Discussion Paper No. 14-114

# Tax Planning of R&D Intensive Multinationals

Jost H. Heckemeyer, Katharina Richter,
and Christoph Spengel

ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

Discussion Paper No. 14-114

# Tax Planning of R&D Intensive Multinationals

Jost H. Heckemeyer, Katharina Richter,
and Christoph Spengel

# Tax Planning of R&D Intensive Multinationals

Jost H. Heckemeyer
University of Hannover & ZEW Mannheim

Katharina Richter
ZEW Mannheim

Christoph Spengel
University of Mannheim & ZEW Mannheim

**Abstract**

The allocation of management and control in the business decision process finds expression in the coordination intensity between agents in the firm. We develop and test a theory, based on the organizational design literature, for the intensity in which the tax department strives to coordinate with managers from other business units in order to intervene in investment decisions. Our theoretical considerations predict that R&D intensity is an important determinant of the tax department's role. Using data from a confidential survey taken in 2012 of top financial and tax managers of very large multinational companies, representing 8% of business R&D spending in the OECD, we indeed find supporting evidence that in R&D intensive multinational firms the tax department operates more as a controller than as a manager. In particular, tax departments of R&D intensive firms make less tax planning effort, are less ambitious to minimize the tax burden of the firm, are later involved in the decision-making process of a new investment project, but are more likely to have a veto right in the decision on a new investment project as compared to less R&D intensive firms. Conditional on R&D intensity, however, the level of intangible assets in the firm is associated with more tax planning efforts and ambitions. Our results are statistically significant and robust towards several sensitivity checks.

**Keywords:** corporate taxation, organizational design, survey data

**JEL Classification: H25, L22, M41**

Financial support from the research programme 'Strengthening Efficiency and Competitiveness in the European Knowledge Economies (SEEK)', funded by the State of Baden-Württemberg, is gratefully acknowledged. The authors thank Margarete Schätzler and Frank Schmidt from PricewaterhouseCoopers (PwC) and Alfred Storck for their great support in conducting the survey. Moreover, we appreciate helpful comments and suggestions from Michelle Hanlon, Christian Kunz, Dirk Totzek, Arne Schnitger, Johannes Voget, and workshop participants at the University of Mannheim.

Corresponding author: Jost H. Heckemeyer, heckemeyer@steuern.uni-hannover.de

# 1 Introduction

The focus of this study is to gain a deeper understanding of how tax planning takes place in research and development (R&D) intensive multinational firms. Innovative multinationals are notorious for having increased tax planning opportunities. By locating intangible assets at low tax affiliates, they can reduce the tax burden on a relevant fraction of their economic rents. In recent years, our understanding of the existence and functioning of this type of tax planning strategy has increased at remarkable rate. The empirical literature provides compelling evidence for a tax-driven allocation of intangibles within multinational groups (see Grubert and Slemrod, 1998; Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012; Griffith et al., 2014). Consistently, the tax accounting literature documents that R&D intensive firms, all other things equal, display lower effective tax rates (ETR) than non-innovating firms (e.g. Graham et al., 2011; Robinson et al., 2010; Graham et al., 2014).

The corporate production process in R&D intensive multinational firms, however, does not only involve administration of intangible assets. These companies also have to decide on where to set up R&D facilities and final output production for consumers. Innovative activity indeed turns out increasingly mobile with firms locating their R&D units away from their home countries, and in multiple locations (Abramovsky et al., 2008). Surprisingly, the existing literature has largely ignored the particularities of tax planning in R&D intensive firms with respect to these choices. In view of the OECD's ambitions to take action against multinational tax avoidance (OECD, 2013b), however, it seems very important to better understand the role that tax considerations and tax executives play in investment decisions of R&D intensive multinationals beyond the management of intellectual property (IP). In the same vein, in their comprehensive review of empirical tax research Hanlon and Heitzman (2010) call for more research on tax decision-making inside the firm.

Using data from a confidential survey taken in 2012 of international top financial and tax managers, we develop and test a theory, based on the organizational design literature, for the intensity in which the tax department coordinates with managers from other business units to intervene in real investment decisions. We argue that in the decision-making process, the tax department can get involved in decision control or engage in decision management. Following Fama and Jensen (1983b), decision control involves the ratification and monitoring of initiated projects, whereas decision management includes, in particular, the initiation and set-up of projects and thus occurs at a much earlier stage of the decision process. According to organizational design

theory, the optimal allocation of decision rights is determined by coordination costs, i.e. the costs of knowledge transfer between managers, that are incurred when centralization of management and control is high, and the costs of autonomy that arise when management and control are exercised separately. We argue that this coordination problem also drives the choice of whether the tax department serves a controlling function ensuring tax compliance in the investment process or whether, instead, it acts more as a manager intervening in principal investment choices such as location and financing. Moreover, we consider R&D intensity to be an important determinant of both the costs of coordination and the costs of autonomy. First, there is high pressure in R&D intensive industries to keep the time to market short and the costs caused by time delays associated with coordination between business units are very high. Second, costs of autonomy are low in R&D intensive firms as tax-inefficiencies from autonomous decision-making without involvement of tax experts can be reversed by separating and tax-optimally allocating intangibles within the multinational group.

As archival data is inappropriate to address our research question, we conduct an in-depth survey among worldwide operating multinationals headquartered in different countries and active in diverse industries. Survey studies have been increasingly employed in tax, accounting and finance research to gain insights that would not be obtainable on the basis of publicly available accounting information. For example, Graham and Harvey (2001) survey CFOs on their views and practice of cost of capital, capital budgeting and capital structure. Graham et al. (2005) investigate the determinants of reported earnings and disclosure decisions, Graham et al. (2011) analyze the location decision of real investments and repatriation decisions, while in a follow-up study Graham et al. (2014) examine the incentives for tax planning, especially focusing on reputational concerns. A survey study by Robinson et al. (2010) is more related to the managerial accounting literature and investigates the decision to evaluate the tax department as a cost center as opposed to a profit center. To the best of our knowledge, we are the first ones to provide survey evidence on the particularities of tax planning in R&D intensive multinationals.

In this study, we present evidence from 47 respondent firms. The sample of respondents is small, but we emphasize that 30 respondent firms are among the top 2,000 R&D investors and 15 are among the top 200 R&D investors worldwide as listed on the EU Industrial R&D Investment Scoreboard.[1] Nine respondent firms are among the

[1]The EU Industrial R&D Investment Scorboard lists the 2,000 larged R&D investors worldwide. These 2,000 firms represent more than 90% of the total R&D expenditure by private businesses worldwide. For more information, see http://iri.jrc.ec.europa.eu/scoreboard.html.

Top 50 patent applicants at the European Patent Office (EPO).[2] Altogether, our sample firms spent more than $50,000 million on R&D, according to their latest published financial statements, corresponding to approximately 8% of the total business R&D spending within the OECD in 2012 or to 7.7% of the total R&D expenditure spent in 2012 by the 2,000 largest R&D investors worldwide listed on the EU Industrial R&D Investment Scoreboard.

We indeed document supporting evidence that in R&D intensive multinational firms the tax department operates more as a controller than as a manager. In particular, tax departments of R&D intensive firms make less tax planning effort, are less ambitious to minimize the tax burden of the firm, are later involved in the decision-making process of a new investment project, but are more likely to have a veto right in the decision on a new investment project as compared to less R&D intensive firms. Conditional on R&D intensity, however, the level of intangible assets in the firm is associated with more tax planning efforts and ambitions. Our results are statistically significant and robust towards several sensitivity checks.

Our findings add to a strand of research that studies the interrelationship between organizational architecture and tax planning. Recently, Armstrong et al. (2012) investigate the impact of tax director compensation contracts on effective tax rates. Phillips (2003) examines the effects of compensation based performance measures of chief executive officers and business-unit managers and finds that after-tax compensation significantly lowers the reported GAAP and cash effective tax rate of a firm. Whereas these studies are concerned with performance reward, Robinson et al. (2010) consider performance measurement and evaluate why firms choose to evaluate a tax department as a profit center as opposed to a cost center. In their analysis, they use the degree of coordination between the tax department and operating units as an exogenous variable. In this paper, we want to *explain* the degree of coordination between the tax department and managers from other business units. Thus, our paper puts the focus on the third component of organizational architecture, allocation of decision rights, whereas the previous studies consider the first two components, performance measurement and reward. Similar to these earlier papers, we take another important step towards unraveling the black box of tax avoidance. In this sense, our paper can also be connected to other studies which open part of the black box of tax decision-making. In particular, Gallemore and Labro (2013) investigate the internal information environment within firms and its effect on the reported ETR. They find that firms with high

[2]See http://www.epo.org/about-us/annual-reports-statistics/annual-report.html.

internal information quality report lower ETRs. The unobservable construct of internal information environment is measured by five proxies, which are analyst following, analyst forecast accuracy, management forecast accuracy, the speed by which management announces financial figures such as earnings after fiscal year closing and the absence of material weaknesses in internal control. Furthermore, Dyreng et al. (2010) propose the conjecture that top executives may have a certain style and therefore set a certain tone at the top with respect to tax planning. They track executives who had worked for more than one firm over a longer period of time and indeed find a significant effect of executives on the GAAP and cash ETR. Management research has started to focus on tax aspects, as well. Glaister and Hughes (2008) provide a case study on UK firms analyzing the relationship between corporate strategy formulation and taxation. They find strong support for the view that strategy decisions take priority, while tax decisions follow subsequently in the order of precedence.

Our paper contributes to several further strands of the literature. In general, there is a universe of theoretical and empirical research dealing with the distorting effect of taxation on investment decisions. This literature provides robust evidence that taxes impact on both marginal and infra-marginal investment in domestic and cross-border contexts (De Mooij and Ederveen, 2003; Feld and Heckemeyer, 2011; Hassett and Hubbard, 2002; Bond and Van Reenen, 2007). Investment in R&D, however, is special (Elschner and Spengel, 2010). It is particularly risky because innovation efforts require a long-term perspective with high initial costs and uncertain outcome. On the other hand, once successful, R&D tends to yield very high economic rents, because intellectual property rights establish monopolies for a certain period of time. Time to market plays a crucial role in order to be able to earn these rents. Moreover, R&D activity is supposed to create positive externalities through unpaid knowledge spillovers and considered to be crucial for competitiveness and economic growth. As a consequence, various countries have put in place R&D tax incentives to foster innovative activity. The effectiveness of this type of incentives has been studied extensively in the past. R&D tax credits and additional allowances, for example, are generally found to positively impact on the scale of R&D investment (Hall and Van Reenen, 2000; Arundel et al., 2008; Spengel, 2009; Elschner and Spengel, 2010). Furthermore, there is evidence that tax considerations can lead firms to relocate and shift existing R&D activities to tax favorable jurisdictions (Wilson, 2009; Paff, 2005; Bloom et al., 2002). Bloom and Griffith (2001) speak of 'footloose R&D' to emphasize the international mobility of R&D activity.

The most substantial international tax planning opportunities in R&D intensive

multinationals are associated with the output of the innovation process, i.e. valuable intangible assets, rather than with inputs. A recent strand of research provides robust evidence for a tax-driven allocation of intangibles within multinational groups. For example, Mutti and Grubert (2009) show that US companies obtain high royalty revenues preferably in low tax subsidiaries. Dischinger and Riedel (2011) find that subsidiaries subject to relatively low corporate tax rates show a higher level of intangible asset investment than other affiliates in a multinational group. Karkinsky and Riedel (2012) and more recently also Griffith et al. (2014) substantiate this finding on the basis of patent data.

Finally, our study is connected to a strand of literature that investigates the interrelationship between the tax sensitivity of capital investment and profit shifting opportunities. The literature shows that if foreign earnings are exempt upon repatriation, or taxation is deferred, the host-country tax rate is an important determinant of foreign direct investment (e.g. Janeba, 1995; De Mooij and Ederveen, 2003; Feld and Heckemeyer, 2011). Shifting profits from a given host country to low-tax affiliates reduces, all other things equal, the effective tax burden. In other words, the effective tax rate levied on infra-marginal or marginal returns is no longer determined by the local tax rate of the country where the real business activity takes place but by the tax rate of the jurisdiction where profits are shifted. As a consequence, profit shifting might reduce the sensitivity of investment to local tax rates and, vice versa, restricting profit shifting opportunities can lead to increased investment responses to the local tax rate (Hong and Smart, 2010; Haufler and Runkel, 2012). Empirical evidence for the negative relationship between profit shifting opportunities through IP tax planning and the sensitivity of investment to source country taxation is provided by Overesch and Schreiber (2010). Based on German outbound FDI micro data, Overesch and Schreiber (2010) find that R&D intensive firms' outbound investments are less sensitive to tax than outbound investments of less R&D intensive firms. Our study relates to this previous piece of research in that we try to investigate the functions of the tax department in R&D intensive firms by using organizational design theory and taking a closer look inside the firm.

The remainder of the paper is structured as follows. Section 2 develops our hypothesis. The research design and data are discussed in Section 3. Furthermore, Section 4 explains our estimation approach. Section 5 presents our main results and robustness checks. Section 6 concludes.

# 2 Hypothesis Development

According to organizational design theory, the organizational architecture of a firm depends on three columns: performance measurement, reward and punishment of performance, and the partitioning of decision rights between agents within the firm (Jensen and Meckling, 1992; Zimmerman, 2014). Previous studies have focused on the first two columns of organizational architecture, that is the choice of performance measurement of corporate tax departments (Robinson et al., 2010) and the role of compensation-based incentives in corporate tax planning (Phillips, 2003; Armstrong et al., 2012). In this paper, we are particularly interested in the factors that determine the allocation of decision rights to the tax department and thus put the focus on the third column of organizational design.

Along the decision-making process, the hierarchical structure of a firm must allocate decision rights over four essential steps to different managers or agents (Jensen and Meckling, 1992; Zimmerman, 2014). These four steps are the *initiation* of a certain action, its *ratification*, followed by its *implementation* and, finally, *monitoring tasks*. Fama and Jensen (1983b) use the term *decision management* to summarize activities that fall under initiation and implementation and the term *decision control* to summarize ratification and monitoring. Considering the construction of a new plant, for example, the initiation proposal about whether and where to invest in new facilities may primarily come from division managers with specialized knowledge of the production process and product demand from customers.[3] In the ratification process, senior management assembles knowledge from specialists in finance, human resources, legal, and other departments. Construction of the project, i.e. implementation, is the responsibility of the proposing managers or a separate facilities department within the firm. After construction is completed, internal accountants prepare financial reports to monitor the division operating the project.

Obviously, when firms are sufficiently complex, the relevant knowledge needed to make an investment decision is dispersed among several agents in the firm. Hence, several agents will be involved in the decision-making process and the firm needs some mechanism to structure the way decisions are made. We are interested in the role of tax experts in this process. We think that two scenarios are possible. On the one hand, the tax department could primarily be involved in controlling tasks, supporting ratification and monitoring of the project, and thus acting separately from management activity.

[3]The example is taken from Zimmerman (2014), p. 146.

A tax department that acts as a controller rather than a manager concentrates, for example, on ensuring that local and international tax legislation is complied with but it does not intervene in the structuring of the project. The management of the project would, in this case, be rather decentralized in the hands of the specialized division managers. On the other hand, the tax department could act much more as a manager and be involved in the initial stage of the decision process, for example by preselecting potential investment locations and coordinating directly with the initiating division managers. Thus, the decision process would be more centralized and management and control functions would be exercised in a less separated fashion.

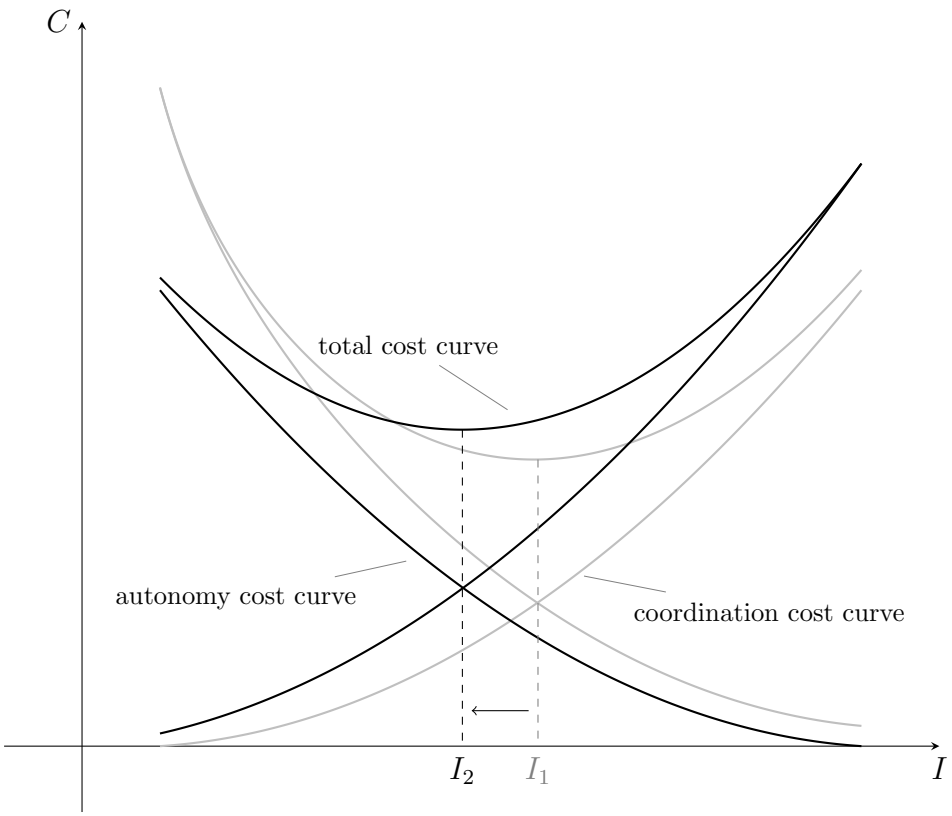
The question of whether the tax department acts more as a manager or as a controller reflects the optimal choice of coordination intensity with other departments and divisions in the firm. Coordination intensity with experts and managers from other departments or divisions will be increasing in the tax department's intervention in decision management. For example, if the tax department gets involved in project initiation, specialized division managers and the tax department will have to coordinate to preselect potential investment locations, taking into account important tax aspects and non-tax factors related to local conditions of production and demand. The cost of coordination result from communication and the so caused delay in making a decision. Cost of delay are costs for missing out opportunities, because transferring knowledge (i.e. coordinating) takes time (Szulanski, 2000; Zimmerman, 2014).

In this coordination problem, the cost of coordination have to be balanced with the cost of autonomy (Emery, 1969). Cost of autonomy emerge from the forgone use of valuable knowledge in the decentralized decision-making process, which can result in inefficient or even entirely wrong decisions. In our context, the costs of autonomy (of the initiating division managers) can best be understood as forgone tax savings due to inefficient use of the tax experts' knowledge.[4]

Figure 1 illustrates the relationship between coordination intensity $I$, represented on the horizontal axis, and associated costs $C$, represented on the vertical axis. The ascending curves represent coordination costs, while the descending curves represent the autonomy costs. With increasing coordination intensity the cost of coordination increase, while the cost of autonomy decrease. The total costs are the sum of coordi-

[4]We use the more general concept and term 'autonomy costs' as e.g. in Emery (1969), instead of referring to the term 'agency costs' as used in Jensen and Meckling (1992), Fama and Jensen (1983a) and Fama and Jensen (1983b). Agency costs occur when agents dispose of private information and do not share common interests. Here, we want to leave open the question whether the tax department and other specialized division managers have conflicting or congruent interests. In any case, with decreasing coordination, the efficiency costs of autonomous decision-making tend to increase.

Figure 1: Coordination Intensity Choice




Notes: Own source, according to Emery (1969). The ascending curves represent the coordination cost curves, while the descending curves represent the autonomy cost curves. The U-shaped curves represent the total cost curves. The grey curves depict the initial situation. We hypothesize that in R&D intensive firms both curves are shifted to the left, as represented by the black curves. The total cost minimum is at the point of equality of the absolute slopes of the autonomy cost and coordination cost curves. In this figure, the point of equal absolute slopes coincides with the intersection of the two cost curves.

nation and autonomy costs, represented by the U-shaped curve. The minimum of the total cost curve indicates the optimal level of coordination intensity, here at $I_1$.[5] In our context, the horizontal axis, depicting coordination intensity, also reflects the nature of the tax departments' tasks. At the right end of the continuum, the tasks of the tax department are managerial in nature, i.e. highly coordination intensive. At the left end, they are of a controlling type with little coordination between tax experts and managers of other business units. Accordingly, the tax departments' choice of coordination intensity with other business units ultimately reflects the decision on the nature of its tasks. Hence, the minimum of the total cost curve represents the optimal bundle of the

[5]The optimal coordination intensity, i.e. the minimum of total costs, is at the point of equality of the absolute slopes of the autonomy cost and the coordination cost curves, which in Figure 1 coincides with the intersection of the two curves.

tax department's managerial and controlling tasks.

We argue that in R&D intensive firms, the optimal level of coordination intensity between the tax department and other business units is lower relative to non-innovating firms, here at $I_2$.[6] In other words, the tax department in highly R&D intensive firms carries out more controlling activities rather than managerial tasks as compared to less R&D intensive companies. We present two principal reasons for our hypothesis:

First, coordination costs in terms of delay costs from lost opportunities are especially high in R&D intensive businesses. The first applicant of a patent has the chance to be granted a monopoly and to extract the associated economic rents, while the runner-up will potentially face important economic and legal barriers to market entry. Moreover, in many high-tech industries, products and innovations follow sharp life cycle patterns. Missing out on the start of a new product cycle means that chances to successfully commercialize one's product are drastically reduced because the pioneers will have seized the market, at least for the lifetime of that new innovation. As a consequence, many companies engaged in R&D put a strong focus on 'time to market' which becomes the primary target dimension in the management of R&D projects (Brem, 2008). In Figure 1, the coordination cost curve for R&D intensive firms is represented by the black ascending curve. It is shifted to the left relative to the 'standard' coordination cost curve for non-innovating firms, representing the increased costs of delay at given levels of coordination intensity.

A second reason for the optimal level of coordination intensity being comparably low in R&D intensive firms relates to the costs of autonomy that arise as a decreasing function of coordination intensity. More specifically, we argue that R&D intensive firms have enhanced opportunities to shift paper profits toward low-tax jurisdictions because R&D activity tends to produce both highly mobile and highly specific intangible assets, which can be separated from the R&D inputs and migrated to low-tax subsidiaries in a tax efficient way.[7] R&D intensive firms thus may care less about taxes in the investment decision process because they have considerable tax planning opportunities at a later stage, i.e. after the investment project has been implemented, and can substantially reduce their effective tax burden no matter where the real economic activity takes

[6] Again, the optimal coordination intensity, i.e. the minimum of total costs, is at the point of equality of the absolute slopes of the autonomy cost and the coordination cost curves, which in Figure 1 coincides with the intersection of the two curves.

[7] For empirical evidence on the tax sensitivity of intangible asset location, see Dischinger and Riedel (2011) and Karkinsky and Riedel (2012).

place.[8] Hence, the autonomy costs in terms of forgone tax savings that result from low coordination intensity between the tax department and other division managers initiating an investment project are low because inefficiencies from a tax point of view can be partially reversed by tax planning with IP. Graphically, this mechanism available to R&D intensive firms is reflected by the black descending autonomy cost curve which is shifted to the left relative to the autonomy cost curve for non-innovating firms. As both the autonomy and the coordination cost curves for R&D intensive firms are shifted to the left, so is the optimal coordination intensity between the tax department and initiating division managers (from $I_1$ to $I_2$ in Figure 1).

In sum, the optimal level of coordination intensity in R&D intensive firms is reduced for two reasons: First, coordination between R&D managers and the tax department is costly, because the cost of delaying an R&D related decision may be exorbitantly high. Second, R&D intensive firms often hold IP that enables them to engage in tax planning no matter where the economic activity actually takes place. These opportunities may help them to compensate tax inefficiencies from low coordination in the initial stage of the investment decision by engaging in IP tax planning *ex post*. Thus, our hypothesis is the following:

> *Hypothesis: In R&D intensive firms, the tax department carries out more controlling rather than managerial tasks than in less R&D intensive firms.*

We argue that the tax department's management-control choice manifests itself in four dimensions, which we are able to directly observe in our survey. These are the effort the tax department makes for tax planning relative to compliance and reporting, the department's ambitions to minimize the overall tax burden of the firm relative to tax risk management, the temporal involvement of the tax department in investment decisions and the ultimate decision rights the tax department has in the investment decision. These characteristics are supposed to describe the nature of the tax department's tasks. We argue that the more the company's tax experts act as managers in the business decision process, the more time they spend on active tax planning relative to mere reporting and compliance tasks. We also suppose that a decision managing tax department tends to have high ambitions to minimize the firm's tax burden and it gets involved early in the initiation phase of the decision process, whereas a controlling tax department comes in at later stages for ratification and monitoring of decisions. With respect to ultimate decision rights, the strongest right, the right to veto, will rather

[8] In line with this notion, Overesch and Schreiber (2010) provide empirical evidence that the impact of taxes on investment decisions decreases with increasing R&D intensity.

rest with the tax department that serves as a controller rather than with a managing tax department.

Table 1: Predictions

| | Tax Department acts more as a ... | Efforts | Ambitions | Temp. Inv. | Rights |
|---|---|---|---|---|---|
| high R&D intensity | ... controller | - | - | - | + |
| low R&D intensity | ... manager | + | + | + | - |

Notes: + / - indicates the predicted direction of the effect of R&D intensity on each of the four dimensions, efforts, ambitions, temporal involvement and rights.

As stated above, we hypothesize that high R&D intensity leads the tax department to adopt more controlling tasks because the cost of coordination, particularly in the form of time delay, may be exorbitantly high. What that means for each separate dimension is shown in Table 1. We expect that a high R&D intensity is associated with less tax planning effort, less ambitions and a later involvement of the tax executives in the decision-making process. Therefore, the predicted effect of R&D intensity on efforts, ambitions and temporal involvement is negative.[9] On the other hand, we expect that R&D intensity is positively associated with rights, because this dimension is inversely related to the management-control-choice, i.e. tax departments that have more controlling tasks are more likely to have a veto right in the decision-making process. Consequently, the hypothesis that R&D intensive firms' tax departments act more as a controller rather than as a manager comes along with a predicted positive effect of R&D intensity on the rights of the tax department.

# 3 Research Method and Sample

## 3.1 Survey Approach

Many previous studies have investigated the effect taxes have on R&D investment and most of them have empirically tested their hypotheses by means of large archival data

[9]We acknowledge that it may appear difficult to disentangle the effect that R&D intensity has on tax planning efforts and ambitions. We argue that the tax department is less involved in active investment decision management and planning both because it wants to avoid time delays and because it can much more efficiently shift profits after the investment took place by migrating mobile and firm-specific intangible assets to low-tax jurisdictions, i.e. through contract R&D agreements (for a more detailed discussion on different migration strategies see Section 4.2). Obviously, this ex post IP and profit migration requires some tax planning effort and ambition itself. In the empirical analysis, we will try to isolate the influences on the four dimensions associated with the management of IP.

sets. Data that has commonly been used to study R&D investment is R&D expenditure (Bloom and Griffith, 2001; Bloom et al., 2002), royalty income (Mutti and Grubert, 2009), balance sheet data on intangible asset holdings (Dischinger and Riedel, 2011) or the number of patent applications (Ernst and Spengel, 2011; Karkinsky and Riedel, 2012; Boehm et al., 2012; Ernst et al., 2014). Instead, we conducted a survey in cooperation with the internationally operating tax consultancy firm PricewaterhouseCoopers (PwC). A major advantage of surveys is the elicitation of otherwise unobservable data (Serita, 2008). As we are interested to gain a deeper understanding of how firm characteristics influence the role the tax department plays in the decision-making process, archival accounting databases would not help us to address our research question.

We designed the questionnaire and entered into a cooperation with PwC, who conducted the survey among preselected global client firms. The preselection of firms was done by PwC to compose a sample of large and multinationally operating firms. After we had designed a first draft of the questionnaire, we made several revisions to it based on feedback from academics in the areas of marketing, finance, accounting and economics. Moreover, three firms beta-tested the questionnaire and provided feedback on the length of the questionnaire and on the readability and comprehensibility of the content to us. Finally, we asked 39 questions, while the questions considerably differed in length and some questions comprised subsections.[10] The questionnaire is 20 pages long, where we assumed that it will take one minute per page to answer the questions. We divided the questionnaire in three subparts. The first part addresses the role of tax considerations in R&D-related business decisions. The second part contains questions regarding the organizational integration of the tax and R&D function. The last part asks for company characteristics of the respondent firm.

The questionnaire was sent out by PwC to its client firms in August 2012. The survey was closed in October 2013. Throughout this period, we sent several reminders to the contacted firms. Out of 321 questionnaires that were sent out, 47 firms returned the questionnaire properly filled out. Thus, the response rate was approximately 15%.

Survey data also entails some drawbacks. The major concern is measurement error caused by inappropriate answers. The answer a respondent gives can be inappropriate due to the lack of knowledge or that the respondent feels uncomfortable to openly and correctly answer the survey questions. Concerns on the part of respondents to honestly answer survey questions might be a problem in our context as international tax planning is generally not well received by public opinion. Respondents might therefore,

[10]This paper analyzes selected questions from the questionnaire.

consciously or subconsciously, be tempted to conceal the true role of tax considerations in their business decisions.

These potential difficulties have to be addressed carefully prior to conducting the survey, especially in the design of the questionnaire and in the way the survey is conducted. Following previous survey studies in the accounting and finance literature (Graham and Harvey, 2001; Graham et al., 2005, 2011) we dealt with these issues in several ways, which we discuss in the following. As we only asked tax experts to fill out the survey, we do not worry that the respondents randomly chose their answers. If the respondent was not motivated to fill out the survey, he could easily refuse to do it. Also, we rely on the expert knowledge of the respondents and believe that the questions we asked were understood correctly. Nevertheless, we included a question to indicate the job title of the person who filled out the form. From the 47 respondents, 29 respondents are head of the tax department, one respondent is the vice president of the tax department, four are CFO of the company, one respondent is the vice president of the CFO, six are local tax managers, one respondent is the CEO of the company, one the assistant to the CEO and another one the assistant to the CFO and, finally, three respondents did not report their job title.

We are aware that some of our questions are sensitive as we also focus on tax planning strategies. These questions are critical, because respondents might not want to answer such questions correctly. First, we made clear that we are only interested in legal tax planning schemes, which is distinct from illegal tax evasion. Second, we decided that PwC conducts the survey for us, because firms will probably have confidence in the integrity and discreetness of their consultancy firm. In the survey, we made clear that all answers will be forwarded to us, the researchers, in anonymous form. We also included a paragraph on data security and confidentiality in the introduction to the questionnaire. We assured our respondents that the data reported in the questionnaire would be treated confidentially and that results would be published in aggregate form only. Last, we pointed out that respondents may also return an uncompleted questionnaire in case they were unable to answer some of the questions. That information was also meant to ensure that respondents felt free to leave some questions unanswered if they were uncomfortable with them.

## 3.2 Survey Data and Sample

The following Tables 2 and 3 provide an overview of the characteristics of the 47 respondent firms. Half of respondents are located in Germany, followed by the US

and Switzerland. Furthermore, the sample comprises firms from Australia, Austria, Finland, Hong Kong, Israel, Mexico, South Africa and the UK. Most firms are publicly traded (35 firms), but our sample also comprises eleven private firms and one firm that indicated some other ownership structure, although without specifying it any further. The majority of respondent firms are operating in heavy industries (16 firms), followed by the manufacturing industry (9 firms).

Table 2: Company characteristics of respondent firms

| Group's parent country (N = 47) | # of firms | Industry (N = 47) | # of firms |
|---|---|---|---|
| Australia | 1 | Agriculture, forestry, fishing | 1 |
| Austria | 1 | Mining, construction | 4 |
| Finland | 1 | Manufacturing: food, textiles and chemicals | 9 |
| Germany | 25 | Heavy industries | 16 |
| Hong Kong | 1 | Transport and utilities | 3 |
| Israel | 1 | Wholesale and retail trade | 1 |
| Mexico | 2 | Banking, finance, insurance, real estate | 3 |
| South Africa | 1 | Information technologies | 4 |
| Switzerland | 6 | Health, pharmaceuticals, biotechnologies | 4 |
| United Kingdom | 1 | Public administration | 2 |
| United States | 7 | | |
| Ownership (N = 47) | | | |
| Public | 35 | | |
| Private | 11 | | |
| Other | 1 | | |

Notes: The group's parent country indicates the country of incorporation of the global ultimate owner company of the respective respondent firm. Industry classification is based on the US Securities and Exchange Commission's (SEC) standard industrial classification (SIC).

On average, our respondents have total assets of $70,800 million, total liabilities of $52,300 million and total sales of $30,000 million. The average net income is $1,830 million and the return on assets is 6.19%. The average respondent firm employs 61,537 people (full-time equivalents), where 5,537 of these are employed in R&D, and is approximately 87 years old. The average balance sheet amount of intangible assets is slightly more than one tenth of the total assets ($7,960 million) and the average spending on R&D is $1,240 million per year. The total R&D spending of all sample firms amounts to approximately $53,400 million. This corresponds to approximately 30% of the total business R&D spending in the EU27 in 2012 or to 8% of the total business R&D spending within the OECD in 2012.[11] This share appears very high in view of

[11]The total business R&D spending in the EU27 in 2012 amounts to $176,744.85 millions and the total business R&D spending within the OECD in 2012 amounts to $649,214.01 millions. The figures are taken from the OECD database on business enterprise expenditure on R&D (BERD). The figures are measured at constant prices and PPP.

the small number of firms we survey. However, the distribution of R&D expenditure across firms worldwide is highly skewed, meaning that the majority of R&D spending is concentrated in the hands of only a few firms. This is highlighted by the EU Industrial R&D Investment Scoreboard published by the European Commission (EC), which covers the top 2,000 investors in R&D worldwide. These 2,000 firms represent more than 90% of the total R&D expenditure by private businesses.[12] Our sample contains 30 firms that are among the top 2,000, and even 15 that are among the top 200 Scoreboard firms. In sum, our sample covers 7.7% of the top 2,000 firms' aggregate R&D expenditure in the year 2012. Moreover, we emphasize that 9 respondents are among the Top 50 applicant firms to the European Patent Office.

Table 3: Selected descriptive statistics of respondent firms

| Variable | # Observations | Mean | Median | Minimum | Maximum |
|---|---|---|---|---|---|
| Total assets | 47 | 70,800 | 22,800 | 113 | 685,000 |
| Total liabilities | 47 | 52,300 | 14,200 | 167 | 625,000 |
| Total sales | 47 | 30,000 | 18,000 | 140 | 147,000 |
| Net income | 46 | 1,830 | 662 | -778 | 13,600 |
| Return on assets | 45 | 6.19% | 6.10% | -34.64% | 29.16% |
| Intangible assets | 45 | 7,960 | 1,400 | 0 | 85,400 |
| R&D expenses | 43 | 1,240 | 193 | 0 | 6,790 |
| Total employees | 47 | 61,537 | 44,000 | 480 | 380,000 |
| R&D employees | 35 | 5,537 | 1,000 | 0 | 38,500 |
| Firm Age | 47 | 87 | 100 | 0 | 179 |

Notes: All financial statement information is in million US Dollars. Firm age is measured in years.

One limitation to survey research is selection bias in the answers due to self-selection of respondents (Dillman, 1978). Firms or managers may decide themselves whether to answer the survey or not and therefore, they select themselves into two groups, the group of respondents and the group of non-respondents. The concern of selection bias is related to the generalizability of the results and conclusions drawn from the survey. One form of selection bias is non-response bias that arises if the group of respondents is systematically different to the group of non-respondents in observable characteristics that influence the subject of interest in our study (i.e. R&D related tax planning behavior). Another form of selection bias arises if the group of contacted firms systematically differs from the population that is researched. Hence, we draw comparisons to address both of these concerns. First, we compare the sample of respondents to bigger populations, i.e. to the group of non-respondents and the group of firms that are part of the Standard & Poors (S&P) 1200 Index. Second, we compare our sample of contacted

[12]See the European Commission's press release on November 18, 2013: http://europa.eu/rapid/press-release_MEMO-13-1000_en.htm.

firms with the group of S&P 1200 firms. The S&P 1200 Index is a stock market index that covers the 1,200 worldwide biggest and publicly traded companies. It comprises approximately 70% of the world's stock market capitalization. Since the bigger part of R&D is concentrated in the hands of a few but very large multinational firms, we are interested to learn how our sample compares to this population of firms, and, therefore, use the sample of S&P 1200 companies as a comparison group.

Table 4: Non-Response Bias Tests

| | S&P 1200 (1) | | All Firms we Contacted with Available Data (2) | | Survey Nonresponders with Available Data (3) | | Survey Responders with Available Data (4) | |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | N | Mean | N | Mean | N | Mean |
| RDINT | 675 | 0.03 | 128 | 0.04 | 85 | 0.04 | 43 | 0.03 |
| IPINT | 1,197 | 0.19 | 147 | 0.20 | 102 | 0.21 | 45 | 0.17 |
| SIZE | 1,209 | 23,800 | 149 | 31,900 | 102 | 32,800 | 47 | 30,000 |
| ROA | 1,209 | 0.07 | 147 | 0.07 | 102 | 0.07 | 45 | 0.06 |
| LEV | 1,206 | 0.60 | 149 | 0.79 | 102 | 0.62 | 47 | 1.17 |
| GROW | 1,207 | 0.15 | 146 | 0.05 | 101 | 0.05 | 45 | 0.07 |
| INVINT | 1,189 | 0.08 | 147 | 0.12 | 102 | 0.11 | 45 | 0.13 |
| CAPINT | 1,186 | 0.28 | 145 | 0.21 | 101 | 0.22 | 44 | 0.20 |

| | p-Value | | | |
|---|---|---|---|---|
| | 1 vs. 2 | 1 vs. 4 | 2 vs. 4 | 3 vs. 4 |
| RDINT | 0.0573 | 0.7419 | 0.5462 | 0.3925 |
| IPINT | 0.0508 | 0.8792 | 0.2566 | 0.1199 |
| SIZE | 0.4426 | 0.1122 | 0.5241 | 0.3776 |
| ROA | 0.3641 | 0.8115 | 0.7779 | 0.6990 |
| LEV | 0.2773 | 0.4240 | 0.9342 | 0.9089 |
| GROW | 0.1006 | 0.7707 | 0.5527 | 0.4146 |
| INVINT | 0.0000 | 0.0005 | 0.4488 | 0.2992 |
| CAPINT | 0.0470 | 0.0888 | 0.6037 | 0.4780 |

Notes: Columns (1) to (4) represent different populations as stated. P-values are based on a two-tailed Wilcoxon test and indicate significant differences among the different populations in the variables observed. All variables are obtained from the Compustat Global and Compustat North America Database and are measured as of 2012. R&D intensity, abbreviated by RDINT, is R&D expenses (XRD) scaled by total assets (AT), IP intensity, abbreviated by IPINT is intangible assets (INTAN) to total assets (AT), size is measured by total sales (SALE) and is in million USD, ROA is the return on assets defined as net income (NI) scaled by total assets (AT), leverage, abbreviated by LEV, is calculated as liabilities (LT) over total assets (AT), asset growth is the percentage change in total assets to the one-year lag total assets (AT), inventory and capital intensity, abbreviated by INVINT and CAPINT respectively, is total inventories (INVT) and net property, plant and equipment (PPENT) respectively over total assets (AT).

Table 4 contains descriptive statistics of all samples and p-values from a Wilcoxon rank-sum test to indicate whether the samples are significantly different from each other. To test for possible selection bias we group firms into four different samples

represented in columns (1) to (4) of Table 4. Column (1) comprises the set of firms that during January 2011 and December 2013 were at least once part of the S&P 1200 Index.[13] Column (2) comprises all contacted firms that were sent a questionnaire. Finally, this column is split in the group of non-respondents (column (3)) and the sample of respondents (column (4)).

Overall, with respect to most characteristics we evaluate, our sample of respondents is similar to the S&P 1200. The firms in the sample only differ from the S&P 1200 in terms of inventory and capital intensity. In other words, the S&P 1200 companies have similar distributions of R&D intensity, IP intensity, total sales, return on assets, leverage, and asset growth. Comparing all contacted firms with the S&P 1200 Index, our contacted firms differ significantly from the S&P 1200 in terms of R&D and IP intensity, in inventory and in capital intensity. Nonetheless, they are similar in terms of size, return on assets, leverage and asset growth. Comparing the characteristics of respondent firms to those of the firms we contacted and to those of non-respondents, we do not find that the respondent firms differ significantly from these two groups.

To sum up, contacted and responding firms are different from S&P 1200 firms along some few dimensions. Therefore, our results might not generalize to the whole sample of S&P 1200 firms. Nonetheless, there is no indication for systematic differences between firms that answered our survey and those that did not answer.[14]

# 4 Estimation Strategy

Our aim is to explore whether R&D intensity influences the coordination intensity of the tax department with other operational units within the firm. Since the tax department's management-control-choice is difficult to observe, we decided to measure specific characteristics of the tax department. Precisely, we assume that the tax departments' position on the continuum between management and control manifests itself in four dimensions. These are the tax departments' tax planning efforts, its tax planning ambitions, its temporal involvement and its ultimate decision rights.

[13]The sample of column (1), therefore, contains slightly more than 1,200 firms.

[14]Generalizability requires a representative sample and, additionally, a sample size that is large enough to reduce the margin of error to conventional levels. Even if our sample of respondents was similar to the relevant comparison group in all characteristics, we would still be cautious about generalizing our findings to the whole population of firms due to our small sample. Limited generalizability is a general limitation of survey research in accounting and taxation and has been encountered by previous studies as well (e.g. Graham et al., 2011, 2014). Still, we believe that survey studies provide valuable contributions to unravel the black box of tax decision-making.

The data on these four dimensions comes from the questionnaire. While the first dimension - tax planning effort - is a proportion, the other three dimensions - ambitions, temporal involvement and rights - are ordinal variables measured on a five-point scale. *Tax planning efforts* are measured by the approximate time (in % of total workload) that is spent on tax planning activities, as opposed to activities linked to compliance and financial reporting, by tax executives. *Ambitions, temporal involvement* and *rights* are measured on a five-point scale respectively, ranging from 0 to 4. We ask *'How important is the minimization of the group's tax burden as an objective for your group's tax department?'* to measure the ambitions of the tax department. A 0 on the response scale indicates that minimization of the group's tax burden is not at all an important objective of the tax department, while 4 indicates that tax minimization is a very important goal. Furthermore, we ask *'Starting from which stage during the planning phase of an investment project are the tax executives involved in the decision-making?'* to measure the temporal involvement in the decision process. 0 again indicates the lowest parameter value, which we equate to a very late involvement of the tax executives and which we scenarize as *'The decision has been made; tax executives optimize given the target location'*. A value of 4 instead means that the tax department gets involved very early and preselects potential targets in the initiation phase of the decision process. Last, ultimate decision rights are measured by the question *'During the planning phase of an investment project, how would you characterize the role of the tax executives?'* and which ranges from 0, *No rights, the decision is made without consultation of tax executives*, to 4, *Tax executives have a veto right.*

To analyze the relationship between R&D intensity and each of these four dimensions, we will perform bivariate tests and regression analyses. Throughout the empirical analysis, we will take into account that our sample is small from a statistical point of view. Standard econometric methods used for hypothesis testing rely on sampling distributions that are approximately normal. The assumption of normality is without problems and justified by the central limit theorem if the sample size is large. However, given our sample size of slightly less than 50 observations, assuming a normal (approximate) sampling distribution may potentially be inaccurate. For our bivariate tests, we will therefore use the Wilcoxon rank-sum test[15] as a robust non-parametric alternative to the common Student's t-test (Wilcoxon, 1945; Mann and Whitney, 1947). However, the normal approximation to the sampling distribution can still be *accurate* in samples as small as 30 observations (p. 89 in Stock and Watson, 2012). We will therefore make statistical inferences on the basis of t-tests as well.

[15]Also known as the Wilcoxon-Mann-Whitney-Test, Mann-Whitney-U-Test, or U-Test.

The regression analysis will estimate an empirical model of the following form

$$\begin{aligned} DIM_i &= \beta_0 + \beta_1 RDINT_i + \beta_2 SIZE_i + \beta_3 ROA_i + \beta_4 LEV_i \\ &+ \beta_5 GROW_i + \beta_6 INVINT_i + \beta_7 CAPINT_i + \beta_8 AGE_i + \epsilon_i \end{aligned} \tag{1}$$

where $DIM_i$ abbreviates the four different dimensions and $RDINT_i$ represents R&D intensity, our variable of main interest.

Our hypothesis (see Section 2) predicts that with increasing R&D intensity it becomes more likely that the tax department takes the position of a controller rather than that of a manager. We measure R&D intensity (RDINT) by the firm's R&D expenses scaled by total assets. Furthermore, we include a number of control variables that likely co-determine the tax department's management-control-choice.

Previous literature substantiates the notion that tax planning opportunities and incentives influence the actual tax avoidance behavior of firms (Manzon and Plesko, 2002; Mills, 1998; Rego, 2003; Frank et al., 2009; Dyreng et al., 2008). Since the tax avoidance behavior of a firm is closely related to the nature of the tax department's tasks, we think that tax planning opportunities and incentives may also influence the management-control-choice of the tax department. Consequently, the first set of control variables capture real tax planning opportunities: Theoretically, it has been argued that the size of the firm increases complexity and, therefore, impacts negatively on the management-control-choice of a firm (Fama and Jensen, 1983b). The empirical evidence, however, reports mixed results. Early evidence by Zimmerman (1983) finds a positive effect of firm size on tax planning and documents that larger firms face higher tax payments. More recently, studies regarding the determinants of the ETR find negative (Boone et al., 2013; Chyz et al., 2013) as well as positive (Hope et al., 2013; Chyz et al., 2013) significant elasticities of firm size. Hence, the effect of firm size is a priori ambiguous. Our empirical analysis contains the logarithm of total sales (SIZE) to control for firm size. In line with Fama and Jensen (1983b), we expect that firm size likely increases complexity and consequently leads to less coordination intensity.

Furthermore, we include the return on assets (ROA) to capture the profitability of a firm, as the literature suggests that profitable firms might have more incentives for tax planning (Chen et al., 2010; Anderson and Reeb, 2003). Thus, we expect that high profitable firms make more effort on tax planning. In general, we suppose that profitability positively impacts on coordination-intensity. Furthermore, we include leverage (LEV) calculated as total liabilities divided by total assets to control for the debt tax

shield benefit resulting from the deductibility of interest expenses. Lastly, we control for asset growth (GROW) by calculating the one-year percentage growth rate of total assets. Although the findings of Keating (1997) and Bankman (1994) suggest a negative impact of growth on tax planning efforts, more recent literature often does not find statistically significant effects of growth on firms' tax avoidance behavior as, for example, reflected in the reported GAAP ETR (Robinson et al., 2010; Chen et al., 2010; Phillips, 2003).

The second set of control variables capture book-tax planning opportunities. Contrary to real tax planning, where real activities are undertaken in a tax optimal way, book-tax planning refers to the tax optimal reporting in the financial as well as in the tax accounts. We include inventory intensity (INVINT) and capital intensity (CAPINT), because inventory and capital intensive firms are more affected by different valuation methods for tax and financial reporting purposes (Hope et al., 2013). Given that these firms have more tax planning opportunities, we could expect a positive effect on coordination intensity. On the other hand, the tax planning opportunities may also reduce the cost of autonomy and thus, cause the tax department to act more as a controller. This argument would substantiate a finding of a negative effect of inventory and capital intensity on coordination intensity. Taken together, the effects are a priori ambiguous. We calculate inventory intensity as inventory scaled by total assets and capital intensity as net property, plant and equipment divided by total assets. Last, we also control for the age of the tax unit. We do not have a prediction for the effect of tax unit age on coordination intensity, because tax unit age has not been studied in empirical analyses of tax planning behavior so far. On the one hand, older tax departments may have more routine and therefore coordinate more efficiently. Hence, one would expect a positive impact of age on coordination intensity due to lower coordination costs. On the other hand, a younger tax department may have to make higher efforts on tax planning as compared to compliance tasks, because it is not yet familiar with the task, which would result in a negative effect of tax department age on coordination intensity.

In sum, we include several firm specific characteristics to control for a potential systematic correlation between R&D intensity and firm specific characteristics. We control for firm size (SIZE) by including the logarithm of total sales, profitability (ROA) by including the return on assets, leverage (LEV) by including the quotient of liabilities over total assets, asset growth (GROW) by including the one-year percentage growth rate of total assets, inventory (INVINT) and capital intensity (CAPINT) by including the quotient of inventory over total assets and the quotient of plant, property and

equipment over total assets and the age of the tax department (AGE).

For purposes of our regression analyses, we dichotomize the ordinal dimensions and estimate our regressions using OLS. The dichotomized variables take on the value 1 if the respondent's answer was 3 or 4, and takes on 0 otherwise. Thus, the value 1, respectively, stands for tax minimization being an important or very important goal, tax executives being involved early or very early, tax executives having strong or even veto rights. We could also use non-linear response models to estimate the three regressions with qualitative dependent variables (ambitions, temporal involvement, decision rights). Indeed the linear probability model, which we prefer, is not beyond redemption. In particular, the predictions from the model cannot be constrained to the 0-1 interval (Greene, 2012).[16] Alternatively, some of the prominent problems associated with the linear probability model can be overcome by making the probability for one a non-linear, rather than a linear, function of the covariates. In contrast to the linear model, however, exact (small sample) properties of the Maximum Likelihood (ML) estimator of logit and probit models cannot be established (Aldrich and Nelson, 1984) and the literature on the small sample behavior of the ML estimator for binary regression models is rather limited (Chen and Giles, 2012). As outlined above, the central limit theorem can hold already in small samples of 30-50 observations and the normal approximation to the distribution of the OLS estimator should be appropriate. Thus, when using OLS we have more confidence in our inferences about the true empirical relationship between the explanatory variables of interest and the four dimensions of the tax department's role in the decision-making process. Nonetheless, we will check whether our results are sensitive to the choice of linear vs. non-linear estimation.

The data are primarily taken from the questionnaire. However, we also resort to data from Compustat Global and Compustat North America. When neither questionnaire data nor Compustat data is available, we also use the Worldscope database provided by Thomson Reuters. In addition, we always cross-checked the data obtained from the questionnaire with publicly available data from these alternative databases. Where we encountered any errors or even missing observations in all three data sources, we hand-collected the data from the consolidated financial statements directly. Nevertheless, we sometimes could not identify the necessary data in the financial statements and some firms did not even publish their reports, which leaves us with a few missing observations in our final sample. The consolidated financial statement information refers to the

[16]For an exchange on the usefulness of the linear probability model, see Angrist (2001) and Moffitt (2001). Its shortcomings notwithstanding, the linear probability model is applied, among many others, by Caudill (1988), Heckman and MaCurdy (1985), and Heckman and Snyder (1997).

Table 5: Cross-Correlation Table

| Variables | RDINT | IPINT | SIZE | ROA | LEV | GROW | INVINT | CAPINT | AGE |
|---|---|---|---|---|---|---|---|---|---|
| RDINT | 1.0000 | | | | | | | | |
| IPINT | 0.1208 | 1.0000 | | | | | | | |
| | (0.4402) | | | | | | | | |
| SIZE | -0.1248 | -0.0406 | 1.0000 | | | | | | |
| | (0.4253) | (0.7914) | | | | | | | |
| ROA | -0.0108 | 0.1452 | 0.0996 | 1.0000 | | | | | |
| | (0.9453) | (0.3413) | (0.5150) | | | | | | |
| LEV | -0.1363 | -0.1770 | **-0.3590** | 0.1052 | 1.0000 | | | | |
| | (0.3835) | (0.2448) | (0.0132) | (0.4917) | | | | | |
| GROW | -0.0417 | -0.0094 | -0.0772 | -0.0794 | -0.1144 | 1.0000 | | | |
| | (0.7908) | (0.9511) | (0.6142) | (0.6040) | (0.4544) | | | | |
| INVINT | 0.0463 | -0.1283 | -0.2678 | -0.1183 | 0.0404 | 0.0426 | 1.0000 | | |
| | (0.7682) | (0.4010) | (0.0753) | (0.4391) | (0.7924) | (0.7813) | | | |
| CAPINT | -0.2293 | -0.1337 | 0.1765 | 0.0768 | -0.0453 | 0.1829 | 0.0932 | 1.0000 | |
| | (0.1440) | (0.3868) | (0.2518) | (0.6205) | (0.7704) | (0.2346) | (0.5475) | | |
| AGE | -0.1037 | -0.0185 | **0.5122** | -0.0927 | **-0.3120** | 0.2090 | **-0.3513** | 0.1626 | 1.0000 |
| | (0.5083) | (0.9039) | (0.0002) | (0.5449) | (0.0328) | (0.1683) | (0.0180) | (0.2915) | |

Notes: The table presents Pearson correlation coefficients for the variables used in the empirical analyses and reports p-values in brackets. Bold indicates that the Pearson correlation coefficient is statistically significant at $p < 0.05$.

last publicly available financial statements from the date when the questionnaire was returned to us.

Table 5 presents cross correlations among our explanatory variables. R&D intensity is negatively correlated with capital intensity, size in terms of total sales is negatively correlated with leverage and inventory intensity and positively correlated with the tax department's age. The tax department's age is, moreover, positively correlated with asset growth and negatively correlated with leverage and inventory intensity. Most correlations, however, are small and, thus, rule out potential concerns about multicollinearity.

# 5 Results

## 5.1 Bivariate Analysis

First, we present results from bivariate analyses. For each variable of interest, we split the sample into firms above and below the respective median value. For example, with respect to R&D intensity, we form one group of firms showing high R&D intensity and another group of firms displaying low R&D intensity, where high and low is defined by the median R&D intensity. We then use a Wilcoxon rank-sum test to figure out whether tax departments in the two groups of firms take different roles in the decision process,

as reflected by their tax planning efforts, ambitions, the timing of involvement and ultimate decision rights. Remember that the first dimension - tax planning efforts - is a continuous variable, whereas all other dimensions - ambitions, temporal involvement and rights - are ordinal variables which are measured on a five-point scale ranging from 0 to 4. The bivariate analysis relies on this measurement. The ordinal indicator for tax planning ambitions takes on the value 0 if minimization of the group's tax burden is not at all important and thus, indicates the lowest parameter value. The highest parameter value is 4 and represents the highest level of importance of the minimization of the tax burden. Similarly, a 0 for temporal involvement indicates that the tax department is involved late, while a 4 indicates an early involvement. And last, tax executives have no rights in the decision process and are not consulted if the variable takes on the value 0, while they have a veto right if the variable takes on the value 4.

Table 6 presents findings from the Wilcoxon rank-sum test and shows, for each of the four dimensions of interest, the probability that a draw from the 'low' group, in terms of the seven distinct characteristics respectively, is larger than a draw from the corresponding 'high' group. Under the null hypothesis, the two groups do not systematically differ and the probability to draw a larger value from the first group as compared to the second is 50 percent.

Considering the results displayed in Table 6, the survey-based indicators for tax planning efforts, tax planning ambitions, the timing of involvement and the ultimate decision rights tend to show higher values for firms with low R&D intensity. In other words, the probability to draw higher values from the group of firms with low R&D intensity as compared to the group of firms with high R&D intensity is larger than 50 percent. More precisely, the probability that less R&D intensive firms exhibit more tax planning efforts than highly R&D intensive firms is 55.4%. Similarly, we find that the probability that less R&D intensive firms have higher tax planning ambitions is slightly above 50%, the probability that they are earlier involved in the decision-making is 64.1%. The probability that they have stronger ultimate decision rights is almost 60%. Although the differences between groups are, with the exception of what we find for the timing of involvement, not statistically significant, the observed tendencies regarding efforts, ambitions and temporal involvement are in line with our conjecture that increasing R&D intensity leads tax departments to act more as a controller than as a manager, with less tax planning efforts and ambitions and an involvement at a later stage of the decision process. In turn, the dimension of ultimate decision rights does not meet our expectation.

Interestingly, we find that low IP intensity is associated with lower tax planning

efforts and ambitions. While the relationship between R&D intensity and tax planning efforts and ambitions appears negative, IP intensity thus has a positive impact on these dimensions. With respect to ambitions, the difference between less and highly IP intensive firms is statistically significant at 10% (Wilcoxon test) or 5% (t-test). We consider this finding in line with IP intensity being a more precise proxy for tax planning opportunities subsequent to the investment decision than R&D intensity which rather proxies for factors that prevents tax experts from getting actively involved in tax planning, i.e. high costs of delay and, accordingly, a strong focus on time to market.

Furthermore, results in Table 6 document that the conventional determinants of tax planning opportunities and tax planning behavior, which we take from previous literature (see Section 1), do significantly impact on the temporal involvement of the tax department but less so on the other dimensions of the tax department's role in the investment decision process. In particular, findings from the Wilcoxon test suggest that tax executives in relatively small firms and less leveraged firms get involved rather late in the decision process, i.e. the probability to draw higher values of our temporal involvement indicator (where high values stand for early involvement) is significantly reduced for these groups of firms. Moreover, in firms with low levels of inventory and capital intensity, tax departments get involved earlier. Finally, we find that younger tax departments tend to have weaker ultimate decision rights.

Table 6: Bivariate Analysis

| | | Efforts | Ambitions | Temp. Inv. | Rights |
|---|---|---|---|---|---|
| RDINT | low>high | 55.4% | 52.4% | $64.1\%^{*}$ | 59.5% |
| IPINT | low>high | 38.7% | $34.8\%^{*}_{\star\star}$ | 51.0% | 54.8% |
| SIZE | low>high | 46.0% | 53.0% | $35.6\%^{*}_{\star}$ | 37.9% |
| ROA | low>high | 47.6% | 55.3% | 45.5% | 44.3% |
| LEV | low>high | 45.7% | 47.4% | $30.6\%^{**}_{\star\star\star}$ | $34.0\%^{**}_{\star\star}$ |
| GROW | low>high | 44.5% | 49.7% | 42.2% | 41.8% |
| INVINT | low>high | 53.7% | 47.8% | $65.1\%^{*}_{\star}$ | 56.9% |
| CAPINT | low>high | 39.3% | 48.4% | $61.5\%_{\star}$ | 55.6% |
| AGE | low>high | 49.9% | 53.8% | 42.3% | $35.0\%^{*}$ |

Notes: Respondents are split by the median into two groups according to each conditioning variable, listed on the left hand side of the table. It is then tested whether tax departments of one group and tax departments of the other group of firms take different roles in the decision process, as reflected by their tax planning efforts, ambitions, temporal involvement and ultimate decision rights. The probabilities that one group differs from the other group are shown in the table and are based on a Wilcoxon rank-sum test. Asterisks ($*$, $**$ and $***$) indicate statistical significance at the 10%, 5% and 1% level. Stars ($\star$, $\star\star$ and $\star\star\star$) indicate statistical significance at the 10%, 5% and 1% level based on a t-test. For example, with respect to R&D intensity, the probability that tax departments of less R&D intensive firms make more tax planning efforts than tax departments in high R&D intensive firms is 55.4%.

Overall, the picture from the bivariate analysis is mixed. On the one hand, some of the

results support the view that coordination of the tax department with other operational units in R&D intensive firms is costly and may prompt tax experts in the firm to act less as managers in the investment process but more as merely ratifying controllers. On the other hand, only a few findings are statistically significant, an outcome which could however be attributable to the small sample size. Importantly, we find that significant differences between groups of firms according to the Wilcoxon rank-sum test are in most cases confirmed by the alternative t-test for the difference between the group means of the four dimensions considered. We conclude that inference based on conventional parametric procedures is accurate despite potential concerns arising from the small sample size.

## 5.2 Regression Analysis

The main results from the regression analyses are presented in Tables 7 and 8. Again, we are primarily interested in whether R&D intensity has an impact on the tax department's role in the business decision process, as reflected by its tax planning efforts, tax planning ambitions, the timing of involvement and ultimate decision rights. While tax planning efforts is measured as a proportion, the other dimensions - ambitions, temporal involvement and rights - are dichotomous variables as described in Section 4. They are measured as binary variables, where the variable takes on the value 1 if the original answer was 3 or 4 on the five-point scale and 0 otherwise. Column 1 of Table 7 shows the response of tax planning efforts, again measured by the approximate time (in % of total workload) that is spent on tax planning activities, as opposed to activities linked to compliance and financial reporting. Column 2 of Table 7 shows the response of tax planning ambitions, measured as a dichotomous variable, which is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise. Column 3 of Table 7 shows the results for temporal involvement, again measured as a dichotomous variable, which is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise. Column 4 of Table 7 shows the results for ultimate decision rights, again measured on a dichotomous scale, where 1 reflects strong or even veto rights of the department.

Table 7 presents coefficient estimates from regressions of efforts, ambitions, temporal involvement and rights on R&D intensity and control variables. Standard errors robust to heteroscadasticity are given in parentheses. The coefficient estimate of R&D intensity on efforts (specification (1)) is -2.193 and statistically significant at 1%. This result means that an increase of R&D intensity by one percentage point leads to a 2.2

Table 7: Coordination Intensity in R&D Intensive MNEs

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Efforts | Ambitions | Temp. Inv. | Rights |
| RDINT | -2.193*** | -3.354 | -4.362** | 3.609 |
| | (0.739) | (3.337) | (1.960) | (2.412) |
| SIZE | 0.033** | -0.052 | 0.024 | 0.103* |
| | (0.016) | (0.063) | (0.056) | (0.058) |
| ROA | -0.058 | -0.944 | 0.728 | 0.410 |
| | (0.122) | (0.702) | (0.834) | (0.709) |
| LEV | -0.005 | -0.040*** | 0.024* | 0.054*** |
| | (0.004) | (0.014) | (0.013) | (0.013) |
| GROW | 0.384*** | 0.143 | 0.700** | 0.893*** |
| | (0.088) | (0.383) | (0.277) | (0.259) |
| INVINT | 0.400 | -0.685 | -0.854 | -0.205 |
| | (0.335) | (1.163) | (0.699) | (0.794) |
| CAPINT | -0.047 | 0.771 | -0.905 | -0.216 |
| | (0.190) | (0.605) | (0.568) | (0.606) |
| AGE | -0.073** | -0.057 | 0.100 | 0.136 |
| | (0.033) | (0.095) | (0.089) | (0.087) |
| Constant | -0.252 | 2.212 | 0.046 | -2.469* |
| | (0.311) | (1.444) | (1.291) | (1.435) |
| Observations | 39 | 41 | 42 | 42 |
| R-squared | 0.410 | 0.208 | 0.333 | 0.319 |

Notes: All regressions are based on OLS estimation. While the dependent variable 'efforts' is a proportion, the variables 'ambitions', 'temporal involvement' and 'rights' are binary variables. The dependent variable 'efforts' (specification (1)) represents the workload spent on tax planning relative to total workload; 'ambitions' (specification (2)) is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise; 'temporal involvement' (specification (3)) is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise; 'rights' (specification (4)) is 1 if the tax department has strong or even veto rights in the decision process. The four dimensions are regressed on firm characteristics, which are R&D intensity (RDINT), firm size (SIZE), profitability (ROA), leverage (LEV), firm growth (GROW), inventory and capital intensity (INVINT and CAPINT) and age of the tax department (AGE). Asterisks ($*$, $**$ and $***$) indicate statistical significance at the 10%, 5% and 1% level. Heteroscadasticity robust standard errors are in parentheses.

percentage point decrease of the proportion of workload spent on tax planning. The regression results from the dimension ambitions are reported in specification (2) and depict a different picture than the results from the effort-dimension. The coefficient estimate of R&D intensity is not significant indicating that R&D intensive firms are statistically not more or less ambitious to minimize their tax burden as compared to less R&D intensive firms. Furthermore, we investigate at which stage during the planning phase of an investment project tax executives are involved in the decision-making (see specification (3) of Table 7). We find that temporal involvement decreases in the R&D intensity. Precisely, an increase in R&D intensity by one percentage point is associated with a decrease in the probability that tax executives are involved early in the

decision-making by 4.36 percentage points. This finding supports our hypothesis that coordination costs are too high to involve tax executives early in the decision-making process. Last, we regress the dichotomous indicator for ultimate decision rights on R&D intensity and controls and present results in specification (4). Contrary to the other three dimensions efforts, ambitions and temporal involvement, R&D intensity has a positive estimated coefficient. This would indeed suggest that with increasing R&D intensity tax executives have stronger rights to oppose the decision made by other departments. However, the positive coefficient of R&D intensity is not statistically different from zero at all conventional levels of significance.

To sum up, we observe that R&D intensity seems to reduce the coordination intensity of the tax department with other departments in the firm, at least in terms of two of the four investigated dimensions. These two dimensions are the tax planning efforts measured as time of total workload attributed to tax planning and the temporal involvement of tax executives in the decision-making process. Tax executives indeed get involved at later stages of the investment decision and do not intervene in initial decisions such as investment location choices. With respect to the other dimensions, however, we find no evidence that R&D intensive firms have more or less tax planning ambitions and decision rights than less R&D intensive firms.

Clearly, R&D intensive firms tend to hold more intangible assets as compared to less R&D intensive firms. A look at Table 5 documents a positive correlation (12.08%) between the R&D intensity and the IP intensity of our respondent firms. As intangible assets are highly specific, their true value is hardly observable for national tax authorities, which provides leeway for transfer price distortions. As a consequence, a transfer of IP to low-tax affiliates may be attractive and require less planning efforts than direct intervention in initial decisions about the set-up and location of production facilities. If it is indeed easier for tax planners to tax-efficiently migrate IP within a multinational than it is for them to tax-efficiently structure real R&D investments, firms may accept forgone tax savings due to tax-inefficient R&D investments and will reverse part of those tax inefficiencies by means of tax-optimal transfers of their intangibles *ex post*. In other words, tax planning in R&D intensive firms takes place, but it takes place less with respect to R&D but with respect to IP location. In Figure 1 presented in Section 2, these ex post profit shifting opportunities by means of IP migration trigger a shift of the autonomy cost curve in Figure 1 to the left.

If IP intensity is indeed a determinant of the tax department's function in the firm, the coefficients for R&D intensity reported in Table 7 are actually 'biased' in the sense that they reflect the net effect of variation in R&D intensity *and* covarying IP

Table 8: Coordination Intensity in R&D and IP Intensive MNEs

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Efforts | Ambitions | Temp. Inv. | Rights |
| RDINT | -2.670*** | -6.435** | -3.860* | 4.313* |
| | (0.651) | (2.719) | (2.166) | (2.407) |
| IPINT | 0.279** | 1.797*** | -0.441 | -0.619 |
| | (0.125) | (0.512) | (0.505) | (0.408) |
| SIZE | 0.031* | -0.069 | 0.032 | 0.115** |
| | (0.015) | (0.056) | (0.057) | (0.056) |
| ROA | -0.090 | -1.146* | 0.775 | 0.475 |
| | (0.117) | (0.626) | (0.868) | (0.727) |
| LEV | -0.005 | -0.039*** | 0.022* | 0.052*** |
| | (0.003) | (0.012) | (0.013) | (0.013) |
| GROW | 0.390*** | 0.187 | 0.682** | 0.868*** |
| | (0.093) | (0.361) | (0.276) | (0.259) |
| INVINT | 0.476 | -0.210 | -0.833 | -0.176 |
| | (0.307) | (1.015) | (0.712) | (0.804) |
| CAPINT | -0.089 | 0.533 | -0.900 | -0.209 |
| | (0.170) | (0.555) | (0.582) | (0.592) |
| AGE | -0.080*** | -0.100 | 0.099 | 0.135 |
| | (0.024) | (0.103) | (0.086) | (0.085) |
| Constant | -0.196 | 2.586** | -0.097 | -2.670* |
| | (0.324) | (1.243) | (1.330) | (1.368) |
| Observations | 39 | 41 | 42 | 42 |
| R-squared | 0.474 | 0.439 | 0.347 | 0.345 |

Notes: All regressions are based on OLS estimation. While the dependent variable 'efforts' is a proportion, the variables 'ambitions', 'temporal involvement' and 'rights' are binary variables. The dependent variable 'efforts' (specification (1)) represents the workload spent on tax planning relative to total workload; 'ambitions' (specification (2)) is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise; 'temporal involvement' (specification (3)) is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise; 'rights' (specification (4)) is 1 if the tax department has strong or even veto rights in the decision process. The four dimensions are regressed on firm characteristics, which are R&D intensity (RDINT), IP intensity (IPINT), firm size (SIZE), profitability (ROA), leverage (LEV), firm growth (GROW), inventory and capital intensity (INVINT and CAPINT) and age of the tax department (AGE). Asterisks ($*$, $**$ and $***$) indicate statistical significance at the 10%, 5% and 1% level. Heteroscadasticity robust standard errors are in parentheses.

intensity. We now would like to disentangle the effect of R&D and the effect of IP on the tax department's role by additionally including a specific proxy for IP tax planning opportunities into our previous regression framework. We employ IP intensity (IPINT), calculated as the balance sheet item of intangible asset holdings scaled by total assets. As IFRS requires capitalization of both acquired *and* self-created intangible assets,[17]

[17]IAS 38.57 defines under which circumstances self-created IP has to be capitalized in the books. Accordingly, 'development costs are capitalized only after technical and commercial feasibility of the asset for sale or use have been established. This means that the entity must intend and be able to complete the intangible asset and either use it or sell it and be able to demonstrate how the asset will generate future economic benefits'.

the IP intensity we extract from the consolidated accounts of the responding public[18] European multinational firms proxies well for the success of past innovative activity and arising actual profit shifting opportunities. Some countries allow for the capitalization of acquired intangibles only.[19] Still, even in these cases IP intensity reflects that part of profit shifting potential associated with acquired IP. The results of augmenting the empirical model with IP intensity are presented in Table 8.

Interestingly, we see that the effect of R&D intensity persists and is even stronger if we additionally control for IP intensity. Considering Column (1) of Table 8, a one percentage point increase in R&D intensity statistically significantly decreases the share of tax planning efforts in the tax department's total workload by -2.670 percentage points. At the same time, IP intensity shows a small but significant and positive impact on tax planning efforts. In particular, a one percentage point increase in IP intensity increases the share of tax planning efforts in the tax department's total workload by 0.279 percentage points. This finding supports our conjecture that efforts associated with IP tax planning do not outweigh the reductions in tax planning efforts associated with the tax experts' reduced intervention in real investment decisions. As shown in Column (1) of Table 7 already, the net effect of R&D intensity on tax planning efforts thus is negative. Looking at the dimension ambitions (Column (2) of Table 8), including IP intensity into the regression model turns both coefficients of R&D and IP intensity significant. While an increase in the R&D intensity by one percentage point leads to a decline in the probability that the respondent rates the minimization of the tax burden as important goal for the tax department by 6.44 percentage points, the same increase in the IP intensity leads to an increase in the probability to have an ambitious tax department by 1.8 percentage points. Interestingly, the effects are contrary to each other, which explains our previous finding in Column (2) of Table 7, where R&D intensity captures the net effect and therefore turned out insignificant. With respect to the dimension temporal involvement of the tax executives in the decision-making process (Column (3) of Table 8), the effect of R&D intensity persists when we include IP intensity. In particular, a one percentage point increase in R&D intensity is associated with a decline in the probability that the tax executives are involved early in the

[18]Note, that only publicly traded European firms are obliged to report their consolidated financial statements based on IFRS, see the Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002. In our sample, these are 17 firms.

[19]According to US GAAP, Standard ASC 350, internal research and development costs are generally immediately expensed. There are a few exceptions for computer software or website development. Moreover, our dataset contains five publicly traded Swiss companies. In Switzerland, since 2005 most Swiss companies that are listed on the main board of the Swiss Exchange have an obligation to report either in IFRS or in US GAAP.

decision-making by 3.86 percentage points. Similarly, the effect of IP intensity is also negative, though insignificant. Nevertheless, this finding supports our conjecture that tax planning takes place only at a later stage in the R&D process. Consequently, R&D and IP intensive firms do not see the need for involving tax executives early in the decision-making on a new investment project. Rather, they optimize the legal structure given the target location of an investment, because the cost of autonomy is lower as compared to the cost of coordination. Last, we investigate the effect of R&D and IP intensity on the ultimate decision rights of tax executives. The first results in Column (4) of Table 7 did not show a significant impact of R&D intensity on rights. When including IP intensity though, we indeed find that R&D intensity exerts a significantly positive effect on rights (Column (4) of Table 8). Thus, a one percentage point increase in R&D intensity is associated with an increase in the probability that the tax experts have a veto right in the decision-making process by 4.31 percentage points.

Overall, our results reveal interesting insights in the decision-making of R&D and IP intensive firms and suggest that tax planning activities take place at different stages in the R&D process. Coordination between the tax department and other operational units is negatively affected by R&D intensity. In other words, within R&D intensive firms coordination with the tax department is too costly and therefore, the tax department adopts more controlling than managerial tasks. If the tax department is less strongly involved in the management, the firm runs into the danger to incur costs by forgone tax savings. This, however, can be mitigated by tax planning opportunities that arise with respect to intangible assets. Overall, our findings reconcile previous evidence that taxes matter less for R&D intensive firms when it comes to investment choices (Overesch and Schreiber, 2010) while overall they have been shown to report lower ETRs on average (Graham et al., 2011; Robinson et al., 2010; Graham et al., 2014).

## 5.3 Robustness Checks

In this section, we document the results from a large series of sensitivity analyses assessing robustness of the results from our baseline estimations in Tables 7 and 8.

First, we include industry dummies as suggested by Wilson et al. (1993). Wilson et al. (1993) provides descriptive and qualitative evidence that the industry a firm operates in strongly determines the organizational and incentive structure of firms. For example, the pharmaceuticals and chemicals industry may be similar in many respects, but differ substantially with respect to gross margins. Pharmaceuticals have higher gross margins

and, therefore, will incur higher losses if they fail to become the first patent applicant. Consequently, their costs of delay, which are part of coordination costs, are much higher than those of firms operating in other industries. Furthermore, the chemical industry differs from the pharmaceuticals industry in that transportation costs are substantially higher in the chemical industry. Hence, firms in the chemical industry face a higher pressure to locate their production facilities close to their major markets and suppliers to minimize transportation costs. The baseline regressions presented in Tables 7 and 8 are re-estimated with the inclusion of industry dummies. The results are shown in Table 9. Despite the reduction in degrees of freedom associated with the inclusion of industry dummies, the coefficients of RDINT again turn out significant and show expected signs. Quantitatively, the effects of R&D intensity on the four dimensions of the tax department's role within the business process are larger than without modeling of industry fixed effects. According to the results shown in Table 9, the effect of IP intensity is smaller in magnitude and is statistically significant only with respect to the ambitions of the tax department (specification (4) of Table 9).

As a second robustness check we extended our empirical model by a further variable that captures whether compensation contracts of tax executives are based on some kind of after-tax performance measure. The variable is drawn from our survey. We ask whether compensation of tax executives is based on some kind of performance measure and give four possible options, namely *yes, an after-tax measure*; *yes, a before-tax measure*; *yes, other* and *no*. We then dichotomize the variable to include it in our regression framework as compensation variable (COMP), where it takes on the value 1 if compensation of tax executives is based on some after-tax performance measure and 0 otherwise. Disregarding compensation contracts of tax executives could lead to omitted variable bias. Performance-based compensation typically aims at limiting agency costs as suggested by contracting theory (Jensen and Meckling, 1992). Performance measurement that is based on after-tax measures may motivate managers to care more about the tax consequences of their decisions. Consequently, managers may coordinate more intensively with the tax department. Thus, the four dimensions we use to measure the tax departments management-control-decision are likely influenced by compensation contracts. A common after-tax performance measure in this respect is the reported GAAP ETR of the firm, because it measures the total tax expense scaled by pre-tax profit. Empirical evidence suggests that indeed firms whose managers are compensated based on some after-tax performance measure report lower ETRs on average (Armstrong et al., 2012; Phillips, 2003). We therefore include the tax executives compensation into our modified model. The results are presented in Table 10. In gen-

eral, the results support our hypothesis that the tax department in R&D intensive firms acts more as a controller than as a manager. Including compensation in the empirical model even renders the coefficient estimates of our variables of interest slightly larger in size. The compensation variable itself, however, stays mostly insignificant. Moreover, we considerably lose observations when including COMP in our regressions as it is missing for a number of firms. We therefore consider it as a robustness check and do not include it in our baseline analyses.

Furthermore, we re-estimate our baseline analyses using a non-linear probability model and present the results in Table 11. In our baseline model we decided to follow a linear approach, due to better small sample characteristics of OLS than non-linear probability models. To check robustness, we run the non-linear probit model using the dichotomized variables. The probit regression model is designed for estimation with a binary dependent variable and for capturing the non-linearity in the probabilities (Greene, 2012). Table 11 presents average marginal effects of the included covariates on the probabilities to show high tax planning ambitions, get involved early, and be assigned strong ultimate decision rights, respectively. Considering the results from the probit regression, the estimates of R&D intensity are significant and show the expected signs just as in the baseline model. For IP intensity we also find effects similar to our baseline results. However, according to column (6) of Table 11, IP intensity has a negative and significant effect on the ultimate decision rights of the tax department, whereas its effect was insignificant according to the baseline findings. With the exception of specification (2) of Table 11, estimated effect sizes of both R&D and IP intensity turn out quantitatively consistent to the baseline findings.

Thus, we conclude that our results are qualitatively, and mostly quantitatively, robust towards different estimation methods. Furthermore, the results also hold when estimating an ordered probit regression model using the original variables that range from 0 to 4.[20]

[20]The results from the ordered probit estimation are not tabulated but available from the authors upon request.

Table 9: Robustness Check: Industry Fixed Effects

| | Efforts | | Ambitions | | Temp. Inv. | | Rights | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| RDINT | -3.519*** | -3.549*** | -9.327*** | -9.663*** | -6.157* | -6.254* | 7.272*** | 7.375*** |
| | (0.780) | (0.813) | (1.771) | (2.052) | (3.125) | (3.179) | (2.231) | (2.333) |
| IPINT | | 0.058 | | 0.977* | | 0.282 | | -0.298 |
| | | (0.174) | | (0.568) | | (0.605) | | (0.594) |
| SIZE | 0.015 | 0.017 | -0.089 | -0.074 | 0.088 | 0.092 | 0.100 | 0.096 |
| | (0.013) | (0.015) | (0.079) | (0.074) | (0.076) | (0.078) | (0.076) | (0.081) |
| ROA | -0.264 | -0.262 | -1.642** | -1.608** | 0.822 | 0.832 | 0.642 | 0.632 |
| | (0.172) | (0.179) | (0.733) | (0.697) | (0.913) | (0.911) | (0.842) | (0.877) |
| LEV | -0.008* | -0.008* | -0.046*** | -0.043*** | 0.029 | 0.030 | 0.070*** | 0.069*** |
| | (0.004) | (0.004) | (0.015) | (0.015) | (0.020) | (0.020) | (0.014) | (0.014) |
| GROW | 0.306** | 0.310** | -0.156 | -0.095 | 0.549 | 0.567 | 1.275*** | 1.256*** |
| | (0.116) | (0.121) | (0.310) | (0.303) | (0.359) | (0.357) | (0.346) | (0.347) |
| INVINT | 0.200 | 0.241 | -1.006 | -0.391 | 0.517 | 0.694 | -1.236 | -1.424 |
| | (0.509) | (0.560) | (1.074) | (1.180) | (1.623) | (1.609) | (1.460) | (1.567) |
| CAPINT | 0.158 | 0.140 | 0.210 | 0.107 | -1.275 | -1.304 | -0.377 | -0.345 |
| | (0.185) | (0.213) | (0.655) | (0.663) | (0.955) | (0.956) | (0.855) | (0.858) |
| AGE | -0.046 | -0.050 | 0.042 | -0.011 | 0.032 | 0.016 | 0.208** | 0.224** |
| | (0.030) | (0.037) | (0.079) | (0.106) | (0.122) | (0.121) | (0.090) | (0.106) |
| Constant | 0.158 | 0.128 | 3.322** | 2.912* | -1.038 | -1.156 | -2.012 | -1.887 |
| | (0.345) | (0.383) | (1.600) | (1.539) | (1.695) | (1.750) | (1.674) | (1.777) |
| Industry Fixed Effects | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 39 | 39 | 41 | 41 | 42 | 42 | 42 | 42 |
| R-squared | 0.627 | 0.628 | 0.630 | 0.672 | 0.541 | 0.544 | 0.564 | 0.567 |

Notes: All regressions are based on OLS estimation. While the dependent variable 'efforts' is a proportion, the variables 'ambitions', 'temporal involvement' and 'rights' are binary variables. The dependent variable 'efforts' (specification (1) and (2)) represents the workload spent on tax planning relative to total workload; 'ambitions' (specification (3) and (4)) is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise; 'temporal involvement' (specification (5) and (6)) is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise; 'rights' (specification (7) and (8)) is 1 if the tax department has strong or even veto rights in the decision process. The four dimensions are regressed on firm characteristics, which are R&D intensity (RDINT), firm size (SIZE), profitability (ROA), leverage (LEV), firm growth (GROW), inventory and capital intensity (INVINT and CAPINT), age of the tax department (AGE) and industry dummy variables. Asterisks (∗, ∗∗ and ∗∗∗) indicate statistical significance at the 10%, 5% and 1% level. Heteroscadasticity robust standard errors are in parentheses.

Table 10: Robustness Check: Compensation

| | Efforts | | Ambitions | | Temp. Inv. | | Rights | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| RDINT | -2.211** | -2.641*** | -5.151 | -7.251** | -4.553* | -4.020 | 4.915* | 6.288** |
| | (0.820) | (0.699) | (3.305) | (2.762) | (2.612) | (2.890) | (2.844) | (2.769) |
| IPINT | | 0.306** | | 1.475** | | -0.375 | | -0.964** |
| | | (0.131) | | (0.577) | | (0.557) | | (0.402) |
| SIZE | 0.028* | 0.026* | -0.031 | -0.042 | 0.031 | 0.034 | 0.079 | 0.087 |
| | (0.016) | (0.013) | (0.061) | (0.058) | (0.070) | (0.070) | (0.069) | (0.065) |
| ROA | -0.041 | -0.068 | -1.224* | -1.351** | 0.733 | 0.765 | 0.354 | 0.437 |
| | (0.119) | (0.107) | (0.639) | (0.578) | (0.903) | (0.930) | (0.783) | (0.781) |
| LEV | -0.006 | -0.005* | -0.042*** | -0.040*** | 0.023 | 0.022 | 0.061*** | 0.059*** |
| | (0.004) | (0.003) | (0.013) | (0.012) | (0.015) | (0.015) | (0.013) | (0.013) |
| GROW | 0.385*** | 0.392*** | 0.037 | 0.074 | 0.679** | 0.670** | 0.864*** | 0.841*** |
| | (0.088) | (0.078) | (0.345) | (0.333) | (0.282) | (0.291) | (0.274) | (0.271) |
| INVINT | 0.377 | 0.471* | -0.829 | -0.387 | -0.656 | -0.768 | -1.237 | -1.526 |
| | (0.345) | (0.232) | (1.200) | (1.065) | (1.118) | (1.157) | (1.181) | (1.217) |
| CAPINT | -0.050 | -0.075 | 0.315 | 0.198 | -0.962 | -0.933 | -0.026 | 0.050 |
| | (0.213) | (0.206) | (0.618) | (0.616) | (0.728) | (0.731) | (0.660) | (0.603) |
| AGE | -0.072* | -0.076*** | -0.099 | -0.119 | 0.094 | 0.099 | 0.224** | 0.237*** |
| | (0.035) | (0.024) | (0.087) | (0.096) | (0.122) | (0.117) | (0.087) | (0.081) |
| COMP | 0.004 | -0.037 | 0.349** | 0.151 | -0.122 | -0.072 | -0.146 | -0.016 |
| | (0.062) | (0.071) | (0.146) | (0.165) | (0.233) | (0.241) | (0.250) | (0.276) |
| Constant | -0.122 | -0.096 | 2.064 | 2.213* | -0.106 | -0.143 | -2.165 | -2.262 |
| | (0.293) | (0.270) | (1.399) | (1.274) | (1.472) | (1.498) | (1.607) | (1.514) |
| Observations | 37 | 37 | 39 | 39 | 39 | 39 | 39 | 39 |
| R-squared | 0.440 | 0.513 | 0.325 | 0.473 | 0.292 | 0.301 | 0.345 | 0.399 |

Notes: All regressions are based on OLS estimation. While the dependent variable 'efforts' is a proportion, the variables 'ambitions', 'temporal involvement' and 'rights' are binary variables. The dependent variable 'efforts' (specification (1) and (2)) represents the workload spent on tax planning relative to total workload; 'ambitions' (specification (3) and (4)) is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise; 'temporal involvement' (specification (5) and (6)) is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise; 'rights' (specification (7) and (8)) is 1 if the tax department has strong or even veto rights in the decision process. The four dimensions are regressed on firm characteristics, which are R&D intensity (RDINT), firm size (SIZE), profitability (ROA), leverage (LEV), firm growth (GROW), inventory and capital intensity (INVINT and CAPINT), age of the tax department (AGE) and compensation of tax executives (COMP). Asterisks ($*$, $**$ and $***$) indicate statistical significance at the 10%, 5% and 1% level. Heteroscadasticity robust standard errors are in parentheses.

Table 11: Robustness Check: Probit Estimation Model

| | Ambitions | | Temp. Inv. | | Rights | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| RDINT | -3.692 | -31.701*** | -4.116** | -3.882** | 5.354*** | 6.615*** |
| | (2.348) | (11.304) | (1.927) | (1.957) | (2.072) | (2.325) |
| IPINT | | 11.073*** | | -0.388 | | -0.814* |
| | | (3.448) | | (0.389) | | (0.489) |
| SIZE | -0.037 | -0.331*** | -0.006 | 0.008 | 0.023 | 0.044 |
| | (0.062) | (0.107) | (0.052) | (0.055) | (0.051) | (0.055) |
| ROA | -2.082* | -5.264*** | 0.862 | 0.712 | 0.946 | 0.734 |
| | (1.217) | (1.628) | (0.727) | (0.732) | (0.633) | (0.662) |
| LEV | -0.607 | -0.727 | 0.542 | 0.378 | 0.723* | 0.451 |
| | (0.527) | (0.597) | (0.480) | (0.518) | (0.417) | (0.519) |
| GROW | 0.677 | 1.859*** | 0.852 | 0.779 | 1.277** | 1.150** |
| | (0.902) | (0.677) | (0.612) | (0.545) | (0.578) | (0.566) |
| INVINT | -0.693 | 0.307 | -0.900 | -0.975 | -1.222 | -1.345 |
| | (0.918) | (0.748) | (0.590) | (0.628) | (0.910) | (0.847) |
| CAPINT | 0.813 | -0.376 | -0.855 | -0.934 | 0.371 | 0.514 |
| | (0.658) | (0.382) | (0.523) | (0.578) | (0.438) | (0.453) |
| AGE | -0.039 | -0.792*** | 0.084 | 0.086 | 0.180*** | 0.221*** |
| | (0.090) | (0.296) | (0.068) | (0.065) | (0.060) | (0.073) |
| Observations | 41 | 41 | 42 | 42 | 42 | 42 |

Notes: The table presents average marginal effects for non-linear probit estimations. The dependent variables 'ambitions', 'temporal involvement' and 'rights' are binary variables. The dependent variable 'efforts' (specification (1) and (2)) represents the workload spent on tax planning relative to total workload; 'ambitions' (specification (3) and (4)) is 1 if tax minimization is an important or very important objective of the tax department, and 0 otherwise; 'temporal involvement' (specification (5) and (6)) is 1 if the tax department gets involved early or even very early in the initiation phase of the decision process, and 0 otherwise; 'rights' (specification (7) and (8)) is 1 if the tax department has strong or even veto rights in the decision process. The four dimensions are regressed on firm characteristics, which are R&D intensity (RDINT), firm size (SIZE), profitability (ROA), leverage (LEV), firm growth (GROW), inventory and capital intensity (INVINT and CAPINT) and age of the tax department (AGE). Asterisks ($*$, $**$ and $***$) indicate statistical significance at the 10%, 5% and 1% level. Heteroscadasticity robust standard errors are in parentheses.

# 6 Conclusion

By locating intangible assets at low-tax affiliates, R&D intensive multinationals can reduce the tax burden on a relevant fraction of their economic rents. The corporate production process, however, does not only involve administration of intangible assets. These companies also have to decide on where to set up R&D facilities and final output production for consumers. This study contributes to better understand the particularities of tax decision-making in R&D intensive multinational firms. In particular, we focus on the allocation of management and control functions to the tax department, adding a new facet to the literature dealing with the interrelationship between tax decision-making and organizational architecture.

Using data from a confidential survey taken in 2012 of 47 top financial and tax managers of very large multinational companies, we develop and test a theory, based on the organizational design literature, for the intensity in which the tax department coordinates with managers from other business units to intervene with real investment decisions. According to organizational design theory, the optimal allocation of decision rights to managers inside the firm is determined by coordination costs that are incurred when centralization of management and control is high and the costs of autonomy that arise when management and control are exercised separately. We argue that this coordination problem also drives the choice of whether the tax department serves a controlling function or whether, instead, it acts more as a manager. We consider R&D intensity to be an important determinant of both the costs of coordination and the costs of autonomy. First, there is high pressure in R&D intensive industries to keep the time to market short and coordination costs in form of time delays associated with coordination between business units are very high. Second, costs of autonomy are low in R&D intensive firms as tax-inefficiencies from autonomous decision-making without involvement of tax experts can be reversed by separating and tax-optimally allocating intangibles within the multinational group.

We indeed document supporting evidence that in R&D intensive multinational firms the tax department operates more as a controller than as a manager. In particular, tax departments of R&D intensive firms make less tax planning effort, are less ambitious to minimize the tax burden of the firm, are later involved in the decision-making process of a new investment project, but are more likely to have a veto right in the decision on a new investment project as compared to less R&D intensive firms. Conditional on R&D intensity, however, the level of intangible assets in the firm is associated with more tax planning efforts and ambitions. Our results are statistically significant and

robust towards several sensitivity checks.

We acknowledge that our findings can only be considered a *first piece* of evidence due to the qualifications associated with small sample surveys. However, this first piece of evidence is important as it represents another illustration of the association between organizational design theory and the integration of the tax function in the hierarchical structure of firms. In this sense, we take another important step towards unraveling the black box of tax avoidance. Opening further parts of this black box is urgently required in view of the OECD's and the G20's major initiative to restrain what they call base erosion and profit shifting (BEPS) (OECD, 2013a,b). Understanding the intentional and unintentional consequences of profit shifting restrictions requires a good understanding of the tax planning mechanisms inside multinational firms and how these interact with business decision processes.

# References


Abramovsky, L., R. Griffith, G. Macartney, and H. Miller (2008): "The Location of Innovative Activity in Europe," *The Institute for Fiscal Studies (IFS) Working Paper*, No. 08/10.

Aldrich, J. and F. Nelson (1984): *Linear probability, Logit, and Probit Models*, Sage Publications, Beverly Hills.

Anderson, R. C. and D. M. Reeb (2003): "Founding-Family Ownership and Firm Performance: Evidence from the S&P 500," *The Journal of Finance*, 58, No. 3, 1301–1328.

Angrist, J. (2001): "Estimation of limited dependent variable models with dummy endogenous regressors: simple strategies for empirical practice," *Journal of Business and Economic Statistics*, 29, 2–15.

Armstrong, C. S., J. L. Blouin, and D. F. Larcker (2012): "The incentives for tax planning," *Journal of Accounting and Economics*, 53, 391 – 411.

Arundel, A., C. Bordoy, P. Mohnen, and K. Smith (2008): "Innovation Surveys and Policy: Lessons from the CIS," in *Innovation Policy in Europe: Measurement and Strategy*, C. Nauwelaers and R. Wintjes, London.

Bankman, J. (1994): "The structure of Silicon Valley start-ups," *UCLA Law Review*, 41, 1737–1768.

Bloom, N. and R. Griffith (2001): "The Internationalisation of UK R&D," *Fiscal Studies*, 22, 337–355.

Bloom, N., R. Griffith, and J. Van Reenen (2002): "Do R&D tax credits work? Evidence from a panel of countries 1979–1997," *Journal of Public Economics*, 85, 1–31.

Boehm, T., T. Karkinsky, and N. Riedel (2012): "The Impact of Corporate Taxes on R&D and Patent Holdings," *Paper presented at the NBER TAPES Conference 2012 at the University of Oxford*.

Bond, S. and J. Van Reenen (2007): "Microeconometric Models of Investment and Employment," in *Handbook of Econometrics*, ed. by J. J. Heckman and E. E. Leamer, Amsterdam, 4417–4498.

Boone, J. P., I. K. Khurana, and K. Raman (2013): "Religiosity and Tax Avoidance," *Journal of the American Taxation Association*, 35, No.1, 53–84.

Brem, A. (2008): *The Boundaries of Innovation and Entrepreneurship*, Springer Gabler, Wiesbaden.

Caudill, S. (1988): "An advantage of the linear probability model over Probit or Logit," *Oxford Bulletin of Economics and Statistics*, 50, 425–427.

Chen, Q. and D. A. Giles (2012): "Finite-sample properties of the maximum likelihood estimator for the binary logit model with random covariates," *Statistical Papers*, 53, 409–426.

Chen, S., X. Chen, Q. Cheng, and T. Shevlin (2010): "Are family firms more tax aggressive than non-family firms?" *Journal of Financial Economics*, 95, 41–61.

Chyz, J. A., W. S. C. Leung, O. Z. Li, and O. M. Rui (2013): "Labor unions and tax aggressiveness," *Journal of Financial Economics*, 108, 675–698.

De Mooij, R. A. and S. Ederveen (2003): "Taxation and Foreign Direct Investment: A Synthesis of Empirical Research," *International Tax and Public Finance*, 10, No.6, 673–693.

Dillman, D. (1978): *Mail and Telephone Surveys: The Total Design Method*, New York: John Wiley.

Dischinger, M. and N. Riedel (2011): "Corporate taxes and the location of intangible assets within multinational firms," *Journal of Public Economics*, 95, 691–707.

Dyreng, S. D., M. Hanlon, and E. L. Maydew (2008): "Long Run Corporate Tax Avoidance," *The Accounting Review*, 83, 61–82.

——— (2010): "The Effects of Executives on Corporate Tax Avoidance," *The Accounting Review*, 85, 1163–1189.

Elschner, C. and C. Spengel (2010): "Steuerliche Anreize für Forschung und Entwicklung - Empirische Befunde, internationaler Vergleich und Reformansätze für Deutschland," *Zeitschrift für Betriebswirtschaft (Special Issue)*, 2, 1–22.

Emery, J. C. (1969): *Organizational Planning and Control systems: Theory and Technology*, New York: The Macmillan Company.

Ernst, C., K. Richter, and N. Riedel (2014): "Corporate Taxation and the Quality of Research and Development," *International Tax and Public Finance*, 21, 694–719.

Ernst, C. and C. Spengel (2011): "Taxation, R&D Tax Incentives and Patent Application in Europe," *ZEW Discussion Paper*, No. 11-024.

Fama, E. F. and M. C. Jensen (1983a): "Agency problems and residual claims," *Journal of Law and Economics*, 26, 327–349.

——— (1983b): "Separation of Ownership and Control," *Journal of Law and Economics*, 26, 301–325.

Feld, L. P. and J. H. Heckemeyer (2011): "FDI and Taxation: A Meta-Study," *Journal of Economic Surveys*, 25, 233–272.

Frank, M. M., L. J. Lynch, and S. O. Rego (2009): "Tax Reporting Aggressiveness and its Relation to Aggressive Financial Reporting," *The Accounting Review*, 84, No. 2, 476–496.

Gallemore, J. and E. Labro (2013): "The Importance of the Internal Information Environment for Tax Avoidance," *Working Paper*.

Glaister, K. W. and J. F. Hughes (2008): "Corporate Strategy Formulation and Taxation: Evidence from UK Firms," *British Journal of Management*, 19, 33–48.

Graham, J. R., M. Hanlon, and T. Shevlin (2011): "Real Effects of Accounting Rules: Evidence from Multinational Firms' Investment Location and Profit Repatriation Decisions," *Journal of Accounting Research*, 49, 137–185.

Graham, J. R., M. Hanlon, T. Shevlin, and N. Shroff (2014): "Incentives for Tax Planning and Avoidance: Evidence from the Field," *The Accounting Review*, 89, No.3, 991–1023.

Graham, J. R. and C. R. Harvey (2001): "The theory and practice of corporate finance: evidence from the field," *Journal of Financial Economics*, 60, 187–243.

Graham, J. R., C. R. Harveya, and S. Rajgopal (2005): "The economic implications of corporate financial reporting," *Journal of Accounting and Economics*, 40, 3–73.

Greene, W. H. (2012): *Econometric Analysis*, Pearson Prentice Hall.

Griffith, R., H. Miller, and M. O'Connel (2014): "Ownership of Intellectual Property and Corporate Taxation," *Journal of Public Economics*, 112, 12–23.

Grubert, H. and J. Slemrod (1998): "The Effect of Taxes on Investment and Income Shifting to Puerto Rico," *MIT Press*, 80, No.3, 365–373.

Hall, B. and J. Van Reenen (2000): "How effective are fiscal incentives for R&D? A review of the evidence," *Research Policy*, 29, 449–469.

Hanlon, M. and S. Heitzman (2010): "A review of tax research," *Journal of Accounting and Economics*, 50, 127 – 178.

Hassett, K. A. and R. G. Hubbard (2002): "Tax Policy and Business Investment," in *Handbook of Public Economics*, ed. by A. J. Auerbach and M. Feldstein, Amsterdam, 1293–1343.

Haufler, A. and M. Runkel (2012): "Firms' financial choices and thin capitalization rules under corporate tax competition," *European Economic Review*, 56, 1087–1103.

Heckman, J. and T. MaCurdy (1985): "A Simultaneous equations Linear Probability Model," *Canadian Journal of Economics*, 18, 28–37.

Heckman, J. and J. Snyder (1997): "Linear Probability Models of the Demand for Attributes with an Empirical Application to Estimating the Preferences of Legislators," *Rand Journal of Economics*, 28, special issue.

Hong, Q. and M. Smart (2010): "In praise of tax havens: International tax planning and foreign direct investment," *European Economic Review*, 54, 82–95.

Hope, O.-K., M. S. Ma, and W. B. Thomas (2013): "Tax avoidance and geographic earnings disclosure," *Journal of Accounting and Economics*, 56, 170 – 189.

Janeba, E. (1995): "Corporate income tax competition, double taxation treaties, and foreign direct investment," *Journal of Public Economics*, 56, 311–325.

Jensen, M. C. and W. H. Meckling (1992): "Specific and General Knowledge, and Organizational Structure," in *Contract Economics*, L. Werin and H. Wijkander. Oxford.

Karkinsky, T. and N. Riedel (2012): "Corporate taxation and the location of patents within multinational firms," *Journal of International Economics*, 88, No.1, 176–185.

Keating, A. S. (1997): "Determinants of divisional performance evaluation practices," *Journal of Accounting and Economics*, 24, 243–273.

Mann, H. B. and D. R. Whitney (1947): "On a test whether one of two random variables is stochastically larger than the other," *Annals of Mathematical Statistics*, 18, 50–60.

Manzon, G. B. and G. A. Plesko (2002): "The Relation between Financial and Tax Reporting Measures of Income," *Tax Law Review*, 55, 175–214.

Mills, L. F. (1998): "Book-Tax Differences and Internal Revenue Service Adjustments," *Journal of Accounting Research*, 35, No. 2, 343–356.

Moffitt, R. (2001): "Comment on estimation of limited dependent variable models with dummy endogenous regressors: simple strategies for empirical practice," *Journal of Business and Statistics*, 19, 26–27.

Mutti, J. and H. Grubert (2009): "The Effect of Taxes on Royalties and the Migration of Intangible Assets Abroad," in *International Trade in Services and Intangibles in the Era of Globalization*, Marshall Reinsdorf and Matthew J. Slaughter.

OECD (2013a): "Action Plan on Base Erosion and Profit Shifting," *OECD Publishing*.

——— (2013b): "Addressing Base Erosion and Profit Shifting," *OECD Publishing*.

Overesch, M. and U. Schreiber (2010): "Asset Specificity, International Profit Shifting, and Investment Decisions," *Zeitschrift für Betriebswirtschaft*, 2, 23–47.

Paff, L. A. (2005): "State-level R&D tax credits: A firm-level analysis," *The B. E. Journal of Economic Analysis & Policy*, 5, No.1.

Phillips, J. D. (2003): "Corporate Tax-Planning Effectiveness: The Role of Compensation-Based Incentives," *The Accounting Review*, 78, 847–874.

Rego, S. O. (2003): "Tax-Avoidance Activities of U.S. Multinational Corporations," *Contemporary Accounting Research*, 20, No. 4, 805–833.

Robinson, J. R., S. A. Sikes, and C. D. Weaver (2010): "Performance Measurement of Corporate Tax Departments," *The Accounting Review*, 85, 1035–1064.

Serita, T. (2008): "On Survey Data Analysis in Corporate Finance," *Journal of International Economic Studies*, 22, 97–111.

Spengel, C. (2009): *Steuerliche Förderung von Forschung und Entwicklung (FuE) in Deutschland*, Berlin.

Stock, J. H. and M. W. Watson (2012): *Introduction to Econometrics*, Pearson.

Szulanski, G. (2000): "The Process of Knowledge Transfer: A Diachronic Analysis of Stickiness," *Organizational Behavior and Human Decision Processes*, 82, No.1, 9–27.

Wilcoxon, F. (1945): "Individual comparisons by ranking methods," *Biometrics*, 1, 80–83.

Wilson, G. P., R. G. Hubbard, and J. Slemrod (1993): *Studies in International Taxation*, University of Chicago Press, chap. The Role of Taxes in Location and Sourcing Decisions, 195–234.

Wilson, R. J. (2009): "An Examination of Corporate Tax Shelter Participants," *The Accounting Review*, 84, 969–999.

Zimmerman, J. L. (1983): "Taxes and Firm Size," *Journal of Accounting and Economics*, 5, 119–149.

——— (2014): *Accounting for decision making and control*, McGraw Hill, New York.