital and hence increase the capital-labour ratio. Similar to the basic asymmetric tax competition model, the degree to which capital reacts to a change in tax rates crucially depends on the relative size of the jurisdiction. While the denominator of equation (6.8a) and (6.8b) is a constant that is equal for both jurisdictions in the case of a quadratic production function[119], the numerator is larger for the small country. Consequently, an increase in the tax rate of the small jurisdiction will result in a higher outflow of capital. Our results deviate from those in the standard model since the reaction of capital with respect to a tax change also depends on the parameter α. For positive values of α, the effect of a tax change is lower than in the standard model. In relative terms dk_i / dt_i will be lower for both jurisdictions. In absolute terms, the decrease will be stronger for the smaller jurisdiction. This result resembles the findings of Mintz and Smart (2004) that income shifting tends to make the location of real investment less responsive to tax rate differentials (compare section 2.1.5) and can be summarised in:

Proposition 6.1.: *The tax-sensitivity of real investment will decrease with the fraction of income that is shifted from the high tax jurisdiction to the low tax jurisdiction.*

6.2.3. The government's problem

Governments in each jurisdiction set their capital tax rate so to maximize per-capita tax revenue. This is consistent with the assumption of a "Leviathan" type government or of a welfare maximizing government when the marginal benefit of a public good is constant and exceeds marginal welfare from private consumption. We assume that jurisdictions behave non-cooperatively in setting tax rates and that there exists an asymmetric equilibrium in which $t_A > t_B$[120].

[119] Using equation (6.1), the denominator in equation (6.8a) and (6.8b) simplifies to f''.

[120] An asymmetric equilibrium exists as long as it holds that $\alpha < 1$.

Due to the asymmetry of our model, revenue for the two jurisdictions is composed differently. Revenue for the high tax jurisdiction is given by:

$$R_A = t_A(1-\alpha)k_A \tag{6.9a}$$

Revenue for the low tax jurisdiction is given by:

$$R_B = t_B k_B + t_B \alpha k_A \tag{6.9b}$$

Differentiating equation (6.9a) with respect to t_A, the revenue-maximizing tax rate for jurisdiction A, for any tax rate chosen by jurisdiction B, is given by the following condition:

$$F^A(t_A, t_B) = (1-\alpha)k_A + \left[(1-\alpha)\frac{dk_A}{dt_A} - \frac{d\alpha}{dt_A}k_A\right]t_A = 0 \tag{6.10a}$$

When setting its tax rate, the high tax jurisdiction has to consider the following effects: first, tax revenue per unit of capital reported in A will change. Second, there will be an inflow (outflow) of capital to (from) jurisdiction B. Third, the tax rate determines α, which will partly replace real capital flows between A and B with flows that only exist on paper. An increase in t_A will simultaneously decrease k_A and increase α. As a result, there are two negative effects for the tax base.

The revenue-maximizing value for the low tax jurisdictions tax rate, now depending on the tax rate chosen by jurisdiction A, can be obtained by the following condition that results from differentiating (6.9b) with respect to t_B:

$$F^B(t_A, t_B) = k_B + \alpha k_A + \left[\frac{dk_B}{dt_B} + \frac{dk_A}{dt_B}\alpha + \frac{d\alpha}{dt_B}k_A\right]t_B = 0$$

From equation (6.6), we know that $d\alpha / dt_B = -\left(d\alpha / dt_A\right)$. Since we know from equation (6.8a) and (6.8b) that $dk_B / dt_B = \left(dk_A / dt_A\right)\left(s_A / s_B\right)$ and

$dk_A / dt_B = -\left(dk_A / dt_A\right)$, we can rewrite the condition for the optimal value of t_B as:

$$F^B(t_A, t_B) = k_B + \alpha k_A + \left[\left(\frac{s_A}{s_B} - \alpha\right) \frac{dk_A}{dt_A} - \frac{d\alpha}{dt_A} k_A \right] t_B = 0 \tag{6.10b}$$

In contrast to the high tax jurisdiction, an increase in t_B now has three different effects. First, there will be capital outflows that decrease k_B. However, since any decrease in k_B results in an increase in k_A, from which a fraction α comes back for taxation "on paper", the overall effect for the tax base is weakened. Finally, an increase in t_B will decrease misreporting activities which has an negative impact for the tax base.

In the Nash equilibrium, both conditions (6.10a) and (6.10b) have to be fulfilled. We now want to determine the required condition for the existence of this Nash equilibrium. Since $F^A(t_A, t_B) = 0$ and $F^B(t_A, t_B) = 0$ in equilibrium, it must also hold that $F^A(t_A, t_B) = F^B(t_A, t_B)$. Thus, the Nash equilibrium pair of tax rates must obey:

$$k_A - k_B - 2\alpha k_A + (t_B - t_A)\alpha \frac{dk_A}{dt_A} + \left[t_A - \frac{s_A}{s_B} t_B \right] \frac{dk_A}{dt_A} + (t_B - t_A) \frac{d\alpha}{dt_A} k_A = 0 \tag{6.11}$$

Any parameter combination that does not meet condition (6.11) can be ruled out as a possible equilibrium solution. Investigating condition (6.11), it is straightforward to see that the term $-2\alpha k_A$ is negative for any α greater than zero, which is obviously the case for $t_A > t_B$. Additionally, we know from equation (6.6) that $(t_B - t_A)(d\alpha / dt_A)k_A$ is negative in this case. Originating from $\bar{k}$ in both jurisdictions, in equilibrium, we have capital flows from the high tax jurisdiction A to the low tax jurisdiction B. Hence, the term $k_A - k_B$ has also to be negative. On the other hand, given that $t_A > t_B$, and bearing in mind equation (6.8a) the term $(t_B - t_A)\alpha(dk_A / dt_A)$ is clearly positive. However, as shown in Appendix 6.A.1., this positive term is more than offset by the negative term $k_A - k_B$. Finally, we have to investigate the sign of the last term:

$$\left[t_A - \frac{s_A}{s_B} t_B \right] \frac{dk_A}{dt_A} \tag{6.12}$$

As all other terms are negative, this term has to be positive to fulfil condition (6.11). In equilibrium, it therefore must hold that:

$$s_B t_A - s_A t_B < 0 \tag{6.13}$$

This condition can be fulfilled if, and only if, $s_A > s_B$. This gives us:

Proposition 6.2.: *In an asymmetric equilibrium of tax competition with income shifting, the capital tax rate levied by a small jurisdiction will always be lower than that levied by a large jurisdiction.*

This is consistent with the results of Bucovetsky (1991), which state, that in the case of tax competition between two jurisdictions of different size, and without misreporting activities, the small jurisdiction will levy the lower tax rate. Introducing income shifting will therefore not alter the main result of the standard model. This is, of course, not a surprising result: The small jurisdictions lower tax rate stems from the fact that, as compared to the large jurisdiction, it faces a higher outflow of capital for a given change in its tax rate. As shown by equation (6.8a), although weakened by misreporting activities, this effect is still at work in our model.

Up to this point of our analysis, we only know that t_B will be lower than t_A in equilibrium. However, therewith we have not made a statement on how the capital-labour ratio, tax rates, and tax revenue will change by introducing misreporting activities. This will be addressed in the next section.

6.3. Comparative statics

6.3.1. Variation of the exogenous income shifting parameter

To evaluate the effects of income shifting on the two jurisdictions we carry out a comparative static analysis. This is, we investigate how the variation of the exogenous concealment cost parameter β influences the choice of the two tax rates in equilibrium. Following Dixit (1986) the direction of changes of the optimal tax rate of jurisdiction i in response to a variation in β is then determined by:

$$sign\left(\frac{dt_i}{d\beta}\right) = sign\left(\frac{dt_i}{d\beta}\Big|_{t_j=const.} + \frac{dF^i}{dt_j}\frac{dt_j}{d\beta}\Big|_{t_i=const.}\right) \qquad i,j \in \{A,B\};\ i \neq j \qquad (6.14)$$

where the first term on the right hand side depicts the direct effect of a change in the parameter β, while the second term depicts the indirect effect. The direct effect determines how a change in the exogenous cost parameter affects the optimal choice of jurisdiction i given that jurisdiction j does not change its tax rate in response to a change in β. The indirect effect determines the response of t_i to a change in t_j that is induced by the change in β. To determine the sign of equation (6.14) we first have to take a closer look at both the direct and the indirect effects for each jurisdiction.

6.3.2. Derivation of direct effects

To determine the direct effect for the low tax jurisdiction B, we have to implicitly differentiate condition (6.10b) with respect to the exogenous cost parameter β. Using equation (6.8a) and (6.6) we get:

$$\frac{dt_B}{d\beta}\Big|_{t_A=const.} = \frac{-\left(k_A + (2\alpha s_B - 1)t_B\frac{1}{f''}\right)\frac{d\alpha}{d\beta}}{(1-\alpha)(s_A - \alpha s_B)\frac{2}{f''} - 2k_A\frac{d\alpha}{dt_A}} < 0 \qquad (6.15)$$

with $\frac{d\alpha}{d\beta} < 0$ from equation (6.5).

We know that the denominator of equation (6.15), which is equal to the second order condition for the revenue maximising tax rate of jurisdiction B, will always be negative since $(s_A - \alpha s_B)$ is always positive. Furthermore, since $(2\alpha s_B - 1)$ is always lower than zero[121], the numerator is positive. Therefore we can state that the sign of equation (6.15) is negative. This gives us:

Proposition 6.3a.: *For a given tax rate in the high tax jurisdiction, the tax rate of the low tax jurisdiction will decrease in* β.

Stated differently, a decrease in the concealment cost parameter β, which results in an increase in income shifting activities, will lead to higher tax rates for the small jurisdiction. At first sight, this result is counterintuitive since one may expect that income shifting will lead to a higher mobility of the tax base. Note first, however, that as shown by Proposition 6.2., the elasticity of real investment decreases since real capital flows are substituted by "paper" flows. Second, the tax base of jurisdiction B is increasing in α, since a higher fraction of the capital employed in A will be shifted towards jurisdiction B. Although an increase in the tax rate of jurisdiction B will diminish α, the net effect will always be positive. As a result, the elasticity of the tax base will decrease in α. If this is the case, and if misreporting costs decrease, then it is straightforward that the optimal reaction of jurisdiction B, assuming that jurisdiction A will not change its policy, is to increase its tax rate. This will result in higher tax revenues for the small jurisdiction.

We now want to investigate how the variation in the concealment costs will change the tax rate for the high tax jurisdiction A, holding the tax rate for jurisdiction B constant. Analogous to the case of jurisdiction B, we implicitly differentiate equation (6.10a) and get:

[121] This follows from equation (6.1), the equilibrium condition $s_A > s_B$ and $\alpha < 1$.

$$\left.\frac{dt_A}{d\beta}\right|_{t_B=const.} = \frac{-\left(-k_A + (1-\alpha)(1-t_A)s_B \frac{1}{f''}\right)\frac{d\alpha}{d\beta}}{(1-\alpha)(2-2\alpha-t_A\frac{d\alpha}{dt_A})s_B\frac{1}{f''} - 2k_A\frac{d\alpha}{dt_A}} > 0 \qquad (6.16)$$

While the numerator is clearly negative, the sign of the denominator can not be determined that easy. The denominator is identical to the second order condition for the tax revenue maximizing tax rate in jurisdiction A. Hence, it has to be negative[122]. So, with the denominator being negative, the sign of equation (6.16) is positive. This positive sign implies:

Proposition 6.3b.: *For a given tax rate in the low tax jurisdiction, the tax rate of the high tax jurisdiction will increase in* β.

According to Proposition 6.3b., an exogenous decrease in the costs of income shifting leads to lower taxes in the large jurisdiction, if the tax rate of the small jurisdiction remains unchanged. Hence, the best response to an increase in the level of income shifting (stemming from a decrease in the exogenous cost parameter) for jurisdiction A is to decrease its tax rate. The effect of income shifting is thus the reverse from the case of the low tax jurisdiction. An exogenous decrease in β that increases α will make the domestic tax base more elastic. This is the case since the outflows of taxable income are higher than the inflows of real investments. For a given tax rate, this will reduce revenues for the high tax jurisdiction. By decreasing its tax rate, the high tax jurisdiction will diminish α so that the negative effect of income shifting is reduced. Accordingly, for a given policy of the low tax jurisdiction, increasing

[122] One can show that the second order condition is fulfilled: From equation (6.6) we know that $d\alpha / dt_A = 1/\theta_{\alpha\alpha}(\alpha,\beta)$. To prevent income shifting ($\alpha = 0$) in the case of different tax rates, $\theta(\alpha,\beta)$ and so $\theta_{\alpha\alpha}(\alpha,\beta)$ has to be infinite while it has to be zero to guarantee full income shifting ($\alpha = 1$). Now, we can determine the sign of the denominator using (6.6): For α close to zero, the first term converges to $2s_B / f''$, which is obviously negative, while the second term converges to zero. For α close to one, the first term of the denominator disappears while the second, negative, term increases to infinity.

income shifting will reduce tax revenues for the high tax jurisdiction. It thereby induces the jurisdiction to lower its tax rate.

6.3.3. Comparative statics in equilibrium

As can be seen from equation (6.15) and (6.16), the two direct effects have opposite signs. To determine the general equilibrium effects in equation (6.14), we next determine the indirect effects. This is relegated to section 6.A.2. of the appendix where we show that both reaction functions are upward sloping ($dF^i / dt_j > 0$). Together with the condition for the stability of the Nash equilibrium we get:

$$0 < dF^i / dt_j < 1 \tag{6.17}$$

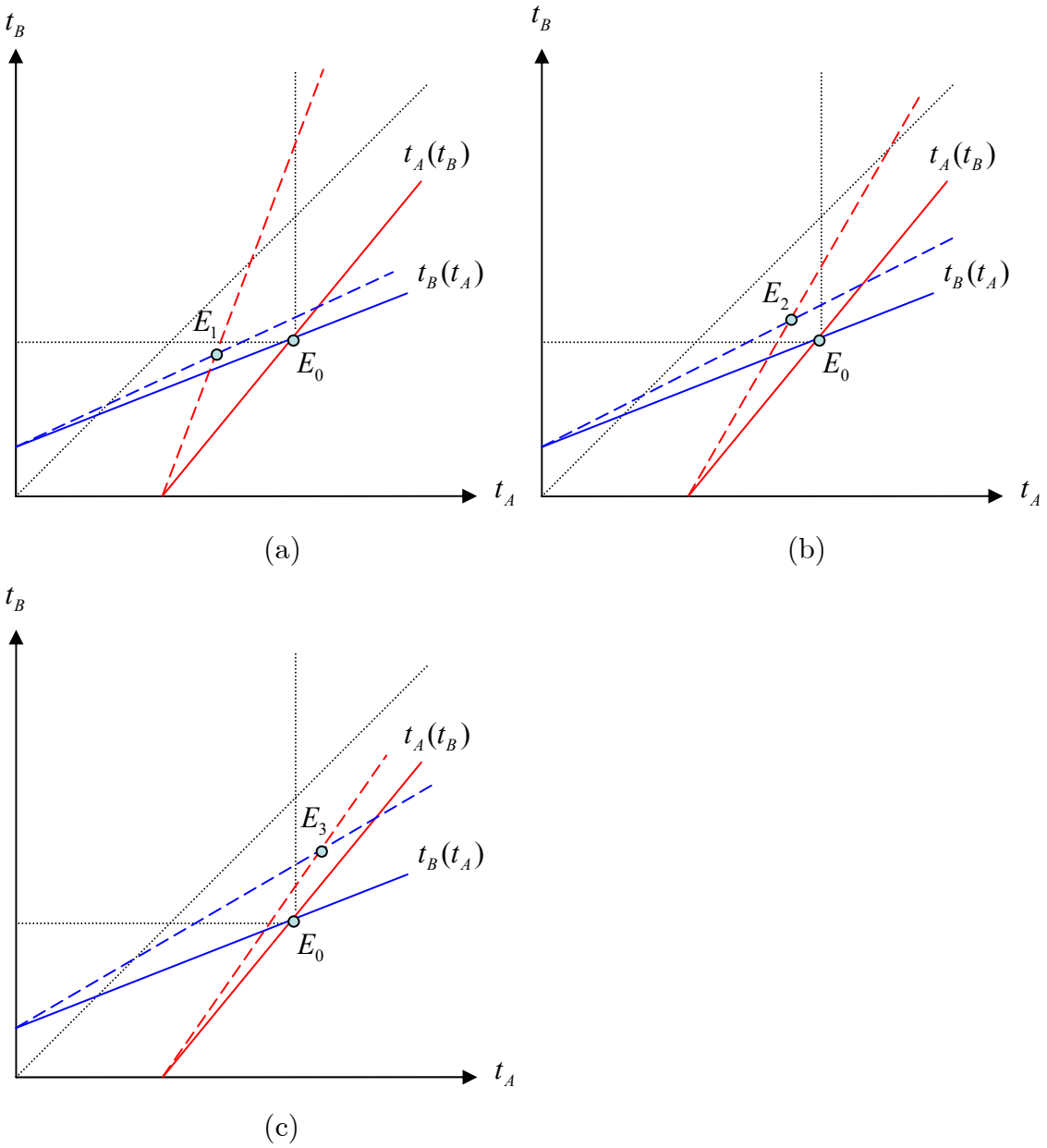
Hence, we have not only opposite signs for the direct effects in the two jurisdictions but we have also opposite signs for the direct and indirect effects in each jurisdiction. Given the complexity of equation (6.14), which depends on the combination of the endogenous parameters t_A, t_B and α, for which our model can not be solved, we can not determine general equilibrium effects. According to (6.15) and (6.16) and illustrated by Figure 6.1., a decrease in the exogenous income shifting cost parameter β, which leads to an increase in income shifting activities, makes the reaction functions of the two tax rates steeper. We have to distinguish three possible outcomes of this change in reaction functions.

Possibility 1 (Figure 6.1a.): The direct effect on the large jurisdiction A is rather high compared to that for the small jurisdiction B. The equilibrium moves from its initial point E_0 to the point E_1. In the new equilibrium both jurisdictions levy lower tax rates. In this case, the tax reduction in t_A puts strong downward pressure on t_B, and thus overcompensates the direct effect in the small jurisdiction B. While the large jurisdiction unambiguously loses tax revenue from an increase in income shifting this is not clear for the small jurisdiction. On the one hand, the small jurisdiction still gains from the

misreporting of capital inputs. On the other hand, it suffers from increased tax competition and the resulting lower equilibrium tax rates.

Figure 6.1.

Equilibrium tax rate changes



Possibility 2 (Figure 6.1b.): The direct effect dominates for both jurisdictions (i.e. dF^i / dt_j is small). The equilibrium moves from its initial point E_0 to the point E_2. In the new equilibrium the high tax jurisdiction decreases its tax rate

while the low tax jurisdiction increases its tax rate. While the large jurisdiction unambiguously loses tax revenue, the small jurisdiction gains revenue from an increase in income shifting activities.

Possibility 3 (Figure 6.1c.): The direct effect on the small jurisdiction B is rather high compared to that for the large jurisdiction A. The equilibrium moves from its initial point E_0 to the point E_3. In the new equilibrium both jurisdictions levy higher tax rates. In this case, the tax increase in t_B allows jurisdiction A likewise to increase its tax rate. This effect is strong enough to overcompensate the direct effect in the large jurisdiction A. Since the small jurisdiction unambiguously gains from income shifting, there is the possibility that an increase in income shifting will be beneficial for both jurisdictions. Even though tax revenue of the large jurisdiction is still negatively affected by the misreporting of capital inputs, it gains from increased tax rates in equilibrium.

As a result we can state that income shifting will not inevitably lead to increased pressure on tax rates, as first intuition would suggest. In fact it might also lead to a rise in both tax rates. An intermediate, and not implausible, scenario is to assume that the direct effect dominates for both jurisdictions. In this case, a decrease in the exogenous cost parameter will lead to convergence in capital tax rates.

6.4. Discussion and possible extensions

Even though income shifting is thought of as increasing the mobility of tax bases and thereby promoting competition between jurisdictions, we have shown that it will not inevitably result in a race to the bottom in corporate tax rates. Instead, income shifting may also lead to convergence in tax rates which counteracts the effects of differences in size or it may even lead to an uncoordinated increase in tax rates. Furthermore, not considering general equilibrium effects, the high tax jurisdiction will be worse off while the low tax jurisdiction gains from income shifting. This is what distinguishes this particular

study from other work that finds income shifting to spur competition (e.g. Gordon and McKie-Mason, 1995, Haufler and Schjelderup, 2000). What is crucial is the fact that in the symmetric case none of the jurisdictions will gain from income shifting since it will not take place in equilibrium. In our model, however, one country benefits from income shifting and may have incentives to increase its tax rate.

This is also an important issue concerning the question whether both jurisdictions may agree to co-ordinate tax rates. As Wilson (1991) has shown, in the absence of income shifting, it may be possible that potential gains from competition are comparatively large for the small jurisdiction. Eggert and Haufler (1998) analyse the conditions for which this is the case. They show that potential gains are generally, and often strongly, reduced when real-world features such as imperfect mobility are considered. From their results, they conclude that only a few and very small jurisdictions can benefit from tax competition and that an agreement to co-ordinate tax rates may be possible. Our analysis in the previous section has shown that if income shifting is introduced into this model, the small jurisdiction has some extra gains which make it more likely that it can benefit from competition. Therefore, any attempt to co-ordinate capital taxes will be even more difficult than has been anticipated in the earlier literature.

Our results may also be relevant in light of the current debate on a harmonisation of tax bases among the EU as it has been proposed by the Commission of the European Communities (2001). A switch from separate accounting to a consolidated tax base will, in any case, increase the costs of income shifting. For our model, this means to increase β and thereby to decrease α. If direct effects dominate in general equilibrium, then the implementation of the Commission's proposal will lead to more divergence in tax rates. If the indirect effect dominates for the large jurisdiction, then a switch away from separate accounting will even result in increased tax competition. A similar effect has been derived by Keen (2001) for the related problem of preferential taxation: Given that competition through income

shifting is restricted, jurisdictions revert to traditional tax competition, using their remaining instrument, the tax rate more aggressively.

Furthermore, our model may explain the inconclusive results of a number of empirical studies measuring how globalisation influences national tax rates and revenues[123]. Given our results, if increased income shifting is the outcome of globalisation, then it will be hard to answer the question whether globalisation leads to more or less pressure on tax systems, simply by studying the relation between (an index for) globalisation and capital tax rates. Empirical work concentrating on the relation between globalisation and revenues may meet similar problems. Here, it is a crucial point that the existence of income shifting may generate extra revenue for low (and in some cases even for high) tax regions.

The results obtained above rely on a number of simplifying assumptions. One important assumption was the independence of the firm's investment and misreporting decisions (see equation (6.3)), which implies that increasing investment in one jurisdiction has no effect on the overall concealment costs. Instead, as we have argued in Chapter 5, misreporting may become less costly the more capital is employed in a jurisdiction since it is then easier to conceal this activity from tax authorities. A very simple way to incorporate this interdependence in our model would be to make the concealment costs dependent on k_A or k_B[124]. As briefly discussed in footnote 116, this would introduce another distortion into our model since any additional investment in jurisdiction A or B will then represent an investment in tax avoidance. However, this extension of the basic model will not change our qualitative

[123] Garrett (1995) tries to estimated capital tax rates among OECD countries in the years from 1967 to 1990 as a function of a capital mobility index. He finds no significant effects. Swank (2001) even finds a positive correlation between globalisation and tax revenues.

[124] If we use $\theta(\alpha,\beta)k_A^2$ as total costs for income shifting, we are in a situation in which the optimal level of income shifted depends negatively on k_A. An alternative, in which concealment costs decrease with the amount of capital employed in the low tax jurisdiction, is presented in Chapter 5. Note that this type of modelling corresponds to the implementation of a "thin-capitalisation rule".

results. For example, let us assume that concealment costs decrease with k_A[125]. In this case, income shifting still has a negative effect on jurisdiction A (compared to a world where there is no income shifting at all) but the additional investment in tax avoidance reduces this negative effect. As a result, jurisdiction A will still reduce its tax rate in order to minimise income shifting, but the reduction will be smaller than in the basic model. For jurisdiction B, the positive effect of income shifting will be smaller than in the basic model since the additional investment in A implies lower investment in jurisdiction B.

Another interesting point would be to consider the effect of income shifting on labour income (the fixed factor). As shown by Mintz and Smart (2004) and confirmed by our study, income shifting makes the allocation of real capital less responsive to tax rate differences. For a given tax differential, this implies that, whenever income shifting increases, the large jurisdiction will gain some capital at the expense of the small jurisdiction. This will also alter the return of the complementary factor, labour. Since governments simply maximize their capital tax revenue in our model, they do not consider these effects when setting tax rates[126]. In reality, however, we observe an increasing policy interest in attracting physical investment in order to fight unemployment. This aspect can be incorporated by extending the government's revenue function such that revenue consists of two components, revenue from capital taxes and revenue from labour taxes. We then have two counteracting effects of income shifting, one affecting the capital tax base and an additional one affecting the labour tax base. Depending on the size of the additional effect, our results from above may be weakened or even turned around. For instance, one may think about a situation in which most revenue of the large jurisdiction stems from the taxation of labour income. An increase in income shifting activities will then

[125] For the case where concealment costs decrease with investment in jurisdiction B, the argumentation is very similar.

[126] An interesting paper dealing with the effects of income shifting on real investment is Peralta, Wauthy and van Ypersele (2003). In their model, the location of a firm yields positive externalities for the host country. This is related to the potential positive effects on labour income described here. They show that the positive externality of real investment may overcompensate for the loss of capital tax revenue in the high tax jurisdiction.

reduce the capital tax base and enlarge the labour tax base. If the overall effect is revenue increasing, the large jurisdiction effectively gains from income shifting and hence has an incentive to raise its capital tax rate in order to further increase income shifting.

6.5. Conclusion

In this chapter we have extended the literature on tax competition between countries of unequal size (Bucovetsky, 1991) by giving multinational enterprises the possibility to engage in costly cross-border income shifting activities. For revenue maximising governments that have only one tax instrument, we have shown that it is the smaller of two otherwise identical jurisdictions that levies the lower tax rate in equilibrium.

We then studied how a change in income shifting costs affects equilibrium tax rates. The direct effect of a reduction in the costs for income shifting is to increase the tax rate chosen by the small jurisdiction and to decrease the tax rate chosen by the large jurisdiction. If indirect effects, caused by the response of each jurisdiction's tax rate to the tax change in the competing jurisdiction, are not too large, then we get convergence in tax rates. In general, however, we cannot exclude the possibility that the indirect effect dominates the direct effect in either the small or the large jurisdiction. If this is the case, income shifting may either lead to a "race to the bottom" or to a "race to the top" with respect to the rates of capital taxation.

This result has some important policy implications. If income shifting induces the small jurisdiction to increase and the large jurisdiction to decrease its tax rate, then any attempt to reduce income shifting will lead to more divergence in tax rates. In this case however, high tax countries will lose some further tax revenue. Contrary to what one might expect, preventing income shifting may even lead to increased tax competition, which may harm the high tax country more than income shifting by itself. The reason is that some investment in the

high tax country, which is profitable in the case of income shifting, becomes non-profitable when income shifting is not possible any more. Policymakers should be aware of this possibility when discussing the implementation of a consolidated tax base for the European Union.

6.A. Appendix to Chapter 6

6.A.1. Determining the sign of selected terms in equation (6.11)

Assuming a quadratic production function of the form $f(k_i) = ak_i - bk_i^2$. The first and second derivatives of the production function with respect to k_i are given by:

$$f'(k_i) = a - 2bk_i \tag{6.A.1}$$

and $f''(k_i) = -2b$ (6.A.2)

Rearranging equation (6.7) yields:

$$f'(k_A) - f'(k_B) = (t_B - t_A)(1-\alpha) + \theta(\alpha, \beta) \tag{6.A.3}$$

Substituting (6.A.1) and (6.A.2) in (6.A.3) we get:

$$k_A - k_B = \left[(t_A - t_B)(1-\alpha) - \theta(\alpha, \beta)\right]\frac{1}{f''} < 0 \tag{6.A.4}$$

This has to be compared with:

$$(t_B - t_A)\alpha\frac{dk_A}{dt_A} = -\left[(t_A - t_B)(\alpha - \alpha^2)s_B\right]\frac{1}{f''} \tag{6.A.5}$$

Summing up (6.A.4) and (6.A.5), we get:

$$\left[(t_A - t_B)(1 - \alpha - \alpha s_B + \alpha^2 s_B) - \theta(\alpha, \beta)\right]\frac{1}{f''} < 0 \tag{6.A.6}$$

which is negative for any α below one and gets zero for $\alpha = 1$.

6.A.2. Derivation of equation (6.17)

Implicitly differentiating condition (6.10b) with respect to the tax rate of jurisdiction A, we get for the low tax jurisdiction:

$$\frac{dF^B}{dt_A} = \frac{-\left(\left((1-\alpha)(\alpha s_B + s_B - 1) + (3\alpha s_B - s_B - 1)t_B \frac{d\alpha}{dt_A}\right)\frac{1}{f''} + k_A \frac{d\alpha}{dt_A}\right)}{(1-\alpha)(s_A - \alpha s_B)\frac{2}{f''} - 2k_A \frac{d\alpha}{dt_A}} > 0 \qquad (6.A.7)$$

which is obviously positive, since both, the numerator as well as the denominator are negative.

Implicitly differentiating condition (6.10a) with respect to the tax rate of jurisdiction B, we get for the high tax jurisdiction:

$$\frac{dF^A}{dt_B} = \frac{-\left((1-\alpha)\left(t_A \frac{d\alpha}{dt_A}(1-s_A) - (1-\alpha)s_A\right)\frac{1}{f''} + k_A \frac{d\alpha}{dt_A}\right)}{(1-\alpha)(2-2\alpha - t_A \frac{d\alpha}{dt_A})s_B \frac{1}{f''} - 2k_A \frac{d\alpha}{dt_A}} > 0 \qquad (6.A.8)$$

Again, the numerator is negative. Since we know from equation (6.16) that the denominator is also negative, equation (6.A.8) is positive.

CHAPTER SEVEN:

Summary and conclusion

Increased economic integration and the implementation of the single market have enlarged the mobility of business within the European Union. Foreign direct investment between member states has increased and multinational enterprises have become more and more important for European economies. This led to the fear that multinationals may put competitive pressure on governments to reduce corporate taxation, resulting in a "race to the bottom" in which both tax rates and tax revenues collected from corporate taxation will be extremely low.

However, mobility alone is not sufficient for harmful tax competition to take place. Additionally, multinational enterprises have to react to differences in taxation across potential host countries. The empirical literature so far has analysed the location decisions of multinational enterprises within the European Union and how they are determined by corporate tax rates. It is established that foreign direct investment is indeed deterred by high tax rates and studies conclude that there is scope for harmful tax competition to take place. Nevertheless, all these studies use data on aggregated FDI to estimate the reaction of multinationals to changes in tax policy. FDI is a very heterogeneous measure (see section 1.2.2.) and determinants may vary for different types of investment. While some investment is very sensitive to taxation, other investments may be insensitive to taxation. Estimation results of studies using

aggregated data may therefore be inaccurate and only of limited help when used by tax authorities. This was the starting point of the present work that aimed to analyse the determinants of FDI and in particular its sensitivity to corporate taxation in more detail by using disaggregated data on multinational activity.

In a first step, Chapter 2 gave an overview on theories of the location decision of multinational firms. It was found that taxes are an integral part of the determinants of FDI and of the allocation of reported taxable income among the affiliates of the enterprise. We then proceeded with a discussion on how the tax burden imposed on an investment project can be measured. We concluded that the theoretical concept of effective average tax rates should be used in an econometric analysis since more simple measures such as implicit tax rates are associated with certain pitfalls. Moreover, we suggested that the statutory tax rate may be a better indicator for the incentives to shift income than for the decision where to locate real economic activity.

In Chapter 3, we then presented a review of the empirical literature on the tax sensitivity of investment and taxable income. We identified several shortcomings of these studies. While some studies on US data have found first evidence that the distinction of different types of FDI matters, we found that studies concerned with the location decision of FDI in Europe almost exclusively rely on aggregated FDI data instead. A closer look at the empirical literature on income shifting then revealed a lack of evidence for the EU. Moreover, we emphasized that most of the literature in this field analysed the location decision of real activity separately from the decision to shift income. Given that these decisions interact in reality, we concluded that further research on this issue is needed.

To fill these empirical gaps, we made use of disaggregated data on multinational activities. In Chapter 4, we empirically tested if foreign direct investment flows in the three main economic sectors differ in their sensitivity to tax rates. Our results suggest that this is certainly the case. We found that investment in agriculture and mining is not driven by tax incentives. Taxes matter, however,

with respect to FDI flows into the manufacturing and the service sector. The tax elasticity in the service sector is between 20% and 40% above the elasticity we would obtain when using aggregated data on FDI. Given the important role of the service sector for economic development in the last years, aggregated tax elasticities underestimate the effect of taxes. Taking these results together, we concluded that the aggregated elasticities provided by the empirical literature so far are only of limited help for tax planning. Moreover, we found that other factors such as market size play in important role in determining FDI. Accordingly, high tax rates can be outweighed with other locational advantages so that a "race to the bottom" becomes less likely.

In Chapter 5, we then analysed whether different types of FDI respond in different ways to alternative tax measures. We pursued this question with data on foreign activities of large German multinational enterprises. We developed a small theoretical model in which income shifting is a feasible strategy for some but not for all firms. Theoretical results suggested that the location decision of firms that have ample opportunities for income shifting will be affected by statutory tax rates while the decisions of firms that can not make use of income shifting strategies will be affected by effective tax rates. By dividing foreign activities of German multinationals into two broad categories, we confirmed this assumption empirically. We concluded from these results that income shifting is indeed a tax minimising strategy for some German firms. Moreover, as the location decision of shifting firms was independent from other real economic factors, we concluded that income shifting may result in a "race to the bottom".

After having found empirical evidence for income shifting, we turned to theory. In Chapter 6 we developed a theoretical model in which the tax rates set by two competing jurisdictions is endogenously determined by income shifting of multinational enterprises. For the case of asymmetric regions, we found that simultaneously allowing competition for physical capital and taxable income will not inevitably result in a "race to the bottom". The presence of income shifting may reduce competitive pressure. We discussed this result in the context of several proposals that try to limit the possibilities of income shifting in the

European Union. In this respect, our theoretical results may be quite important since they imply that the limitation of income shifting may reinforce competition with other tax instruments.

The results obtained here may be relevant for several policy purposes as well as for further research. Our empirical results suggest that future research should use more disaggregated data on foreign direct investments when evaluating the effect of taxation. Elasticities provided so far may under- or overestimate the effect of tax policy. Moreover, the study gives first evidence for income shifting activities among German multinationals. Tax authorities should take care of this result. Finally, we found that allowing for income shifting may decrease competitive pressure on tax rates. Tax authorities should be careful when enacting policies to prevent income shifting since this may make things even worse.

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