Tax Competition and Political Influence

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Introduction

Globalization has become an important feature of the world economy. During the past few decades, free trade of goods has increased and obstacles to the migration of production factors have been reduced. As a consequence, goods and production factors will locate in the country with the highest net remuneration, which raises the elasticity of the national tax bases. The process of economic integration thus intensifies the interdependency of national fiscal policies and each country's tax policy is constrained by the political decisions of the other jurisdictions.

However, economic integration does not necessarily cause interjurisdictional political cooperation. Due to political sovereignty, each government's tax policy might still be determined locally even if the private and public income of an open economy will be affected by the fiscal policies of all economically connected jurisdictions. Consequently, if the tax burden is at least partially borne by the production of goods or the employment of factors, the mobility of the tax bases in integrated markets causes tax competition between the governments. As a result, independent governments do not recognize the impact of their policy on other jurisdictions, which gives rise to inefficient policy decisions from a global welfare perspective. The roots of this argument can be found in the early literature on fiscal federalism.[1]

In his seminal work, Oates (1972) emphasized the capability of lower levels of government to account for local and heterogeneous preferences, but he also describes efficiency implications of interjurisdictional competition. He argues that non-cooperative behavior of local governments causes inefficiencies in the provision of public goods, since no single jurisdiction can gain a competitive advantage in competition for business investment if all governments behave the same way. In light of this, Gordon (1983) then systematically describes various forms of distortions due to an independent provision of public goods and tax decisions by lower levels of governments. However, it was not until the analyses of Zodrow and Mieszkowski (1986) and Wilson (1986, 1987) that

[1] See Oates (1999) and Wellisch (2000) for comprehensive surveys.

economists explicitly examined the consequences of interjurisdictional tax competition, with special emphasis placed on mobile capital as the tax base. Since then, the efficiency and welfare implications of tax competition have been extensively investigated in a large number of studies, featuring tax competition as one of the main themes in the recent public finance literature.[2]

Even though the subsequent research is extensive, the conclusions remain ambiguous. The main contributions of the early literature on capital tax competition mostly confirm the argument of Oates (1972) in suggesting that government spending will be inefficiently low. The baseline argument is that countries maximize their own welfare non-cooperatively and do not take into account that an increase of their national tax rate leads to an outflow of the mobile tax base to their neighboring countries. This broadens the tax base there and hence constitutes a positive fiscal externality. Consequently, the equilibrium tax rates will be set inefficiently low if all governments act the same way. However, most of the early analyses in this respect focused on one-consumer models in which the representative household owns all factors of production and where a benevolent government decides on taxation.[3] Accordingly, no distortions or imperfections due to the process of political decisions are considered, even though this plays an important role in analyzing real world policy.[4] Modifying the baseline model in that respect, departures from the standard result enriched the analysis in various directions and continuative studies in the literature show even welfare-improving implications of tax competition.[5]

The idea of welfare-enhancing fiscal competition dates back to the influential work by Brennan and Buchanan (1980). They argue that intergovernmental competition may serve as an instrument to tame a 'Leviathan' type of government that is unconcerned about the welfare of residents and seeks to solely maximize the size of the public sector. Of course, this implies that the size of the government will be excessively large without competition, and restricting its taxing power by interjurisdictional mobility of the tax base will enhance social welfare. Hence, fiscal competition may discipline wasteful governments and the efficiency implications of tax competition caused by economic distortions have to be evaluated in light of distortions that arise from the political process, as argued for example by Frey and Eichenberger (1996). Otherwise, the welfare implications of tax competition will be excessively pessimistic.

[2] Recent reviews of the literature are given by Griffith et al. (2010) and Zodrow (2010).

[3] See Wilson (1999) or Haufler (2001) for comprehensive surveys.

[4] For example, see Persson and Tabellini (2000a), Grossman and Helpman (2001) or Besley (2006).

[5] Wilson and Wildasin (2004) review the literature in that respect.

This argument was systematically investigated by Edwards and Keen (1996). In their analysis, a selfish government directs only part of the tax revenue to its own purpose, which is regarded as pure waste. Consequently, tax competition enhances welfare as it reduces rent diversion. At the same time, tax competition reduces the provision of the public good as well. Interjurisdictional tax competition will then be beneficial as long as the first effect dominates, because this enhances the overall efficiency of the public sector. Rauscher (1998) also draws this conclusion regarding benefit taxes, and Eggert (2001) confirms this for the case of wasteful governmental consumption. In a similar vein, Sato (2003) shows that tax competition reduces political rents that are the target of wasteful rent-seeking activities, which in turn are responsible for political distortions within the government sector. Furthermore, Eggert and Sørensen (2008) show that the reduction in political rents mitigates an incentive to inefficiently distribute rents to the public sector as well. The positive welfare implications of fiscal competition in this literature are thus essentially based on a 'discipline effect' that restricts the public sector, but increases social welfare at the same time.[6]

However, in an open economy, the private and public income of a single country will be affected by the fiscal decisions of all economically connected jurisdictions. As a consequence, the national tax policy of a modern democracy is not isolated from the implications of tax competition for its domestic electorate. Of course, this reveals a serious limitation to the 'Leviathan' approach for governmental behavior as this is based on a fairly general government objective function that abstracts from the role of political institutions.[7] Taking this into account, many studies in the political economy literature on tax competition focused on elections, with special attention to the implications of fiscal competition for a jurisdiction's decisive median voter.

One of the early contributions in this literature is Persson and Tabellini (1992). In their analysis, revenue from the taxation of mobile capital is used for redistribution purposes and the owners of capital are able to anticipate the implications of the non-

[6] This is not necessarily true for the case of governmental expenditure competition. As shown by Wilson (2005), if self-interested bureaucrats are engaged in interjurisdictional competition for mobile capital investment, more of a jurisdiction's tax revenue will be used to provide a 'productive' public input. Consequently, governmental 'waste' will be reduced and fiscal competition causes an increase in public expenditures that enhances efficiency. However, in a related article, Cai and Treisman (2005) show for the case of asymmetric regions that fiscal competition can actually increase governmental 'waste'. This is because comparably poor endowed regions give up to provide a 'productive' public input in competition for mobile capital investment. As a consequence, in their approach the share of the public budget spent on non-productive public goods or on the consumption of self-interested governments increases.

[7] The importance of political institutions for economic policies has recently been emphasized by Besley (2007) and Besley and Persson (2008).

cooperative tax setting by the independent governments. As a consequence, the median voter strategically pre-elects a policy-maker that favors redistribution even more than himself, since this (partly) counteracts the downward pressure on capital tax rates due to tax competition.[8] However, if tax revenue is used to provide a local public good and if individuals differ with respect to their labor income as well, tax competition can actually lead to an excessive provision of the public good in equilibrium. This is shown by Fuest and Huber (2001) for regional governments that raise tax revenue by means of an income tax on immobile labor and a source-based tax on mobile capital. In their model of identical small open economies, mobile capital will not be taxed in the political equilibrium. The provision of the public good is then exclusively determined by the marginal excess burden of the wage tax and the relative income position of the median voter. Following this, the median voter's share in the cost of the public good provision will be comparably low if his income is below the average income and, hence, the provision of the public good will be inefficiently high in the political equilibrium.[9] In a related analysis, Borck (2003) shows that if the countries are large enough to affect the interest rate, capital will be taxed in a political equilibrium even if a lump sum tax is available. This is because the tax on capital redistributes income between regions as well as within regions, so that a median voter with a capital endowment below the average may favor a positive capital tax rate.

Economic integration of markets substantially changes the determinants of the political equilibrium, as shown by Lockwood and Makris (2006) for the position of the decisive median voter. It is well-known that the integration of capital markets imply that the incidence of a capital tax is at least partially shifted to the immobile production factor. Consequently, Lockwood and Makris (2006) show that the decisive factor owner may relocate from the owner of the median capital endowment to the one with the median labor supply. As a result, if the median capital endowment is high and the median labor endowment is low, the median voter's preferred tax rate will be even higher in the case of integrated capital markets.[10] In addition, Kessler et al. (2003) show that the

[8] Ihori and Yang (2009) find a similar result in the case of elected policy-makers that are also concerned about the provision of a public good.

[9] Moreover, Fuest and Huber (2001) show that a coordinated increase in capital tax rates can actually be welfare-reducing for the decisive median voter in that case. Hence, tax coordination may fail to receive political support. A similar result can be found in Grazzini and van Ypersele (2003) and Peralta (2007) for the case of asymmetric countries.

[10] An increase in the equilibrium tax rate due to economic integration is also possible in the case of taxation of multinational firms. Haufler et al. (2008) show that economic integration raises the profits of multinational firms and thus enhances the redistributive gain from an increase in tax rates. However, profit-shifting implies an increase in the efficiency costs of corporate taxation as well. Consequently, the median voter prefers to raise the tax rate if the first effect dominates.

welfare implications of capital market integration strongly depend on economical as well as political factors. They show that if jurisdictions are symmetric in their per capita endowments of capital, but different in the capital endowment of its decisive majority, autarky will be socially preferred to integration. In that case, market integration yields no efficiency gain or distributional benefit. Nevertheless, the political majorities will vote for different capital tax rates, which distorts the interjurisdictional allocation of capital. In contrast, if countries are asymmetric in their per capita capital endowment but symmetric in the capital endowment of their median voters, the integration of capital markets can be socially preferred to autarky. This is because there is a potential efficiency gain by the integration of capital markets, whereas the decisive majorities do not distort the allocation of capital. However, as shown in a related article by Kessler et al. (2002), the implications of tax competition change substantially if economic integration increases the mobility of labor as well. In this analysis, tax revenue from capital taxation is used for redistribution purposes to the region's inhabitants. Hence, lowering tax rates in order to attract foreign capital raises the jurisdiction's wage rate and the per capita social transfers. In the case of mobile labor this induces detrimental immigration for the domestic majority so that the median voter prefers higher capital tax rates in equilibrium. As a result, Kessler et al. (2002) show that mobility of both production factors can neutralize each others' economic implications for a jurisdiction and thus alleviate the impact of fiscal competition.

The inclusion of elections in economic analyses of fiscal competition thus substantially affects, and may even reverse the conclusions with respect to the economic implications of capital taxation. However, the political environment is not only an important factor in policy determination between independent governments on a national level. Rather, it also plays an important role in any level of political decision-making within federal states. In fact, the introduction of political factors is the distinctive feature of the so-called 'second generation theory of fiscal federalism'.[11] In this literature, special attention is paid to the connection of the specific level of government decisions and the structure of the political process under imperfect or asymmetric information between voters and politicians.[12]

In this respect, Seabright (1996) develops a model in which governmental decisions on a central level allow for a better coordination of policies, as for example an internalization of economic externalities. However, this comes at the cost of reduced accountability

[11] See Oates (2005), Lockwood (2006) and Weingast (2009) for comprehensive surveys.

[12] See Persson and Tabellini (2000a) and Besley (2006) for comprehensive analyses of accountability and responsiveness caused by political institutions.

of centrally elected policy-makers. Essentially, this trade-off determines the preferred structure of fiscal decentralization. Seabright (1996) then shows that decentralization can be favored, not only in traditional fashion due to differences in local tastes for the provision of the public good but also because of the losses in accountability under a central government.[13] In two important papers, Lockwood (2002) and Besley and Coate (2003) then investigate the specific structure of political decisions on a central level in more detail, taking into account legislative bargaining and strategic delegation of voters. Both studies consider an environment where the provision of regional public goods can be set differently at the central level. Nevertheless, even when the jurisdiction's elected delegates are regionally benevolent, the political process on the central level leads to an inefficient distribution of public goods across the jurisdictions. Lockwood (2002) focuses on the details of a bargaining process. He shows that if minimization of costs for the provision of regional public goods plays an important role in policy-making, the cheapest provision of public goods will have a higher probability of being implemented than those with the highest surplus. This corresponds to an inefficiently low provision of public goods under centralization. Besley and Coate (2003) concentrate on strategic delegation of voters. In their model, the costs of regional public spending are shared by the jurisdictions in a centralized system. As a result, the regional median voters prefer to elect local representatives for the centralized legislature who have higher preferences for the public good than themselves. This potentially leads to an inefficient overprovision, or, because of regional differences in preferences, to a misallocation of regional public goods in equilibrium. Consequently, these analyses confirm Seabright (1996) in showing that fiscal decentralization can even welfare-dominate a centralized provision of public goods as soon as the structure of political decisions are analyzed in more detail. However, in each of these three articles the authors emphasize that the interjurisdictional spillovers must be sufficiently small for fiscal decentralization to be more efficient than a central policy determination.

In a related article, Janeba and Wilson (2011) recently replaced these spillover effects with the fiscal externalities related to tax competition. They show that as long as some inefficiency is present in the public sector, some decentralization of the provision of public goods increases the representative resident's utility. This is because tax competition has some endogenous element of the fiscal externalities that is related to the degree of centralization. When the level of decentralization is low, taxation of mobile capital at the regional level will not be high. Consequently, tax competition for capital has no significant impact and some decentralization enhances welfare. Furthermore, as

[13] A similar result can be found in Tommasi and Weinschelbaum (2007).

shown by Hatfield and Padró i Miquel (2012), partial decentralization can be obtained in a political process if voters explicitly decide on the federal structure of a country in a constitutional stage. On the one hand, in their model, a capital-poor median voter prefers to centralize the provision of public goods. This is because on the central level he does not have to fear that capital investment moves to other jurisdictions, which enables the highest degree of redistribution. On the other hand, if the capital stock of the country is endogenously determined, using distortive taxes for redistribution purposes lowers the aggregated capital supply of a country, and thus the pool from which to redistribute. Consequently, the median voter faces a trade-off where the solution to the constitutional vote balances these two forces and yields a partially decentralized provision of public goods in the political equilibrium.

Asymmetric information between voters and politicians involves problems of moral hazard and adverse selection. As shown by Besley and Smart (2007), on the one hand, elections provide accountability as it allows voters to deselect bad politicians. On the other hand, elections improve the average quality of office-holders by offering incentives for self-interested incumbents to reduce rent diversion in order to increase their probability of being re-elected. Referring to the first as the 'selection effect' and the second as the 'discipline effect' of elections, Besley and Smart (2007) analyze the implications of an intensification of tax competition. For the case of pooling by good and bad politicians, they find that fiscal competition decreases voter welfare even if it restricts the amount of spending that can be diverted by bad politicians without having to fear detection. However, tax competition affects the equilibrium strategy of bad incumbents as the limitation of rent extraction contains an incentive to extract maximal rents in the first place. This separation strategy reveals more information about the incumbent and thus enhances the ability of voters to detect bad politicians. Consequently, the welfare implications are essentially determined by a trade-off between reduced discipline in the short run and the benefits from deselecting bad politicians in the long run. Besley and Smart (2007) show that the selection effect outweighs the discipline effect which implies that intensified tax competition increases voter welfare.[14]

Nevertheless, the specific structure of political institutions plays a crucial role in the welfare implications of tax competition, as recently shown by Janeba and Schjelderup (2009) for the case of self-interested politicians. Following Persson et al. (2000b), the taxation and expenditure decisions are separated in power in the case of a presidential–congressional system, whereas a cohesive majority is necessary for all fiscal deci-

[14] The impact of fiscal decentralization in terms of selection and incentive effects has recently been investigated by Hindriks and Lockwood (2009). They find ambiguous welfare implications.

sions in a parliamentary system. Janeba and Schjelderup (2009) show that tax competition does not affect the provision of the public good in the presidential-congressional regime. Hence, the downward pressure on tax rates goes along with a reduction in extracted rents by the politicians. In contrast, in the case of a parliamentary system tax competition affects the provision of public goods and the extracted rents by the politicians at the same time. As a result, the downward pressure on tax rates can reduce welfare if the reduction in extracted rents do not compensate the loss in utility from a decline in the provision of the public good.

These studies suggest that the political environment seems to play an important role in analyzing the efficiency and welfare implications of tax competition. However, as soon as the connection between policy and personal welfare is recognized, residents with a common interest have an incentive to organize themselves into a lobby group and influence policy in a way that is beneficial to them, as for example argued in the seminal works by Olson (1965) and Becker (1983). In recent years, the economic theory of lobbying has been extensively developed and an increasing number of articles contribute to the 'second generation theory of fiscal federalism' in explicitly considering the implications of political influence within federal states.[15]

One of the early analyses in this literature is Persson and Tabellini (1994). They show that federal-wide financing of the provision of regional public goods generates an incentive for local states to lobby the central government for an increase of the federal budget. Consequently, state lobbying will increase public expenditures beyond the level in a decentralized system, where each state finances its own public good. However, in a related article, Mazza and van Winden (2002) obtain the opposite result by introducing separation of powers and two-tier lobbying. In their model, a federal legislator sets the federation-wide tax and a federal agency assigns a share of the budget to each regional state. If the special interest groups are restricted to lobby only the legislator, influencing the size and the allocation of the federal budget at the same time is no longer possible. This mitigates the incentive to lobby for an increase in the size of the federal budget. Moreover, if the federal agency can be lobbied as well, the

[15] The modelling of political influence in the recent contributions of this literature are almost exclusively based on the so-called 'menu-auction' approach, originally developed by Bernheim and Whinston (1986a, 1986b). In two influential articles, Grossman and Helpman (1994, 1995) extended and applied this apporach to analyze the implications of political influence on trade policy in a small and large open economy. Beginning with this, a large body of research with respect to political influence on trade policies emerged, as can be seen in Grossman and Helpman (2002) or Feenstra (2004). Early applications to governmental policy-making in closed economies include Dixit (1996), Dixit et al. (1997) and Persson (1998). Van Winden (2003) reviews different approaches to political influence in governmental policy-making.

federal legislator dislikes political influence towards the agency as this imposes costs for the local communities. As a consequence, the federal legislator reduces stakes at the agency level and centralization of policy-making can actually lead to a smaller public sector than under decentralization.

Differences in political influence of centralized and decentralized federal structures were also investigated by Bardhan and Mookherjee (2000). They consider a model with two political parties in electoral competition. Each party chooses policy in order to maximize its probability of winning, whereas campaign contributions of politically organized rich residents can be used to affect the voting behavior of uninformed residents.[16] Consequently, they show that there will be less capture when policies are determined at the central level if, at this level, the residents are better-informed or if the rich are politically less organized. However, if there are independent regional shocks to informed voters, the uncertainty in the election outcome at the decentralized level increases. This reduces capture at the decentralized level because the rich are more willing to contribute to the party that will most likely win.

The impact of lobbying in political competition may be overstated if the implications of the electorate's voting behavior are neglected. In that respect, Besley and Coate (2001) develop a model that combines an endogenous entry of political candidates with influence on behalf of an exogenous set of politically organized lobbies. Concentrating on a centralized policy determination, the authors show that if the residents are able to anticipate the impact of lobbying, voters strategically elect a candidate whose policy preferences offset the distortion caused by political influence. Following this, lobbying in political competition need have little or even no effect on the policy outcomes in equilibrium. In a related analysis, Felli and Merlo (2006) show that the policy outcomes will be affected if policy is determined by a bargaining process between lobbyists and the politician. In their model, the elected candidate first chooses a set of special interest groups with opposed political preferences to bargain with, since this maximizes the transfers he gets for compromising on the policy choices.[17] Consequently, political influence moderates the equilibrium policy in their model.

However, the efficiency and welfare effects of political influence on different levels of government decision-making have to be considered in order to evaluate the implications of lobbying in fiscal federalism. In this respect, Bordignon et al. (2008) show that when the interests of the lobbying groups are aligned, decentralization yields a

[16] See Baron (1994) and Grossman and Helpman (1996).

[17] For an explicit treatment of endogenous lobby formation see Mitra (1999) and Laussel (2006).

higher level of social welfare than centralization. This is because governments do not take into account the benefit of their regional policies on the special interest groups in the other region, which reduces the impact of political influence in comparison to a policy determination on a central level. In contrast, if the interests of the two lobbies are conflicting, centralization is welfare-superior to decentralization. This is because regional governments do not internalize the welfare loss of the special interest group in the other region, which strengthens the distortions caused by political influence under decentralization. Accordingly, a welfare-oriented allocation of functions to different levels of government under political influence depends on the interests of politically organized groups. Ruta (2010) explicitly investigates the allocation of competencies between a central institution and regional governments when special interest groups influence the policies as well as the constitutional decision about the federal structure. In his model, centralization creates competition among otherwise single-acting regional special interest groups. However, at the same time, centralization implies that each lobby can influence public spending out of the central government's pool of tax revenues. In the baseline approach without cross-border policy spillovers, Ruta (2010) finds that the political equilibrium always implies decentralization, since political influence of symmetric lobby groups fully offset each other's political impact. As a consequence, only the costs of political influence increase in the case of a central determination. Introducing interjurisdictional spillovers, the result will not change as long as policy spillovers are sufficiently low, that is the increase in costs for political influence is higher than the benefits of an internalization of the economic externalities.

Brou and Ruta (2006) consider the effect of political integration (centralization) when special interest groups are asymmetrically distributed among the integrating jurisdictions. They show that jurisdictions with a higher degree of political organization receive more favorable policies when policies are determined on a central level than under decentralization, whereas the opposite is true for the less organized jurisdiction. This is because political integration reduces competition among lobbies from the perspective of the more organized jurisdiction. As a consequence, the interest groups in the more organized region can influence policies in their favor in both jurisiditions, which a less politically organized region can do to a lesser extent. Internalizing lobby formation, Brou and Ruta (2006) furthermore show that the reduction in competition for lobbies in the better-organized jurisdiction induces even more groups to become politically organized, which represents in their model an additional channel through which the more organized region gains from political integration. Redoano (2010) pays special attention to the implications of different levels of government on political influence.

In her model, the formation of lobbies in a jurisdiction is endogenous and essentially depends on the heterogeneity of preferences for the provision of public goods and the costs of organizing into a special interest group. Comparing the political equilibrium under decentralization and centralization she finds ambiguous implications of centralization on the equilibrium number of lobbies as well as their effect on policy. However, both strongly depend on the heterogeneity of preferences within jurisdictions.

Brusco et al. (2011) investigate how much tax autonomy should be granted to regional governments that are exposed to political influence. They find that a restriction of tax autonomy may be desirable when political influence on policy-makers becomes sufficiently large. A high level of tax autonomy implies a large set of taxation policies. Then lobbying is comparably effective in distorting policies, since each special interest group can influence all available group-specific policies. Therefore, under full tax autonomy lobbying concentrates on group-specific subsidies, whereas tax rates are influenced to redistribute income within the lobby groups. However, in the case of little tax autonomy, the members of all lobby groups are affected by all tax instruments, which reduces the distortionary impact of political influence.

Finally, Esteller-Moré et al. (2012) investigate the implications of vertical tax externalities in fiscal federalism where special interest groups lobby the taxation of a private consumption good. In the case of a highly concentrated market and political influence of producers, they find that spreading the taxing power between two layers of government may increase the aggregated payoff of policy-makers who are only concerned about tax revenues and campaign spending. Moreover, since producers have a strong incentive to lobby for tax reductions in that case, tax-base sharing enhances efficiency as well. Consequently, political influence can be seen as a justification for tax-base sharing among different levels of government within a federal country. In contrast, if the market is sufficiently competitive, politicians are better off when only a single government taxes the consumption good, since the incentives for political influence of producers are rather weak.

The optimal allocation of governmental functions within a federal state has thus received much attention in context of political influence. Overall, the findings in this recent literature suggest that, besides elections, the impact of organized lobby groups as well as the incentive of organizing into a special interest group play an important role in analyzing the efficiency and welfare implications of fiscal (de-)centralization and, hence, the design of an optimal federal structure. However, the increases in free trade and factor migration during the past few decades raises the interregional mobility of

national tax bases as well. Interestingly, there are only a few studies that explicitly emphasize the implications of political influence in context of tax competition for a mobile tax base among independent jurisdictions. This is the main concern of the contributions rolled out in the subsequent chapters of this thesis. In line with the political-economy literature just described, we are interested in providing a positive analysis for the implications of international tax competition, stressing the importance of political influence by organized special interest groups.

Based on so-called political support functions, Haufler (1997) and Lorz (1998) are two early contributions.[18] Haufler (1997) considers a model where the relative weight of capitalists and workers determines the optimal mix of factor taxes. As usual, the economic integration of capital markets increases the efficiency costs of taxation. However, in the presence of politically organized residents, the distributional implications of capital market integration affect the influencing structure of the political arena as well. Consequently, Haufler (1997) shows that both forces will be considered by the policy-makers and market integration yields distributional and efficiency implications that work in the same direction for a capital importing country, but in opposite directions for a capital exporting nation. Lorz (1998) considers special interest groups with different endowments of capital, whereas the payments of lobbying are treated as pure waste. In his model, symmetric lobbying of the organized groups offset each other's policy impact so that tax rates will not be affected. Nevertheless, each lobby pays a positive amount in equilibrium. He shows that tax competition limits the scope for redistribution so that the incentives for political influence decline and thus welfare improves. However, no distortion on capital taxes occurs and, hence, no inefficiency arises in equilibrium. Lai (2010) recently investigated tax inefficiencies in the context of horizontal tax competition and political influence. He considers a model with many small open economies, where the incentive of domestic capital owners to lobby for lower capital tax rates is directly related to the market share of the country. The smaller this share, the higher the tax burden that will be shifted to the immobile production factor. This reduces the capitalists' incentive to lobby for lower tax rates. Accordingly, Lai (2010) shows that intensified tax competition can actually mitigate the underprovision of public goods if the capital owners' lobbying incentive is sufficiently reduced.

[18] Marceau and Smart (2003) consider lobbying in the case of a mobile tax base as well. However, they focus on taxation of irreversible investment where governments will have an incentive for excessive taxation, since this seems to impose small deadweight costs. However, anticipating this, rational investors will reduce saving and sunk investments are discouraged in favor of more flexible ones. Marceau and Smart (2003) show that lobbying of the owners of sunk capital can serve as an instrument to prevent expropriation and thus mitigates the problem of excessive taxation.

In our opinion, the degree of political organization of special interest groups plays an important role in evaluating the implications of tax competition. In light of Olson (1965) and Becker (1983), this allows us to investigate a large scope of political distortions. In chapter 1, we develop a simple two-jurisdiction model of capital taxation in the presence of an endogenous political distortion due to lobbying by the owners of capital and immobile labor. Without political influence in autarky, we first show that the provision of a local public good will be efficient. As a consequence, conflicting lobbying interests of the residents push the capital tax rates in the direction of inefficiently high or low tax rates in equilibrium. The integration of capital markets then causes interjurisdictional tax competition and affects the lobbying incentives at the same time. We find that if special interest groups are organized according to Olson's (1965) logic, the political distortion aligns with the usual downward pressure due to the mobile tax base. In that case, lobbying aggravates the inefficiency in capital taxation. Moreover, in the case of integrated capital markets we show that lobbying affects the welfare of its political counterpart in the other jurisdiction as well. This constitutes a lobbying-induced externality that can increase or reduce the contributions to the government and hence the net-welfare of political influence.

However, multinational enterprises and intra-industrial trade are one of the major elements of proceeding economic integration, whereas it is well-known that multinational firms have ample opportunities to avoid corporate tax payments.[19] However, tax avoiding via political influence has been completely neglected in the literature on corporate taxation so far. In chapter 2, we develop a simple model of corporate taxation in a small open economy, where the governments are influenced by politically organized capital owners and on behalf of the organized owners of a multinational firm. We find that the equilibrium tax rate declines with respect to the firm owners' influence, but rises in the case of lobbying by the domestic capital owners that bear no loss in private income. Consequently, political influence may counterbalance well-known fiscal externalities due to the non-cooperative governmental behavior and thus improves the efficiency of corporate taxation. However, we find that an international organization of firm owners affects corporate taxation in both countries at the same time. As a result, strengthened lobbying by shareholders can even increase profit-shifting to the other country in that case.

Corporate income taxation in the United States is based on Formula Apportionment. Following this, the overall profit of a multi-regional operating firm is consolidated and

[19] See Gresik (2001), Nicodème (2007) or Griffith et al. (2010) for comprehensive surveys.

then apportioned to the jurisdictions of origin according to a certain formula that reflects the economic activity of the firm in that region. Actually, introducing Formula Apportionment on a supranational level of the European Union is proposed by the European Commission (2011). Interestingly, granted autonomy for U.S. states in the determination of the apportionment formula led to a deviation from the initially embodied formula structure with equal weights of the firm's relative capital and sales shares and an apportionment factor that is related to the input factor labor. A similar structure is actually discussed for introducing Formula Apportionment in the European Union.[20] Based on the core findings in the political-economy literature mentioned above, we think that political influence may be important in explaining the different structures of apportionment formulas. For this purpose, we develop in chapter 3 a simple model with two jurisdictions that decide on the weights of the apportionment factors as well as the corporate tax rates. The owners of immobile labor, mobile capital and the shareholders of a multinational firm are allowed to engage in political influence. However, with respect to the decision about the structure of the apportionment formula, we model the actual situation in the U.S. as well as the proposal from the European Commission (2011) in distinguishing with respect to a centralized and decentralized determination of the formula weights. However, in any case, the tax rates are determined on a decentralized level so that we analyze non-cooperative tax setting between independent jurisdictions. We find that the implications of political influence are sensitive with respect to the jurisdictional setting. As a result, the distortions of the formula weights that are caused by political influence can be even reversed when a central government becomes aware of the implications for the other region.

[20] In fact, in U.S. corporate taxation the labor-related apportionment factor consists of the relative payroll shares of the firm, whereas the European Commission (2011) proposes a subdivision into the firm's relative payroll and employment shares. Nevertheless, we are able to consider the implications of this difference in the structure of apportionment formulas qualitatively.

Chapter 1

Capital Tax Competition and Political Influence

1.1 Introduction

Starting with the seminal analyses by Wilson (1986) and Zodrow and Mieszkowski (1986), economists begun to examine the implications of non-cooperative taxation behavior of a mobile tax base. In that case, the governments do not recognize the impact of their policy on other jurisdictions, and the efficiency and welfare implications of tax competition can generally be attributed to fiscal externalities, as pointed out by Wildasin (1989). Even though the subsequent research is extensive, the conclusions remain ambiguous. The main contributions of the early literature on capital tax competition suggest that government spending will be inefficiently low in equilibrium, but continuative studies show even welfare-improving implications.[1]

However, in an open economy the private and public income will be affected by the tax policy of all jurisdictions. The equilibrium tax policy is thus not isolated from the implications of tax competition for the country's electorate. This has been the focus of the political economy literature so far, in particular with respect to the jurisdiction's decisive median voter as shown by Persson and Tabellini (1992), Fuest and Huber (2001), Borck (2003), Lockwood and Makris (2006) or Haufler et al. (2008). These analyses suggest that the political environment seems to play an important role in analyzing the efficiency and welfare implications of tax competition. However, as soon as the connection between policy and personal welfare is recognized, residents with a common interest have an incentive to organize themselves into a lobby group and influence the taxation policy in a way that is beneficial to them. Nevertheless, political influence has not received much attention in the context of tax competition.

We set up a simple model with two jurisdictions that decide non-cooperatively upon capital taxation, but which are influenced by the domestic owners of mobile capital and immobile labor. In light of Olson (1965) and Becker (1983), we allow for different organizational degrees of the two residential groups, which enables us to investigate a large set of political distortions.[2] In autarky, we find that the owners of capital bear the full burden of the capital tax. Hence, capital tax rates will be inefficiently low if the capital owners' lobby has a higher organizational degree and vice versa. However, in the case of integrated capital markets, the tax burden will be partially

[1] See Wilson (1999), Wilson and Wildasin (2004), Fuest et al. (2005) or Zodrow (2010) for comprehensive surveys.

[2] However, we do not investigate if a policy decision should or will be delegated to a supranational level in the presence of political influence, as for example discussed by Bordignon et al. (2008) or Ruta (2010) in context of fiscal federalism.

shifted to the owners of immobile labor. This implies that the number of represented residents becomes decisive for the preferred direction of political influence. This is because, in comparison to the loss in private income, in the larger residential group more individuals gain from the provision of the public good. Consequently, the larger group has an incentive to lobby the government for higher tax rates in equilibrium.

However, the mobility of the tax base distorts the jurisdiction's policy into the direction of inefficiently low tax rates. The efficiency implications of tax competition under political influence are thus crucially dependent on the organizational degrees of the special interest groups. Moreover, lobbying influences capital taxation and hence the political interaction in the other country as well. Since governments cannot be forced into political interaction with the lobbies, this impact calls for a change of the distribution of the rents from political interaction. The result is that this lobbying-induced fiscal externality can substantially affect the equilibrium contributions and hence the gain from political influence.

To the best of our knowledge, there are only two studies that investigate political influence in the context of capital tax competition. Lorz (1998) shows a welfare-enhancing impact of intensified tax competition. In his model, special interest groups with a different endowment of capital lobby for redistributive capital taxation, whereas the payments of lobbying are treated as pure waste. Assuming a symmetrical distribution of capital endowments, Lorz (1998) finds that lobbying by the different capital owners offsets each others political impact. Hence, lobbying doest not affect the equilibrium tax rate, but each special interest group has to pay a positive amount to the government. Introducing tax competition then limits the scope for redistribution so that the lobbying incentives decline and welfare improves. However, there is no other distortion on capital taxation in his model. Consequently, no inefficiency arises in equilibrium and the main theme of the early literature on capital tax competition is neglected in his study. This was recently incorporated by Lai (2010). In his model of many identical countries, the owners of mobile capital lobby the government for lower capital tax rates in autarky. However, the smaller the jurisdiction's market share, the larger the tax burden that will be shifted to the immobile production factor of the country, which reduces the incentives of the capital owners to lobby for lower tax rates. Consequently, Lai (2010) shows that intensified tax competition mitigates the underprovision of a local public good if the capital owners' incentive is sufficiently reduced. However, in light of Olson (1965) and Becker (1983), the possibility of different organizational degrees for special interest groups is not recognized in Lai's study. In contrast, differences in political organization is one of the major concerns of our study, as it allows us to in-

vestigate a larger scope of political distortions in autarky and the case of an integrated capital market.

For example, if the organizational degree of the labor owners is comparably high, we have inefficiently high tax rates in the closed economy. Consequently, tax competition reduces capital tax rates in the direction of the efficient level. This scenario mirrors the results of the studies of welfare-enhancing tax competition by Edwards and Keen (1996) and Eggert and Sørensen (2008), but for a different reason. Edwards and Keen (1996) consider a leviathan government that directs a part of the tax revenue to its own purpose. Eggert and Sørensen (2008) consider a politician who has an incentive to increase the rents to the public sector in order to become comparably more attractive in election. In contrast, our political distortion comes from lobbying by politically organized residents. However, if we follow Olson (1965), the larger residential group has the lower degree of political organization. In that case, we find that the distortion due to the mobility of the tax base pushes the tax rate in the same direction as the overall political distortion in the open economy. Consequently, capital tax rates will then always be inefficiently low in equilibrium.

The remainder of the paper is structured as follows. Sections 1.2 and 1.3 develop a simple model of political influence on capital taxation. Section 1.4 investigates the implications of lobbying in a closed and open economy and the efficiency implications of capital market integration under political influence. Finally, in Section 1.5 we investigate how economic integration of the capital market affects the equilibrium contributions. Section 1.6 contains our conclusion.

1.2 The Model

1.2.1 Residents

Consider a simple model of two identical jurisdictions, labeled a and b. Each country $i \in \{a, b\}$ is inhabited by n^i immobile residents, divided with respect to their source of private income into n_L^i labor and n_C^i capital owners.[3] All n_g^i individuals within group $g \in \{L, C\}$ are assumed to be homogenous. They receive income from their inelastic supply of $\overline{l}^i$ units of labor to the domestic labor market and $\overline{k}^i$ units of capital to the international capital market. The total labor force of a country is thus given by

[3] Note that $n_L^i + n_C^i = n^i$.

$\overline{L}^{\,i} = n_L^i \, \bar{l}^{\,i}$ and the jurisdiction's capital supply by $\overline{K}^{\,i} = n_C^i \, \overline{k}^{\,i}$. All residents have identical preferences given by

$$U_g^i(x_g^i, y^i) \;=\; x_g^i + V(y^i), \tag{1.1}$$

where the individual's consumption of a private good is given by x_g^i. The supply of a locally provided public good is given by y^i. It yields utility $V(y^i)$ with $V' > 0 > V''$. The domestic wage rate is denoted by w^i and the return to capital by r. We then get $x_L^i = w^i \, \bar{l}^{\,i}$ and $x_C^i = r \, \overline{k}^{\,i}$. Accordingly, the welfare of group g can be defined as

$$W_g^i = n_g^i \, U_g^i. \tag{1.2}$$

1.2.2 Production

In each country, a representative firm produces a single good, the price of it being normalized to one. Production factors are capital and labor. The production technology is given by $F^i(K^i, L^i)$, with $F_K^i, F_L^i > 0$ and $F_{LK}^i > 0$, and it is assumed that F^i exhibits constant returns to scale. Capital is assumed to be perfectly mobile and supplied to the firm at a per unit cost of $r > 0$. Additionally, in country i a tax t^i has to be paid on every unit capital employed. Taking the interest rate and the tax rate as given, the firm chooses capital (K^i) and labor (L^i) in order to maximize the after-tax profit

$$\Pi^i = F^i(K^i, L^i) - w^i L^i - (r + t^i) K^i. \tag{1.3}$$

Differentiating (1.3) with respect to K^i and L^i yields the first-order conditions

$$F_K^i \;=\; r + t^i, \tag{1.4}$$

$$F_L^i \;=\; w^i. \tag{1.5}$$

According to equation (1.4), the firm chooses investment in a way that the marginal return to capital is equal to the interest rate plus the tax rate. Equation (1.5) states that labor will be employed until the last unit's marginal product covers the wage rate. Since we consider two jurisdictions, the market interest rate r is endogenously determined in the integrated capital market.[4] Focusing on situations with full employment of labor

[4] For example, see also Wildasin (1988) or DePater and Myers (1994).

in each country, the equilibrium conditions for the factor markets are given by

$$\overline{K}^a + \overline{K}^b = K^a + K^b, \tag{1.6}$$

$$\overline{L}^i = L^i. \tag{1.7}$$

Together with (1.4) and (1.5), equations (1.6) and (1.7) determine the capital allocation, the market interest rate and the domestic wage levels in equilibrium.

Concerning the tax competition analysis in the next sections, it will be useful to know the implications of a change in the capital tax policies. Conducting a comparative static analysis of (1.4)-(1.7), we get

$$\frac{dr}{dt^i} = -\frac{F^j_{KK}}{F^i_{KK} + F^j_{KK}} < 0, \tag{1.8}$$

$$\frac{dK^i}{dt^i} = \frac{1}{F^i_{KK} + F^j_{KK}} < 0, \tag{1.9}$$

$$\frac{dK^j}{dt^i} = -\frac{1}{F^i_{KK} + F^j_{KK}} > 0, \tag{1.10}$$

$$\frac{dw^i}{dt^i} = \frac{F^i_{LK}}{F^i_{KK} + F^j_{KK}}, \tag{1.11}$$

$$\frac{dw^j}{dt^i} = -\frac{F^j_{LK}}{F^i_{KK} + F^j_{KK}}, \tag{1.12}$$

for $i, j \in \{a, b\}$ and $i \neq j$.[5] With a unilateral increase in t^i, the user costs of capital in jurisdiction i rise so that K^i decreases. Accordingly, equation (1.8) states that the market interest rate has to adjust downwards in order to ensure an capital market equilibrium. But even if this counteracts the initial increase in user costs, equation (1.9) shows that in sum will be less invested in country i. This is because the decrease in the market interest rate unambiguously increases investment in the other jurisdiction as well, since the capital tax rate there is not changed, as stated by (1.10). Finally, since the domestic labor supply is fixed and fully employed in equilibrium, equations (1.11) and (1.12) show that an unilateral increase in t^i reduces the wage in country i, but increases the wage in country j, if the production factors labor and capital are complements, i.e. $F^i_{LK} > 0$.

[5] The derivations of the comparative statics are given in Appendix A. Wildasin (1988, 1989) and Hoyt (1991) get similar expressions for more than two jurisdictions.

In order to investigate how capital tax competition affects the incentives for political influence, it will be useful to know something about the effects of capital taxation under political influence in the case of a closed economy. Therefore, suppose that capital is immobile as well. The market interest rate will then be endogenously determined in the domestic capital market. Denoting the costs per unit of capital in autarky by r_A^i, the equilibrium condition for the deomestic capital market is given by $\overline{K}^i = K^i$. Substituting this and equation (1.7) into (1.4) and (1.5), it is straightforward to show that $dw^i/dt^i = 0$ and $dr_A^i/dt^i = -1$. Accordingly, the burden of capital taxation in a closed economy will be entirely borne by the capital owners.

1.3 The Political Area

1.3.1 Special Interest Groups

Since all individuals have the same preferences, it seems natural to distinguish the residents in terms of political influence with respect to their source of income.[6] Following the approach of Grossman and Helpman (1994, 1995) we do not investigate the incentives to organize a lobby group and assume that residents with a common source of income are able to overcome the free-rider problem as first discussed by Olson (1965). More precisely, we assume that only a share $\theta_g^i \in [0,1]$ of each residential group $g \in \{L, C\}$ is politically organized.[7] This enables us to focus on the politically influenced incentives of the governments that compete for a mobile tax base, since we know from Grossman and Helpman (1994) that no political distortion occurs in equilibrium if all residents in a country are politically organized.[8] Moreover, this is in accordance with Olson (1965) as it comprises his argument that the political organization of a residential group is closely related to the number of potential members in a stylized way. According to Olson (1965), it becomes more difficult to coordinate common interests when there are more individuals within the same group, due to free-riding and higher administrative costs. In our model, this corresponds to a smaller organizational degree for the larger residential group.

[6] Lobbying by capital and labor owners with no other source of private income can also be found in Rama and Tabellini (1998).

[7] This constitutes a measure for the policy-relevant size of a residential group, as for example used by Haufler (1997) or Mitra (1999) in a similar way.

[8] Note that equilibrium welfare is still affected since each residential group has to pay contributions.

Following the approach of Grossman and Helpman (1994, 1995), we assume that each lobby offers a political contribution function that is not negative or greater than the aggregate income of the organized members and that depends on the tax rate the government unilaterally decides upon.[9] Accordingly, each lobby submits a function $\varsigma_g^i(t^i)$ to its domestic government in order to maximize the joint welfare of its members net of contributions, that is

$$\Theta_g^i = \theta_g^i W_g^i(t^i, t^j) - \varsigma_g^i(t^i), \tag{1.13}$$

where $\theta_g^i W_g^i(t^i, t^j)$ reflects the gross welfare of lobby group g in country i. Note that the gross welfare levels of the lobby members in (1.13) depend on the tax rates of both countries. However, we follow Aidt and Hwang (2008) in the notation of the contribution schedules. That is, the offered contributions of domestically organized lobbies are assumed to depend only on the jurisdiction's policy instrument, i.e. $\varsigma_g^i(t^i)$. That is, the governments and lobbies in both jurisdictions are assumed to influence only their domestic government and are not able to observe each other's political interaction. Following Grossman and Helpman (1995) and Aidt and Hwang (2008), this seems to be reasonable in the context of non-cooperatively chosen policies on which we focus.[10]

1.3.2 Governments

Following Grossman and Helpman (1994, 1995), the incumbent governments have an implicit objective in being reelected. Accordingly, they are concerned about the well-being of their domestic electorate in terms of social welfare, but they also value the received contributions from the special interest groups that can be used to finance campaign spending in electoral competition.[11] Faced with the contribution schedules, each government chooses its capital tax rate t^i in order to maximize

$$G^i(t^i, t^j) = \alpha^i W^i(t^i, t^j) + \sum_g \varsigma_g^i(t^i). \tag{1.14}$$

[9] Evidence of the interdependence of governmental policy and contribution payments can be found in Snyder (1990), Spiller and Liao (2008), Richter et al. (2009) or Chirinko and Wilson (2010).

[10] If governments negotiate over policies, lobbies will be able to tie their contribution to the outcome of the process. In that case, the offered contributions depend directly on the the tax rates of both jurisdictions, i.e. $\varsigma_g^i(t^i, t^j)$. See Grossman and Helpman (1995) or Aidt and Hwang (2008) for more details.

[11] An explicit treatment of an electoral stage can be found in Grossman and Helpman (1996).

Equation (1.14) reflects the weighted sum of social welfare W^i and contributions, with $\alpha^i > 0$ representing the government's valuation of one unit of social welfare compared to political contributions. Since the governments raise tax revenues solely from capital taxation, the implied budget constraint is given by $y^i = t^i K^i$. Using equations (1.1) and (1.2), social welfare in country i can be written as

$$W^i = \sum_g W_g^i = w^i \overline{L}^i + r \overline{K}^i + n^i V(y^i). \tag{1.15}$$

We are interested in the political equilibrium of a three-stage game. In the first stage, the lobbies in each country simultaneously set their contribution schedules $\varsigma_g^i(t^i)$, contingent on the non-cooperatively chosen capital tax rates by the governments in the second stage. Thereby, they take given the political interaction of its domestic government with the other lobby as well as the tax policy in the other jurisdiction. In the third stage, the firms decide on investment and labor input, the factor markets clear and consumption takes place. Hence, solving by backward induction implies that governments and lobby groups anticipate the behavior of the firm and the factor market adjustments, as given by the results in Section 1.2.2.

1.3.3 Equilibrium of the political game

A political equilibrium of this game can be described as a set of simultaneously chosen contribution schedules $\left\{\varsigma_g^i(t^i), \varsigma_g^j(t^j)\right\}$ in a way that the joint net-welfare of the members of each lobby group is maximized. Thereby, the lobbies take as given the anticipated political optimization of the governments in the subsequent tax competition game. At the same time, the set of chosen tax rates $\{t^i, t^j\}$ has to maximize each government's objective, taking as given the behavior of the other government, the contribution schedules and the behavior of the firms. This political interaction has the structure of the common-agency game analyzed by Grossman and Helpman (1994, 1995).[12] Following this, the equilibrium capital tax policy is characterized by

Definition 1.1
A set of contribution functions $\left\{\widetilde{\varsigma}_g^i(\widetilde{t}^i), \widetilde{\varsigma}_g^j(\widetilde{t}^j)\right\}$ *and a set of capital tax rates* $\left\{\widetilde{t}^i, \widetilde{t}^j\right\}$ *describe for* $i, j \in \{a, b\}$, $i \neq j$ *and* $g \in \{L, C\}$ *an equilibrium if (a)*

$$\widetilde{t}^i \;=\; \arg\max_{t^i} \quad \alpha^i W^i(t^i, \widetilde{t}^j) + \sum_g \widetilde{\varsigma}_g^i(t^i), \tag{1.16}$$

[12] See Bernheim and Whinston (1986a) for an equilibrium characterization for a discrete set of choices.

and (b) for every organized special interest group $g, h \in \{L, C\}$ and $g \neq h$, a feasible contribution function $\varsigma_g^i(t^i)$ and a capital tax rate does not exist that (i)

$$\widetilde{t}^i \;=\; \arg\max_{t^i} \quad \alpha^i W^i(t^i, \widetilde{t}^j) + \varsigma_g^i(t^i) + \widetilde{\varsigma}_h^i(t^i), \tag{1.17}$$

and (ii)

$$\theta_g^i W_g^i(t^i, \widetilde{t}^j) - \varsigma_g^i(t^i) \;>\; \theta_g^i W_g^i(\widetilde{t}^i, \widetilde{t}^j) - \widetilde{\varsigma}_g^i(\widetilde{t}^i). \tag{1.18}$$

A contribution schedule is feasible if it is not negative or greater than the aggregate income of a special interest group. Condition *(a)* states that the national government taxes capital in order to maximize its own objective, taking as given the contribution schedules and the capital tax rate of the other jurisdiction. Condition *(b)* stipulates that no special interest group can improve the net welfare of its members by offering an alternative contribution schedule that induces the domestic government to change its capital tax rate. If this were the case, a lobby can always offer a new contribution schedule in a way that the government changes the policy in the group's favor. Consequently, the lobby can extract rents up to the point where the government remains just indifferent to the initial tax policy. Consequently, the lobby catches all of the potential surplus that is generated by the induced policy change. Of course, it cannot be an equilibrium if such an opportunity exists for any special interest group. Following this, we know from Grossman and Helpman (1994, 1995) and Bernehim and Whinston (1986a) that the equilibrium capital tax rate has to maximize the joint welfare of each special interest group and the government. That is

$$\widetilde{t}^i \;=\; \arg\max_{t^i} \quad \theta_g^i W_g^i(t^i, \widetilde{t}^j) - \widetilde{\varsigma}_g^i(t^i) + \alpha^i W^i(t^i, \widetilde{t}^j) + \sum_g \widetilde{\varsigma}_g^i(t^i). \tag{1.19}$$

The first-order condition to (1.19) is given by

$$\theta_g^i \frac{\partial W_g^i(t^i, \widetilde{t}^j)}{\partial t^i} - \frac{\partial \widetilde{\varsigma}_g^i(t^i)}{\partial t^i} + \alpha^i \frac{\partial W^i(t^i, \widetilde{t}^j)}{\partial t^i} + \sum_g \frac{\partial \widetilde{\varsigma}_g^i(t^i)}{\partial t^i} = 0. \tag{1.20}$$

In addition, the first-order condition according to equation (1.16) reads

$$\alpha^i \frac{\partial W^i(t^i, \widetilde{t}^j)}{\partial t^i} + \sum_g \frac{\partial \widetilde{\varsigma}_g^i(t^i)}{\partial t^i} = 0. \tag{1.21}$$

That is, each government chooses its capital tax rate in order to equate the marginal welfare gain to the sum of marginal contributions received. Of course, the first-order conditions (1.20) and (1.21) have to be fulfilled simultaneously in equilibrium. Inserting equation (1.21) into (1.20) gives

$$\frac{\partial \widetilde{\varsigma}_g^{\,i}}{\partial t^{\,i}} = \theta_g^{\,i} \, \frac{\partial W_g^{\,i}(t^{\,i}, \widetilde{t}^{\,j})}{\partial t^{\,i}}. \tag{1.22}$$

Equation (1.22) states that the offered contribution schedules are set in a way that the marginal change in the contribution matches the effect of its impact on the gross welfare of the lobby's members. Or, stated in the words of Dixit et al. (1997, p. 759.),"the shape of the payment schedules mirror the shape of the principal's indifference surface". Noting equations (1.2) and (1.15), the equilibrium capital tax rate can be characterized by substituting equation (1.22) into (1.21). This gives

$$\sum_g \left[\alpha^{\,i} + \theta_g^{\,i}\right] \frac{\partial W_g^{\,i}(t^{\,i}, \widetilde{t}^{\,j})}{\partial t^{\,i}} = 0. \tag{1.23}$$

Condition (1.23) shows that each residential group receives a higher welfare weight in the maximization of the government. The more residents are organized in a special interest group, the higher the weight.

1.4 Capital Taxation and Political Influence

1.4.1 Efficiency and Lobbying in the Closed Economy

Before we analyze how competition between jurisdictions affects the incentives for special interest groups to influence political decisions, we briefly investigate the situation in a closed economy as a benchmark. Since in that case capital is completely immobile, the budget constraint of country i's government reads $y^{\,i} = t^{\,i}\,\overline{K}^{\,i}$. For given contribution schedules, the equilibrium capital tax rate can then be calculated by inserting equation (1.22) into (1.21). Taking the derivatives of (1.2) and (1.15), noting (1.1), $dr_A^i/dt^i = -1$ and $dw^{\,i}/dt^{\,i} = 0$, we get the first-order condition in jurisdiction i as

$$\frac{\alpha^{\,i} + \theta_C^{\,i}}{\beta^{\,i}} \, n^{\,i} = n^{\,i}\, V'(y^{\,i}), \tag{1.24}$$

where $\beta^i = \alpha^i n^i + \theta_L^i n_L^i + \theta_C^i n_C^i$ denotes the policy-influenced weight of all inhabitants of country i. Equation (1.24) shows that each government chooses its capital tax rate according to a modified Samuelson-condition, where the marginal costs of public funds are affected by political influence of the domestic lobbies. Of course, since $dr_A^i/dt^i = -1$ in the closed economy, only the impact on the private income of the capital owners receives a larger weight due to political organization. Using implicit differentiation of (1.24), we find the impact of a change in political organization of the lobbies on a country's equilibrium capital tax policy as

$$\frac{dt^i}{d\theta_L^i} = -\frac{n_L^i V'(y^i)}{\beta^i V''(y^i)\overline{K}^i} = -\frac{n_L^i \phi_C^i}{\beta^i V''(y^i)\overline{K}^i} > 0, \tag{1.25}$$

$$\frac{dt^i}{d\theta_C^i} = \frac{1 - n_C^i V'(y^i)}{\beta^i V''(y^i)\overline{K}^i} = \frac{n_L^i \phi_L^i}{\beta^i V''(y^i)\overline{K}^i} < 0. \tag{1.26}$$

In equations (1.25) and (1.26), we introduced $\phi_g^i = (\alpha^i + \theta_g^i)/\beta^i$ which describes the relative weight of a resident of lobby group g in the objective function of the government in jurisdiction i.[13] According to equation (1.25), a higher degree of political organization of the labor owners leads to an increase of the capital tax rate in equilibrium. In contrast, the capital tax rate in equilibrium will be reduced if the share of politically organized capital owners increases. This is because each government cares about the gain from the provision of the public good for all residents. Since in autarky the burden of the capital tax is entirely borne by the capital owners, this of course implies that the costs for the provision of the public good are too high from the capital owner's point of view. However, except for political influence, there are no other distortions or externalities at work in the closed economy. Consequently, the efficient provision of the public good can simply be found by substituting $\theta_L^i = \theta_C^i = 0$ into equation (1.24). This gives

$$1 = n^i V'(y^i). \tag{1.27}$$

Substituting (1.27) into (1.24), it is straightforward to show that the local public good will be provided inefficiently if $\theta_C^i \neq \theta_L^i$. Of course, the only incentive for the government to deviate from an efficient provision in a closed economy comes from political influence. In accordance with (1.25) and (1.26), the provision of the public good will be inefficiently low if the organizational degree of the capital owners is higher than the po-

[13] The terms on the right hand side of the last equality sign in (1.25) and (1.26) follow from using (1.24) and $\phi_g^i n_g^i = 1 - \phi_h^i n_h^i$.

litical organization of the labor owners and vice versa. In addition, the provision of the public good will be the same as in the case of an open economy if the two jurisdictions maximize the joint welfare of its residents, without political influence. This cooperative solution is determined in our model by $t^i = \arg\max \alpha^i W^i(t^i, t^j) + \alpha^j W^j(t^i, t^j)$. Noting equations (1.8)-(1.12) and that the jurisdictions are identical, the first-order condition of this maximization problem gives (1.27) as well. Summarizing with respect to the policy-influencing environment, we can establish:

Proposition 1.1
In a closed economy...

(a) a higher degree of political organization of the labor owners leads to a higher capital tax rate in equilibrium.

(b) a higher degree of political organization of the capital owners leads to a lower capital tax rate in equilibrium.

(c) the provision of the local public good will be efficient (inefficiently low, inefficiently high) if $\theta_L^i = \theta_C^i$ ($\theta_L^i < \theta_C^i$, $\theta_L^i > \theta_C^i$).

(d) the provision of the local public good coincides with the cooperative solution in case of an open economy if $\theta_L^i = \theta_C^i = 0$.

1.4.2 Efficiency and Lobbying in the Open Economy

When setting up its capital tax policy, each governments take as given the contribution schedules and the behavior of the firm. In case of integrated capital markets, a characterization of the country's capital tax policy can be found by substituting (1.22) into (1.21). Taking the derivatives of (1.2) and (1.15) and noting (1.1), we get for the first-order condition of country i's government

$$\begin{aligned} \Psi^i(t^i, t^j) &:= (\alpha^i + \theta_L^i)\frac{dw^i}{dt^i}\overline{L}^i + (\alpha^i + \theta_C^i)\frac{dr}{dt^i}\overline{K}^i + \beta^i V'(y^i)(K^i + t^i\frac{dK^i}{dt^i}) = 0 \\ \Leftrightarrow \qquad & \frac{(\alpha^i + \theta_L^i)\frac{dw^i}{dt^i}\overline{L}^i + (\alpha^i + \theta_C^i)\frac{dr}{dt^i}\overline{K}^i}{\beta^i\,(K^i + t^i\frac{dK^i}{dt^i})}\, n^i = n^i\, V'(y^i). \end{aligned} \tag{1.28}$$

As shown by (1.28), the mobility of capital in the open economy implies that the marginal costs of public funds differ from autarky in two respects. First, the labor

owners bear part of the tax in equilibrium. Consequently, the impact of the tax on their private income receives a higher weight due to political influence as well. Second, as usual in models of capital tax competition, an increase in the tax revenue is partly offset by a distortion of the firm's investment decision.

In order to get further insights in the properties of the equilibrium tax policies and contributions in the next sections, we follow most previous studies in concentrating on a symmetric Nash equilibrium with identical capital tax rates, i.e. $t^i = t^j =: t$. This occurs for an equal distribution of the countries' residents, $n_g^i = n_g^j =: n_g$ and $n^i = n^j =: n$, as well as equal endowments with capital and labor, i.e. $\overline{k}^i = \overline{k}^j =: \overline{k}$ and $\bar{l}^i = \bar{l}^j =: \bar{l}$ respectively. Furthermore, the organizational degrees of lobby formation, the relative social welfare weights and the firms' production technology have to be the same, i.e. $\theta_g^i = \theta_g^j =: \theta_g$, $\alpha^i = \alpha^j =: \alpha$ and $F^i(K,L) = F^j(K,L) =: F(K,L)$. Accordingly, it is clear from (1.4)-(1.7) that $K^i = K^j =: K = \overline{K}$. Evaluating equation (1.28) at the symmetric equilibrium, we get [14]

$$\frac{\phi_L + \phi_C}{2(1-\epsilon)}\, n = n\, V'(y), \tag{1.29}$$

with $\epsilon = -\frac{dK}{dt}\frac{t}{K}$. Equation (1.29) shows that the public good will be provided until its marginal gain outweighs the private income loss of the sum of all politically organized residents. In general, this implies a political distortion. However, since we consider jurisdictions with an integrated capital market, now an additional distortion occurs. As well-known in the literature on capital tax competition, the more elastic invested capital reacts on a country's tax policy, as represented by $1 > \epsilon > 0$, the higher the marginal gain of the last unit of the public good will be. Consequently, the tax rate in the symmetric equilibrium will be lower even if it is not affected by lobbying at all.[15]

Conducting a comparative static analysis, we are now able to investigate how a change in the political environment influences the tax policy of an open economy. The results of this analysis are derived in Appendix C and given by

$$\frac{dt}{d\theta_L} = -\frac{n_L}{D}\left[\frac{dw^i}{dt^i}\,\bar{l} + V'(y)(K + t\frac{dK^i}{dt^i})\right] = -\phi_C\,\frac{\overline{K}}{2D}(n_L - n_C), \tag{1.30}$$

$$\frac{dt}{d\theta_C} = -\frac{n_C}{D}\left[\frac{dr}{dt^i}\,\overline{k} + V'(y)(K + t\frac{dK^i}{dt^i})\right] = -\phi_L\,\frac{\overline{K}}{2D}(n_C - n_L), \tag{1.31}$$

[14] The derivation is given in Appendix B.

[15] Note that the equilibrium capital tax rate without lobbying is characterized by $\alpha/(1-\epsilon) = n\,V'(y)$.

with $D < 0$. Equation (1.30) and (1.31) show that the situation in an open economy differs substantionally from the case of a closed economy, as already discussed in Section 1.4.1. This is because the immobile production factor now at least partially bears the burden of the tax on the mobile factor. Hence, each lobby faces a trade-off with respect to the group members' optimal public good provision. The terms on the right hand side of the first equality sign of (1.30) and (1.31) then show that an increasing political organization of lobby g will not affect the equilibrium tax policy if it was already chosen optimally from the special interest groups' point of view. More precisely, the terms in brackets will be zero if the group members' marginal loss in private income matches their gain from the increased supply of the public good. This is a group-specific Samuelson-condition in the provision of the public good. However, in the case of a constant returns to scale production technology, the marginal loss in private income will be the same for the owners of the production factors in the symmetric equilibrium, that is $dw^i/dt^i\, n_L\, \overline{l} = dr/dt^i\, n_C\, \overline{k}$.[16] Hence, the lobbies' desired direction for influence depends on their members' additional gain from the public good provision. However, the government is concerned about all (politically organized) residents within its jurisdiction. For the larger residential group, this implies that more individuals gain from the provision of the public good. Consequently, they will lobby for a higher capital tax rate in equilibrium. For the smaller residential group it will be the other way round. Note that this is true for any given $1 > \epsilon > 0$ and, since all residents will be considered by the governments due to welfare considerations ($\alpha > 0$), even if the political opponent of lobby g does not influence policy.

In order to investigate the efficiency implications of lobbying in the open economy, we first isolate the economic distortion due to non-cooperative governmental behavior, and afterwards compare this to the impact of political influence. This can be done by setting θ_g^i equal to zero. In this case, each government is only concerned about its domestic welfare and does not take into account the impact of its tax rate on the other jurisdiction. It is well-known that the efficiency properties of the equilibrium tax rates can then be analyzed by investigating the fiscal externalities that describe the deviation from the cooperative tax policy. Noting equation (1.15), in the symmetric equilibrium this is described by

$$\alpha \frac{\partial W^j}{\partial t^i} = \alpha \sum_g \frac{\partial W_g^j}{\partial t^i} = \alpha \left[\frac{dw^j}{dt^i} \overline{L} + \frac{dr}{dt^i} \overline{K} + n\, V'(y) (\widetilde{t} \frac{dK^j}{dt^i}) \right]. \tag{1.32}$$

[16] For a constant returns to scale production function, the Euler equation implies $F_{LK}^i L^i = -F_{KK}^i K^i$. Dividing by $F_{KK}^i + F_{KK}^j$ and using (1.8) and (1.11) yields the statement for the symmetric equilibrium.

In accordance with the comparative static results in (1.8)-(1.12), equation (1.32) shows that the fiscal externality can be divided into three parts: a positive income externality on the labor owners, a negative income externality on the capital owners and a positive externality on the provision of the public good. However, in the case of a constant returns to scale production technology, we know that the marginal impact of capital taxation on the factor owners' private income will be of the same magnitude in equilibrium. Noting equations (1.8)-(1.12), the two income externalities thus cancel out for the symmetric equilibrium. Consequently, each government neglects a positive impact on the other jurisdiction's tax base and tax rates will be set inefficiently low in the non-cooperative equilibrium. The efficiency implications of political influence in an open economy can then be investigated by comparing the fiscal externality in (1.32) to the impact of political influence on the equilibrium capital tax rates in an open economy, as described by $\sum_g \theta_g^i \partial W_g^i(t^i, t^j)/\partial t^i$.[17] Using equation (1.28), this yields for the symmetric equilibrium

$$\underbrace{\frac{(\theta_g - \theta_h)(n_g - n_h)}{2\,\beta}}_{:=\epsilon_E} \gtreqless \epsilon. \tag{1.33}$$

According to condition (1.33), in an open economy the provision of the public good will be efficient if $\epsilon_E = \epsilon$. That is, it will be efficient if the downward pressure on the capital tax rate in equilibrium due to an outflow of capital is neutralized by the structure of political influence. Since $1 > \epsilon > 0$, this is possible if $\theta_g > \theta_h$ and $n_g > n_h$. In this case, the overall political distortion is positive because the larger residential group has the higher degree of political organization as well. As a result, the capital tax rate will increase in the non-cooperative equilibrium. This implies that lobbying mitigates the downward pressure due to tax competition in case of $0 < \epsilon_E < \epsilon$, whereas political influence leads to inefficiently high capital tax rates in the symmetric equilibrium if $0 < \epsilon < \epsilon_E$. In contrast, if $\theta_g > \theta_h$ and $n_g < n_h$, the overall political distortion is negative because the smaller residential group has the higher degree of political organization. Since the smaller group lobbies for a lower equilibrium tax rate, political influence aggravates the downward pressure due to tax competition in that case. Finally, we note that lobbying does not affect capital tax rates if $\theta_g = \theta_h$ or $n_g = n_h$. In the first case, political influence increases the weight of each residential group in the governments maximization by the same amount, so that the relative welfare weight of both lobbies is still of equal size. In the second case, each special

[17] Alternatively, this can be investigated by inserting (1.27) into (1.29).

interest group represents the same number of domestic residents. This implies that in addition to the identical marginal impact on private income, the marginal gain of the public good distributes equally among the lobbies as well. Summarizing the results with respect to a country's political environment, we stipulate:

Proposition 1.2
In a open economy...

(a) a higher organizational degree of special interest group $g \in \{L, C\}$ leads to a higher (lower) capital tax rate in the symmetric equilibrium if the lobby represents the larger (smaller) residential group.

(b) if $\theta_g > \theta_h$ and $n_g > n_h$, political influence increases the equilibrium capital tax rate. The provision of the public good will be efficient (inefficiently low, inefficiently high) if $0 < \epsilon_E = \epsilon$ ($0 < \epsilon_E < \epsilon$, $0 < \epsilon < \epsilon_E$).

(c) if $\theta_g > \theta_h$ and $n_g < n_h$, political influence reduces the equilibrium capital tax rate. Consequently, this aggravates the inefficient underprovision of the public good due to tax competition.

(d) if $\theta_g = \theta_h$ or $n_g = n_h$, political influence does not affect the equilibrium capital tax rate. Consequently, tax rates will be inefficiently low due to tax competition.

1.4.3 Capital Market Integration and Political Influence

So far, we have analyzed how political influence affects capital taxation in a closed and open economy. However, condition *(b)* in Proposition 1.2 shows that the desired direction for political influence can change if capital markets integrate. This is because the immobile production factor has to bear part of the income loss caused by capital taxation in the open economy. Consequently, when compared with the situation in the closed economy, the incentive for the owners of mobile capital to lobby for less taxation will be reduced. This was recently shown by Lai (2010) for the case of more than two countries. However, for the same reason, in our model, the incentive for the labor owners to lobby for a higher tax rate will be reduced as well. Accordingly, capital market integration can increase or decrease the equilibrium tax rate under political influence. This depends on the extent of the distortion due to tax competition and the relative political strength of the lobbies and can be seen when we substitute (1.24) into

(1.29). This gives

$$\underbrace{\frac{\theta_C - \theta_L}{2\,(\alpha + \theta_C)}}_{:=\epsilon_A} \gtreqless \epsilon. \tag{1.34}$$

According to condition (1.34), the provision of the public good will only be the same as in autarky if $\epsilon_A = \epsilon$. In this case, the downward pressure on equilibrium tax rates due to tax competition exactly outweighs the impact of the mobile tax base on the lobbying incentives for the special interest groups. Since $1 > \epsilon > 0$, this is possible for $\theta_C > \theta_L$, from which we know from Proposition 1.1 that the equilibrium capital tax rates are set inefficiently low in the closed economy. However, in that case, the impact on the lobbying incentives for the capital owners receives more attention in the government's objective than the consequences for the labor owners' special interest group. Compared with the closed economy, this implies an increase in the equilibrium capital tax rate. Consequently, capital market integration reduces the provision of the public good if $0 < \epsilon_A < \epsilon$. In contrast, the supply of the public good will increase if $0 < \epsilon < \epsilon_A$. However, tax competition implies that the provision of the public good will always be lower in the open economy if $\theta_C < (=)\,\theta_L$, where the capital tax rates are set inefficiently high (efficient) in the closed economy. In summary:

Proposition 1.3
In comparison with the closed economy...

(a) for $\theta_C > \theta_L$, capital market integration reduces (increases) the equilibrium capital tax rate if $0 < \epsilon_A < \epsilon$ ($0 < \epsilon < \epsilon_A$).

(b) for $\theta_C \lesseqgtr \theta_L$, capital market integration reduces the equilibrium capital tax rate.

Given the results of our Propositions 1.1 to 1.3, we now discuss the efficiency implications of capital tax competition under different scenarios of political influence. Suppose that the domestic labor owners are the larger residential group that has a higher degree of political organization as well, that is $\theta_L > \theta_C$ and $n_L > n_C$. In this case, the provision of the public good will be inefficiently high in autarky. Consequently, capital market integration unambiguously reduces the equilibrium tax rate and leads to an efficient (inefficiently low, inefficiently high) provision of the public good if $0 < \epsilon_E = \epsilon$ ($0 < \epsilon_E < \epsilon$, $0 < \epsilon < \epsilon_E$). The results in this scenario mirror the conclusions of the analyses for welfare-enhancing implications of tax competition by Edwards and Keen (1996) and Eggert and Sørensen (2008), but for a different reason. In Edwards and

Keen (1996), a selfish government directs part of the tax revenue to its own purpose. Since this is regarded as pure waste, tax competition leads to a reduction in waste and the provision of the public good at the same time. Consequently, tax competition will be beneficial as long as the first effect dominates, as this enhances the efficiency of the public sector. Eggert and Sørensen (2008) apply this idea to a setting where the inefficiency in the public sector is endogenous. In their model, only workers that are employed in the public sector are politically organized. Consequently, a politician has an incentive to increase rents to the public sector in order to become comparably more attractive in election. Tax competition limits this tendency since capital taxation for higher public sector wages reduces the private consumption of politically unorganized but voting residents comparably more in an open economy. In contrast to their analyses, the inefficiently large public sector in autarky is in our model endogenously caused by the direct influence of organized workers in the private sector. Nevertheless, common in all analyses is that if capital is sufficiently elastic, the downward pressure due to tax competition dominates at some point.

Now consider the scenario where the domestic capital owners are the residential group that has a higher degree of political organization, that is $\theta_C > \theta_L$ and $n_C > n_L$. In autarky, the provision of the public good will then be inefficiently low and we have $0 < \epsilon_A$. In combination with condition *(b)* of Proposition 1.2, it follows that capital market integration increases the equilibrium tax rate if $0 < \epsilon_E < \epsilon < \epsilon_A$ or $0 < \epsilon < \epsilon_E < \epsilon_A$.[18] However, the equilibrium provision of the public good will still be inefficiently low in the first case. In the second case, the impact on lobbying incentives outweighs the downward pressure due to the mobility of the tax base. Consequently, this leads to an inefficiently high provision of the public good in the open economy. Nevertheless, if $0 < \epsilon_E < \epsilon_A < \epsilon$, capital market integration unambiguously aggravates the inefficiency due to the higher political organization of the capital owners in autarky. The results in this scenario correspond to the conclusions of the recent analysis for welfare-improving lobbying by capital owners of Lai (2010).[19] He considers a model with many small open economies, where the incentive of domestic capital owners to lobby for lower capital tax rates is directly related to the market share of the country. The smaller this share, the more of the tax burden will be shifted to the immobile production factor. This reduces the capitalists' incentive to lobby for lower capital tax rates. In contrast to the conclusions of Hoyt (1991), he shows that intensified capital tax competition can actually mitigate the underprovision of public goods in that case.

[18] Using (1.33) and (1.34), it is straightforward to show that $\epsilon_A \gtreqless \epsilon_E \Leftrightarrow \theta_C \gtreqless \theta_L$.

[19] See Proposition 2 in Lai (2010).

However, if special interest groups organize according to Olson's (1965) argument, condition *(c)* of Proposition 1.2 applies. Consequently, political influence reduces the equilibrium capital tax rate and aggravates the inefficient underprovision due to tax competition. The reason is that the lobbies' incentive for political influence depends crucially on the number of represented individuals in the open economy. If the smaller residential group has a higher degree of political organization, the relative welfare weight in the government's objective shifts under political influence in the smaller group's favor. As a consequence, the overall distortion that is caused by political influence always pushes the capital tax rate in the same direction as the impact due to the mobility of the tax base. This aggravates the inefficiency due to tax competition. Nevertheless, note that there exists one case where the equilibrium capital tax rate in the open economy can be closer to the efficient level. If $\theta_C > \theta_L$ and $n_C < n_L$ it is possible that $\epsilon_E < 0 < \epsilon < \epsilon_A$. In this case, the provision of the public good in the open and the closed economy is always inefficiently low. However, due to political influence of the domestic capital owners, in autarky it is even below the level that will be provided when the capital markets are integrated.

So far, we have analyzed the structure and outcome of the political interaction between governments and lobby groups in terms of the equilibrium tax policy. However, the mobility of capital causes a fiscal externality on the other jurisdiction that will be affected by lobbying as well. This is what we investigate in the next section with respect to the impact of the mobility of the tax base on the equilibrium contributions and hence the distribution of rents between the lobbies and the governments.

1.5 Contributions in the Political Equilibrium

With respect to the distribution of rents in the political equilibrium, Grossman and Helpman (1994) suggest that the lobbies' contributions are determined by the excess of the special interest group's welfare over a fixed level B_g^i, the rent from the political interaction. In our model, this can be written as

$$\varsigma_C^i(\widetilde{t}^i, B_g^i) \;=\; \max\left[0, \theta_g^i\, W_g^i(\widetilde{t}^i, \widetilde{t}^j) - B_g^i\right]. \tag{1.35}$$

According to equation (1.35), each lobby seeks to increase B_g^i to its maximum. However, each special interest group can extract rents only up to the point where the government is just indifferent to neglecting political influence from the lobby at all.

This can be expressed as

$$\alpha^i W^i(\widetilde{t}^i, \widetilde{t}^j) + \sum_g \varsigma_g^i(\widetilde{t}^i, \widetilde{B}_g^i) = \alpha^i W^i(\widetilde{t}_{-g}^i, \widetilde{t}^j) + \varsigma_h^i(\widetilde{t}_{-g}^i, \widetilde{B}_h^i). \tag{1.36}$$

In condition (1.36), $\widetilde{B}_g^i$ denotes the rent of special interest group g in equilibrium and we introduced $\widetilde{t}_{-g}^i$ as determined by

$$\widetilde{t}_{-g}^i \quad = \quad \arg\max_{t^i} \quad \alpha^i W^i(t^i, \widetilde{t}^j) + \widetilde{\varsigma}_h^i(t^i), \tag{1.37}$$

for $g, h \in \{L, C\}$ and $g \neq h$. Assuming positive equilibrium contributions, we use equation (1.35) to rewrite (1.36) as

$$\widetilde{\varsigma}_g^i(\widetilde{t}^i, \widetilde{B}_g^i) = \alpha^i \left[W^i(\widetilde{t}_{-g}^i, \widetilde{t}^j) - W^i(\widetilde{t}^i, \widetilde{t}^j)\right] + \theta_h^i \left[W_h^i(\widetilde{t}_{-g}^i, \widetilde{t}^j) - W_h^i(\widetilde{t}^i, \widetilde{t}^j)\right]. \tag{1.38}$$

Taking the offered schedules of the other politically organized residents as given, equation (1.38) shows that each lobby g has to compensate its government for what it can achieve together with group h in the non-cooperative equilibrium, where g does not influence the policy.

1.5.1 The Closed Economy

We know from our results in Section 1.4.1 that the public good will be efficiently provided if there are no active lobby groups in autarky. However, since the lobbies act non-cooperatively, each special interest group takes the interaction of the domestic government with the other lobby as given. Following this, we investigate how lobbying affects the equilibrium contributions by calculating the impact of a small increase in lobby g's degree of political organization. Differentiating equation (1.38) with respect to θ_g^i, we derive in Appendix D

$$\frac{d\,\widetilde{\varsigma}_g^i}{d\,\theta_g^i} = \theta_g^i \frac{\partial W_g^i(\widetilde{t}^i)}{\partial t^i} \frac{d\,t^i}{d\theta_g^i}. \tag{1.39}$$

According to equation (1.39), the impact of an increase in political organization of lobby g on the equilibrium contribution to the government matches the effect of the induced policy change on the lobby members' gross welfare. Or stated in other words, in autarky the gain in gross welfare matches the cost for a small change in capital taxation into the group's desired direction.

1.5.2 The Open Economy

When we consider countries with an integrated capital market, we know from our results in Section 1.4.2, that the mobility of the tax base affects the equilibrium capital tax policy even if there is no lobbying of interest groups. In order to investigate how the equilibrium contributions are affected by political influence in the open economy, we calculate in Appendix D the impact of a symmetrical increase in lobby g's degree of political organization in both jurisdictions. The result is

$$\begin{aligned}\frac{d\widetilde{\varsigma}_g^i}{d\theta_g} = \theta_g^i \frac{\partial W_g^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^i}\frac{dt^i}{d\theta_g} + \alpha^i\left[\frac{\partial W^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j}\right]\frac{dt^j}{d\theta_g} \\ + \theta_h^i\left[\frac{\partial W_h^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W_h^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j}\right]\frac{dt^j}{d\theta_g},\end{aligned} \tag{1.40}$$

where we recall from equation (1.15) that $W^i(t^i,t^j) = \sum_g W_g^i(t^i,t^j)$ and, noting (1.1) and (1.2), with

$$\begin{aligned}\frac{\partial W_L^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W_L^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j} = \left[\frac{dw^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{dt^j} - \frac{dw^i(\widetilde{t}^i,\widetilde{t}^j)}{dt^j}\right]\overline{L}^i \\ + n_L^i\left[V'(\widetilde{y}^i_{-g})\,\widetilde{t}^i_{-g}\frac{dK^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{dt^j} - V'(\widetilde{y}^i)\,\widetilde{t}^i\frac{dK^i(\widetilde{t}^i,\widetilde{t}^j)}{dt^j}\right],\end{aligned} \tag{1.41}$$

$$\begin{aligned}\frac{\partial W_C^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W_C^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j} = \left[\frac{dr(\widetilde{t}^i_{-g},\widetilde{t}^j)}{dt^j} - \frac{dr(\widetilde{t}^i,\widetilde{t}^j)}{dt^j}\right]\overline{K}^i \\ + n_C^i\left[V'(\widetilde{y}^i_{-g})\,\widetilde{t}^i_{-g}\frac{dK^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{dt^j} - V'(\widetilde{y}^i)\,\widetilde{t}^i\frac{dK^i(\widetilde{t}^i,\widetilde{t}^j)}{dt^j}\right].\end{aligned} \tag{1.42}$$

With respect to the impact on the equilibrium contributions to the government, the first term on the right hand side of equation (1.40) shows that the effect of an increase in political organization is directly related to its impact on the residing lobby groups' gross welfare. However, the capital tax rate in the other jurisdiction is affected by political influence of its residential group g at the same time, which constitutes a lobbying-induced fiscal externality on country i. Since governments are free to neglect political influence at all, this implies that lobby g has to compensate for what its government can achieve solely together with the other lobby. As represented by the

two square brackets in (1.40), this also applies to the difference in the lobbying-induced fiscal externality that can be related to political influence of residential group g in country i.[20] Consequently, the equilibrium contributions and hence the distribution of rents are affected. The expressions in (1.41) and (1.42) then show that this effect can be decomposed into the difference in the marginal impacts of an increase in t^j with respect to the private income as well as the provision of the public good in country i, as represented by the first and second square brackets respectively.

Suppose that g is the larger residential group that lobbies for a higher tax rate and that dw^i/dt^j or dr/dt^j are monotonically increasing in t^i. In this case, we have $dw^i(\widetilde{t}^i_{-g}, \widetilde{t}^j)/dt^j < dw^i(\widetilde{t}^i, \widetilde{t}^j)/dt^j$ and $dr(\widetilde{t}^i_{-g}, \widetilde{t}^j)/dt^j < dr(\widetilde{t}^i, \widetilde{t}^j)/dt^j$. In this case the income externalities on country i that are caused by an increase in t^j will be lower when g does not influence policy. Since $dw^i/dt^j > 0$ and $dr/dt^j < 0$, this implies for the externality on wage income that it will be more positive and for the externality on capital income that it will be less negative when g lobbies the government. All other things being equal, this reduces the equilibrium contributions of lobby g with respect to the difference in the marginal impacts of an increase in t^j on wage or capital income, as represented by the first terms on the right hand side of (1.41) and (1.42). If g is the smaller residential group that lobbies for less capital taxation, we have $dw^i(\widetilde{t}^i_{-g}, \widetilde{t}^j)/dt^j > dw^i(\widetilde{t}^i, \widetilde{t}^j)/dt^j$ and $dr(\widetilde{t}^i_{-g}, \widetilde{t}^j)/dt^j > dr(\widetilde{t}^i, \widetilde{t}^j)/dt^j$ respectively. In this case, the income externalities on country i that are caused by an increase in t^j will be higher when g does not influence policy. This implies for the wage income that an increase in t^j causes a less positive income externality and for the capital income an even more negative income externality when g lobbies the government. However, since the smaller residential group lobbies for a reduction in tax rates, this reduces the equilibrium contributions of g with respect to the difference in the marginal impacts of an increase in t^j on wage or capital income as well. Of course, it will be the other way round if dw^i/dt^j or dr/dt^j are monotonically decreasing in t^i.

With respect to the marginal effect of an increase in t^j on the provision of the public good in jurisdiction i, political influence of the larger group g leads to a positive tax base externality. If $V'(\widetilde{y}^i_{-g})\,\widetilde{t}^i_{-g} dK^i(\widetilde{t}^i_{-g}, \widetilde{t}^j)/dt^j > V'(\widetilde{y}^i)\,\widetilde{t}^i dK^i(\widetilde{t}^i, \widetilde{t}^j)/dt^j$, the additional units of the public good in jurisdiction i are valued more in the situation where g does not influence policy. Consequently, lobbying of g constitutes a negative impact on the government that has to be compensated, since otherwise the government in i might completely neglect g's political offers. All other things being equal, this increases

[20] Evidence for the impact of lobbying on externalities can be found in Guriev et al. (2010).

g's equilibrium contributions. However, if g is the smaller residential group, political influence leads to a lobbying-induced negative tax base externality. Since this will be valued more in the situation where g is not politically active as well, lobbying into the direction of lower capital tax rates constitutes a positive impact on the government. In that case, lobby g can reduce its equilibrium contributions to the government. In contrast, if $V'(\widetilde{y}^i_{-g})\,\widetilde{t}^i_{-g}dK^i(\widetilde{t}^i_{-g},\widetilde{t}^j)/dt^j < V'(\widetilde{y}^i)\,\widetilde{t}^i dK^i(\widetilde{t}^i,\widetilde{t}^j)/dt^j$, the change in the tax base will be valued more in the situation where g is politically active as well. Consequently, lobby g can reduce its equilibrium payments to the government if it is the larger group and it has to increase its contributions if it is the smaller group.

To sum up, in the open economy a divergence occurs in the benefits and costs from lobbying which is related to the implications of the fiscal externality that is related to political influence. Since the implications of this lobbying-induced externality are ambiguous, it may increase or decrease the equilibrium contributions of the lobby groups. Accordingly, it will enhance or reduce the resident's net-welfare from political influence. This is a substantial difference from the welfare-enhancing impact of intensified tax competition in Lorz (1998). In his model, special interest groups with a different endowment of capital lobby for redistributive capital taxation, where the payments of lobbying are treated as pure waste. He shows that if the capital endowments are symmetrically distributed, political influence of lobby groups exactly offsets each other in autarky as well as in the case of an open economy. Accordingly, no political distortion of the equilibrium tax policy occurs in his model. However, tax competition limits the scope for redistributive capital taxation, which consequently dampens the incentives for political influence. Hence, inefficiency in equilibrium capital tax policy is neglected in his study, but essential in our model with respect to the ambiguous implications for domestic residents.

1.6 Conclusion

We have analyzed the impact of lobbying on behalf of organized capital and labor owners on capital taxation in a closed and open economy. The results regarding the political organization of the lobby groups are different in the two scenarios. Whereas the special interest group of the mobile production factor always influences in the direction of lower tax rates in autarky, this remains only true in the case of an open economy if the lobby represents the smaller residential group. The reason is that in the case of integrated capital markets, the tax burden is partially shifted to the owners

of the immobile production factor. Hence, capital market integration can reverse the desired direction of political influence by lobby groups. However, the mobility of the tax base distorts the equilibrium tax policy in an open economy into the direction of inefficiently low tax rates. In addition, the extent of political influence is affected at the same time. In comparison with autarky, we find that capital market integration under political influence can lead to a higher or lower equilibrium provision of the public good. In that respect, the relation of political organization and the share of represented residents of the lobby groups turn out to be the key determinants. More precisely, if the larger residential group has also a higher share of politically organized residents, our results are in line with the conclusions of important studies to the welfare-enhancing implications of tax competition. In contrast, if we presume that special interest groups organize themselves according to Olson's (1965) logic of collective action, tax competition and political influence are in line and distort capital taxation in the direction of inefficiently low tax rates.

Nevertheless, each special interest group lobbies for a change in the capital tax rate in order to increase its members' welfare. However, in an open economy this leads to a fiscal externality on the other jurisdiction that can be related to the lobbies political influence. This affects the equilibrium contributions of each special interest group to the government as soon as the tax base is mobile. Accordingly, a divergence exists in the benefits and costs from political influence that crucially depends on the outcome of the political interaction in the other jurisdiction. Therefore, our results indicate an important connection of taxation and political influence in the case of a mobile tax base, since its welfare implications change substantially in comparison with a closed economy.

Appendix

A Comparative statics of the firms' investment decision and factor costs in equilibrium

Substituting the firms factor demand from (1.4) and (1.5) into (1.6) and (1.7) implies an adjustment of the market interest rate in reaction to capital taxation of both jurisdictions in order to ensure a capital market equilibrium, that is $r(t^i, t^j)$. Noting this when differentiating (1.4) and (1.5) with respect to K^i,w^i, t^i and t^j yields

$$\begin{bmatrix} F^i_{KK} & 0 \\ F^i_{LK} & -1 \end{bmatrix} \begin{bmatrix} dK^i \\ dw^i \end{bmatrix} = \begin{bmatrix} \frac{dr}{dt^i} + 1 & \frac{dr}{dt^j} \\ 0 & 0 \end{bmatrix} \begin{bmatrix} dt^i \\ dt^j \end{bmatrix}, \tag{1.A.1}$$

for $i, j \in \{a, b\}$ and $i \neq j$. Given this matrix equation, using Cramer's rule we find

$$\frac{dK^i}{dt^i} = \frac{\frac{dr}{dt^i} + 1}{F^i_{KK}} \quad ; \quad \frac{dK^i}{dt^j} = \frac{\frac{dr}{dt^j}}{F^i_{KK}}, \tag{1.A.2}$$

$$\frac{dw^i}{dt^i} = \frac{(\frac{dr}{dt^i} + 1)F^i_{LK}}{F^i_{KK}} \quad ; \quad \frac{dw^i}{dt^j} = \frac{\frac{dr}{dt^j}F^i_{LK}}{F^i_{KK}}. \tag{1.A.3}$$

Noting this when differentiating (1.6) with respect to t^i, we get

$$\frac{dK^i}{dt^i}\, dt^i + \frac{dK^j}{dt^i}\, dt^i = 0. \tag{1.A.4}$$

Substituting (1.A.2) in (1.A.4) gives (1.8). Inserting (1.8) into (1.A.2) and (1.A.3) yields (1.9)-(1.12).

B Derivation of equation (1.29)

Using (1.8), (1.11), ϵ and the definition of ϕ^i_g, the first-order condition in (1.28) reads

$$-\phi^i_L \frac{F^i_{LK}}{F^i_{KK} + F^j_{KK}} \frac{\overline{L}^i}{K^i} + \phi^i_C \frac{F^j_{KK}}{F^i_{KK} + F^j_{KK}} \frac{\overline{K}^i}{K^i} = V'(y^i)(1 - \epsilon).$$

Using the fact that for a constant returns to scale technology $F^i_{LK}L^i = -F^i_{KK}K^i$ and that in the symmetric equilibrium $K^i = \overline{K}$, $L^i = \overline{L}$ and $F^i_{KK} = F^j_{KK}$ yields (1.29).

C Comparative statics of the equilibrium capital tax rate

Differentiating (1.28) with respect to t^i, t^j, θ^i_g and θ^j_g yields the matrix equation

$$\begin{bmatrix} \frac{\partial \Psi^i}{\partial t^i} & \frac{\partial \Psi^i}{\partial t^j} \\ \frac{\partial \Psi^j}{\partial t^i} & \frac{\partial \Psi^j}{\partial t^j} \end{bmatrix} \begin{bmatrix} dt^i \\ dt^j \end{bmatrix} = \begin{bmatrix} -\frac{\partial \Psi^i}{\partial \theta^i_g} & -\frac{\partial \Psi^i}{\partial \theta^j_g} \\ -\frac{\partial \Psi^j}{\partial \theta^i_g} & -\frac{\partial \Psi^j}{\partial \theta^j_g} \end{bmatrix} \begin{bmatrix} d\theta^i_g \\ d\theta^j_g \end{bmatrix}. \tag{1.C.1}$$

For the components on the right hand side of (1.C.1), using symmetry at last we get

$$\frac{\partial \Psi^i}{\partial \theta^i_L} = n_L \left[\frac{dw^i}{dt^i} \overline{l} + V'(y)(K + t\frac{dK^i}{dt^i}) \right], \tag{1.C.2}$$

$$\frac{\partial \Psi^i}{\partial \theta^i_C} = n_C \left[\frac{dr}{dt^i} \overline{k} + V'(y)(K + t\frac{dK^i}{dt^i}) \right], \tag{1.C.3}$$

$$\frac{\partial \Psi^i}{\partial \theta^j_g} = 0. \tag{1.C.4}$$

With respect to the matrix on the left hand side of (1.C.1), we know from the stability conditions in Dixit (1986) that its determinant has to be positive, that is

$$\frac{\partial \Psi^i}{\partial t^i}\frac{\partial \Psi^j}{\partial t^j} - \frac{\partial \Psi^i}{\partial t^j}\frac{\partial \Psi^j}{\partial t^i} > 0. \tag{1.C.5}$$

With $\partial \Psi^j / \partial t^j = \partial \Psi^i / \partial t^i$ and $\partial \Psi^j / \partial t^i = \partial \Psi^i / \partial t^j$ by symmetry, we rewrite (1.C.5) as

$$\underbrace{\left[\frac{\partial \Psi^i}{\partial t^i} + \frac{\partial \Psi^i}{\partial t^j} \right]}_{:=D} \underbrace{\left[\frac{\partial \Psi^i}{\partial t^i} - \frac{\partial \Psi^i}{\partial t^j} \right]}_{:=E} > 0. \tag{1.C.6}$$

Since $\partial \Psi^i / \partial t^i < 0$ from second-order conditions, (1.C.6) is only fulfilled for $|\partial \Psi^i / \partial t^i| > |\partial \Psi^i / \partial t^j|$. Hence, $D < 0$ and $E < 0$, corresponding to the stability condition of diagonal dominance in Dixit (1986). The first parts in (1.30) and (1.31) can then be found by using Cramer's rule and afterwards imposing symmetry. For the second parts, we substitute (1.28) and the definition of ϕ^i_g. Using (1.8), (1.11) and $\phi^i_g n^i_g = 1 - \phi^i_h n^i_h$

gives

$$\frac{dt}{d\theta_L} = \phi_C \frac{1}{F^i_{KK}+F^j_{KK}}(F^i_{LK}\overline{L}^i n^i_C + F^j_{KK}\overline{K}^i n^i_L), \tag{1.C.7}$$

$$\frac{dt}{d\theta_C} = -\phi_L \frac{1}{F^i_{KK}+F^j_{KK}}(F^i_{LK}\overline{L}^i n^i_C + F^j_{KK}\overline{K}^i n^i_L). \tag{1.C.8}$$

Using $F^i_{LK}L^i = -F^i_{KK}K^i$ in the case of a constant returns to scale technology and that in the symmetric equilibrium $K^i = \overline{K}^i$, $L^i = \overline{L}^i$ and $F^i_{KK} = F^j_{KK}$, we get (1.30) and (1.31).

D Derivation of equations (1.39) and (1.40)

Noting equation (1.22), the first-order condition to (1.37) can be expressed as

$$\alpha^i \frac{\partial W^i(t^i,\widetilde{t}^j)}{\partial t^i} + \theta^i_h \frac{\partial W^i_h(t^i,\widetilde{t}^j)}{\partial t^i} = 0. \tag{1.D.1}$$

In autarky we have $W^i_g(t^i,t^j) = W^i_g(t^i)$ for all $g \in \{L,C\}$ and thus $W^i(t^i,t^j) = W^i(t^i)$. Noting this when differentiating (1.38) with respect to θ^i_g and using (1.D.1) and (1.23) gives the expression for the case of a closed economy in (1.39).

For the case of an open economy we differentiate (1.38) with respect to a symmetrical increase in lobby g's political organization, i.e. $d\theta^i_g = d\theta^j_g > 0$. This gives

$$\begin{aligned}\frac{d\widetilde{\varsigma}^i_g}{d\theta_g} := \frac{d\widetilde{\varsigma}^i_g}{d\theta^i_g} + \frac{d\widetilde{\varsigma}^i_g}{d\theta^j_g} = \quad & \alpha^i \left[\frac{\partial W^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^i}\frac{dt^i}{d\theta_g}\bigg|_{\theta^i_g=0} - \frac{\partial W^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^i}\frac{dt^i}{d\theta_g}\right] \\ & + \theta^i_h \left[\frac{\partial W^i_h(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^i}\frac{dt^i}{d\theta_g}\bigg|_{\theta^i_g=0} - \frac{\partial W^i_h(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^i}\frac{dt^i}{d\theta_g}\right] \\ & + \alpha^i \left[\frac{\partial W^i(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W^i(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j}\right]\frac{dt^j}{d\theta_g} \\ & + \theta^i_h \left[\frac{\partial W^i_h(\widetilde{t}^i_{-g},\widetilde{t}^j)}{\partial t^j} - \frac{\partial W^i_h(\widetilde{t}^i,\widetilde{t}^j)}{\partial t^j}\right]\frac{dt^j}{d\theta_g},\end{aligned} \tag{1.D.2}$$

with $dt^i/d\theta_g := dt^i/d\theta^i_g + dt^i/d\theta^j_g$ for $i,j \in \{a,b\}$ and $i \neq j$. The first-order condition in (1.D.1) implies that the first terms in the square brackets of the first and second line in (1.D.2) are together equal to zero. The result in (1.40) then follows by additionally using condition (1.23).

Chapter 2

Corporate Income Taxation and Lobbying of Multinational Firms

2.1 Introduction

The statutory corporate tax rates in developed countries have fallen substantially during the last decades, and the strategic interactions between jurisdictions due to tax competition have been identified as one of the main reasons for this decline, e.g. Devereux et al. (2008). In the context of proceeding economic integration, multinational firms are one of the major elements of this issue. Several studies to corporate income taxation show that optimal investment and profit declaration of multinational firms depend on the prevailing corporate tax rates and the difference in these tax rates, as multinational firms reduce their overall tax burden by relocating investment and by shifting pre-tax profits to low-tax countries, e.g. Hines (1996), Clausing (2003) and Huizinga and Laeven (2008). In turn, this gives an incentive for each government to strategically reduce its corporate tax rate in order to attract the internationally mobile tax base and to improve its public revenues.

Although the interaction of corporate income taxation and tax avoiding behavior of multinational firms is well studied with regard to efficiency implications,[1] a central element in corporate tax determination has been largely neglected so far: the aspect of political influence. Several studies in the literature on political economics give empirical evidence of an influencing connection between firms and political decisions, e.g. Masters and Keim (1985), Richter et al. (2009) or more recently with respect to corporate taxation by Gerard and Ruiz (2009) and Hill et al. (2011), and of a connection of political instruments and lobbying activities, e.g. Snyder (1990) or Spiller and Liao (2008). Following this, the aim of our analysis is to investigate how non-cooperatively determined corporate tax rates and the profit shifting behavior of multinational firms are affected by lobbying of special interest groups.

We develop a simple theoretical model of two small open economies. Each country hosts an affiliate of a representative multinational firm that has the opportunity to shift profits between the jurisdictions. Tax revenue from corporate income taxation is the only source for the provision of a local public good and the tax rates are determined by a government that receives political contributions from organized capital owners and shareholders of the multinational firm. Following the approach of Grossman and Helpman (1994, 1995), we apply lobbying to the setting of non-cooperative tax determination in the sense of a menu auction.[2] Beside well-known inefficiencies

[1] See Wilson (1999), Gresik (2001), Fuest et al. (2005), Nicodème (2007) or Griffith et al. (2010) for comprehensive surveys.

[2] This concept was originally developed by Bernheim and Whinston (1986a, 1986b).

due to the non-cooperative governmental behavior, we will thus be able to investigate the implications of political influence on corporate taxation and profit shifting.

In our model, political influence implies that governments become more aware of the corporate tax policy's impact on the gross welfare of the organized residents. Lobbying of the capital owners then increases the equilibrium corporate tax rate in a small open economy, since they bear no loss in private income. In contrast, the provision of the local public good will be too high from the firm owners' perspective, since each government is concerned about the well-being of all residents. Consequently, the firm owners lobby for a reduction in corporate tax rates. However, it is well known that non-cooperative governmental behavior imposes fiscal externalities on other countries that cause inefficiencies in corporate taxation. These can be reduced by political influence. We find that if the overall fiscal externality is positive, lobbying by the capital owners pushes the corporate tax rate closer to the efficient level, whereas political influence by the firm owners improves efficiency if the fiscal externality is negative.

In addition, we consider an international coordination of policy-influencing activities by the owners of the multinational firm. We discovered, this can fundamentally change the connection of profit shifting behavior and political influence. This is because an international special interest group becomes aware of the implications of local corporate taxation on social welfare and the organized firm owners' welfare in the other jurisdiction. Consequently, the possibility of the firm to shift profits will be realized with respect to its welfare implications for all organized shareholders. This implies that the political organization of the firm owners in one country directly affects the corporate tax determination in both countries. In contrast to the case where special interest groups are restricted to lobby only their domestic government, we find that strengthened political pressure by the firm owners can even increase profit shifting to the other jurisdiction in such a scenario.

Finally, since profit shifting and political influence can be seen as two channels to avoid tax payments, we analyze their connection by investigating how an increase in the concealment costs for profit reallocation affects the lobbies' equilibrium contributions to the government. When profit shifting becomes more expensive, the incentive to attract the mobile tax base will be reduced for each government. This increases the corporate tax rates in both countries and thereby pushes them into the preferred direction of the capital owners' lobby, while at the same time this is undesirable from the firm owners' perspective. However, in the case of a government that is solely interested in campaign contributions, we show that the lobbies' payments unambiguously increase

in equilibrium. This is because lobbying influences the magnitude of the externality from the increase in the other country's corporate tax rate. If the shareholders' lobby acts in an international way, we show that this constitutes a positive externality that can be related to the politically organized capital owners. Consequently, the payments by both special interest groups increase in equilibrium, but for different reasons. On the one hand, the capital owners' willingness to pay increases, since the externality pushes the tax rate in its preferred direction. On the other hand, at the same time the contributions of the firm owners have to rise, since they have to compensate the government for a comparably larger loss when the tax rate is reduced on behalf of their political influence.

Our analysis is related to the small literature on lobbying in presence of mobile capital. Marceau and Smart (2003) study the implications of political influence for excessive taxation on sunk investment. The analyses of Lorz (1998) and Lai (2010) investigate how lobbying affects capital tax competition. However, none of these studies investigates a multinational firm with the opportunity to shift profits or the role of an international special interest group. International lobbying was recently analyzed by Conconi (2003) and by Aidt and Hwang (2008). However, Conconi (2003) focuses on the role of an international environmental lobby in the context of transnational pollution, and Aidt and Hwang (2008) analyze the implications of an international organization of workers and firm owners in the context of labor market policy.

The remainder of the paper is structured as follows. In Section 2.2, we develop a simple theoretical model. Section 2.3 describes the structure of political influence. We then investigate in Section 2.4 how lobbying affects corporate income taxation. Finally, we investigate the connection of political influence and profit shifting in Section 2.5 and in Section 2.6 the connection of profit shifting and political contributions. Section 2.7 contains the conclusion.

2.2 The Model

2.2.1 Multinational Firm

Consider a simple model of two identical countries, labeled a and b, each hosting an affiliate of a representative multinational firm. In each country the firm produces a numeraire good with mobile capital. The production technology is given by $F(K^i)$,

with $F'(K^i) > 0$ and $F''(K^i) < 0$ for $i \in \{a, b\}$. The concavity of F implies that there is an additional factor, like e.g. entrepreneurial knowledge, that is given in fixed supply in each country and gives rise to positive pure profits in equilibrium.[3] Capital is assumed to be perfectly mobile and supplied to the firm at a per unit cost of $r > 0$. Since we consider the countries a and b as small compared to the rest of the world, the market interest rate r is exogenously given.

We assume that the multinational firm can avoid tax liabilities via profit shifting by manipulating transactions between its affiliates. For example, this can take the form of distorted transfer prices of intrafirm trade of goods or services or by manipulating the debt-equity structure.[4] Such activities are in a stylized way captured by the variable s. Restricted to leave positive profits in each entity, $s > 0$ ($s < 0$) indicates profit shifting from the affiliate in a (b) to the affiliate in b (a). Profit shifting involves a concealment cost, which reflects the firm's risk of being detected and penalized, e.g. Kant (1988), or simply the cost of hiring a tax consultant as argued for example in Haufler and Schjelderup (2000). For tractability reasons, we use the quadratic function $Q(s) = 1/2\, c\, s^2$, with $c > 0$. Hence, the concealment cost is convex in profit shifting with a minimum at $s = 0$, where no shifting occurs.

In each country, the firm has to pay a corporate income tax. Since most tax systems grant depreciation allowances to the user costs of capital and deductions of debt financing cost, we introduce a general parameter $\rho \in [0, 1]$ that represents the part of total capital costs that can be deducted from the tax base in each jurisdiction. The tax bases of the multinational firm in the two countries are then given by

$$\pi_t^a = F(K^a) - \rho\, r K^a - s, \quad \pi_t^b = F(K^b) - \rho\, r K^b + s. \tag{2.1}$$

Net of concealment costs, the total after-tax profit of the firm can be written as

$$\Pi = (1 - \tau^a)\, \pi_t^a + (1 - \tau^b)\, \pi_t^b - r\,(1 - \rho)(K^a + K^b) - \frac{1}{2}\, c\, s^2, \tag{2.2}$$

where $\tau^i \in]0, 1[$ denotes the statutory tax rate on corporate profits in country i. The firm chooses profit shifting activities (s) and capital investment in each affiliate (K^i)

[3] See Haufler and Schjelderup (2000) or Riedel and Runkel (2007) for a similar production set-up.

[4] See Hines (1999), Clausing (2003) or Huizinga and Laeven (2008).

in order to maximize (2.2). After rearranging, we get the first-order conditions

$$F'(\widetilde{K}^i) = \frac{r\,(1-\rho\,\tau^i)}{1-\tau^i}, \tag{2.3}$$

$$\widetilde{s} = \frac{\tau^a - \tau^b}{c}, \tag{2.4}$$

where the tilde indicates equilibrium values. Equation (2.3) characterizes the firm's optimal investment decision for the affiliate in country i. If the user costs are fully deductible, i.e. $\rho = 1$, capital will be invested until the marginal return equals the interest rate. However, the investment decision will be distorted in the case of no or partial deductibility. In that case, the return of the last unit capital has to cover the tax as well and investment will be reduced. Equation (2.4) states that the multinational firm shifts profits in a way that the marginal gain, i.e. the tax differential of the two countries, equals the marginal concealment cost. Hence, for $\tau^a > \tau^b$ the marginal concealment cost is positive and the firm shifts profits from the entity in country a to its affiliate in b. If $\tau^a < \tau^b$ it will be the other way round.

For the tax competition analysis in the next sections, a comparative static analysis of the national tax policies on the optimal behavior of the firm will be useful. Differentiating (2.3) and (2.4) yields

$$\frac{d\widetilde{K}^i}{d\tau^i} = \frac{r\,(1-\rho)}{(1-\tau^i)^2 F''(K^i)} \leq 0, \tag{2.5}$$

$$\frac{d\widetilde{K}^i}{d\tau^j} = 0, \tag{2.6}$$

$$\frac{d\,\widetilde{s}}{d\tau^a} = -\frac{d\,\widetilde{s}}{d\tau^b} = \frac{1}{c} \geq 0, \tag{2.7}$$

for $i, j \in \{a, b\}$ and $i \neq j$. According to equation (2.5), an increase in the corporate tax rate of a jurisdiction reduces capital investment in this jurisdiction, if the user costs of capital are not fully deductible. However, since the declared profits of the multinational firm are only taxed in the jurisdiction of origin, the investment decision in the other jurisdiction will not be affected, as shown by (2.6).[5] Finally, expression (2.7) states that unilateral increase in a jurisdiction's tax rate rises profit shifting to the other country.

[5] This clearly relies on the assumption of considering the jurisdiction a and b as small compared to the rest of the world, i.e. a fixed market interest rate r. If this were no the case, an increase in τ^i would generally affect the net return of capital and hence the investment and the tax base in jurisdiction j as well.

2.2.2 Residents

Each country is inhabited by n^i immobile residents, consisting of n_C^i capital owners and n_F^i shareholders of the multinational firm. Accordingly, a single resident receives income from the inelastic supply of his $\overline{k}^i$ units of capital to the world market or from his share $\overline{z}^i$ of the firm's global after-tax profit. Within each residential group $g \in \{C, F\}$ all n_g^i individuals are assumed to be homogenous. The total capital supply of country i is thus given by $\overline{K}^i = n_C^i \overline{k}^i$ and the total ownership share by $\overline{Z}^i = n_F^i \overline{z}^i$.[6] The preferences of each resident are assumed to be of the quasi-linear type

$$U_g^i(x_g^i, y^i) = x_g^i + V(y^i), \tag{2.8}$$

where a resident's consumption of the private good is determined by $x_C^i = r\,\overline{k}^i$ or $x_F^i = \overline{z}^i \Pi$ respectively. The provision of the local public good y^i yields utility $V(y^i)$, with $V'(y^i) > 0$ and $V''(y^i) < 0$. The welfare of residential group g can be written as

$$W_g^i = n_g^i U_g^i. \tag{2.9}$$

2.3 The Political Area

2.3.1 Special Interest Groups

Since all individuals in our model have the same preferences, it seems natural to distinguish residents with respect to the source of income when we intend to analyze the implications of political influence.[7] Following the approach of Grossman and Helpman (1994, 1995) we do not investigate the incentives to organize into a lobby group and assume that residents with a common source of income are just able to overcome the free-rider problem as first discussed by Olson (1965). More precisely, we henceforth assume that only a share $\theta_g^i \in [0, 1]$ of each residential group $g \in \{C, F\}$ is politically organized.[8] This enables us to focus on the implications of political influence on corporate taxation and thus the profit shifting behavior of a multinational firm, since we know from Grossman and Helpman (1994) that no political distortion occurs in

[6] We assume $\overline{Z}^i + \overline{Z}^j = 1$, so the multinational firm is exclusively owned by the residents of the two jurisdictions.

[7] Lobbying based on the source of income can also be found in Rama and Tabellini (1998).

[8] This constitutes a measure for the policy-relevant size of a residential group, as for example used in a similar way by Haufler (1997) or Mitra (1999).

equilibrium if all residents in a country are politically organized.[9] Moreover, this is in accordance with Olson (1965) as it comprises in a stylized way his argument that the political organization of a residential group is closely related to the number of potential members. According to his logic, it will get more difficult to coordinate common interests when there are more individuals within the same group, because of free-riding and higher administrative costs. In our model, this corresponds to a smaller organizational degree for the larger residential group.

Following the approach of Grossman and Helpman (1994, 1995), we assume that each special interest group offers a political contribution function ς_g^i to the residing country's government that is not negative or greater than the aggregate income of the lobby and that depends on the corporate tax rate the government unilaterally decides upon.[10] Thereby, each lobby seeks to maximize the net welfare of its members, given by

$$\Theta_C^i = \theta_C^i W_C^i(\tau^i, \tau^j) - \varsigma_C^i(\tau^i), \tag{2.10}$$

$$\Theta_F^i = \theta_F^i W_F^i(\tau^i, \tau^j) - \varsigma_F^i(\tau^i), \tag{2.11}$$

where $\theta_g^i W_g^i(\tau^i, \tau^j)$ reflects the gross welfare of the organized members in lobby group g of country i. However, the shareholders' intention with respect to the source of income is the same in both countries, since it depends on the global after-tax profit of the multinational firm. Hence, we allow for the possibility of an international coordination of policy-influencing activities by the firm owners as well. Following the approaches of Conconi (2003) and Aidt and Hwang (2008), the objective of the international lobby of the firm owners can be written as

$$\Theta_F^{ij} = \theta_F^i W_F^i(\tau^i, \tau^j) + \theta_F^j W_F^j(\tau^i, \tau^j) - \varsigma_F^i(\tau^i; \tau^j) - \varsigma_F^j(\tau^j; \tau^i). \tag{2.12}$$

According to equation (2.12), the international lobby offers one contribution schedule to each government in a way to maximize the joint welfare of its members in both countries.[11] Note that the gross welfare levels of the lobby members in (2.10)-(2.12) depend on the corporate tax rates of both countries. However, we follow Aidt and

[9] Note that equilibrium welfare is still affected since each residential group has to pay contributions.

[10] Evidence on the interdependence of governmental policy and contribution payments can be found in Snyder (1990), Spiller and Liao (2008) or Richter et al. (2009).

[11] Since $Z^i + Z^j = 1$, equation (2.12) contains the case of lobbying by the multinational firm itself if $\theta_F^i = \theta_F^j = 1$. However, we are interested in the impact of a change in the political environment on corporate taxation and profit shifting. Hence, it will be useful to stay with the chosen set-up. Moreover, in a recent working paper, Hill et al. (2011) show a primary motivation of corporate lobbying with respect to the shareholders' wealth.

Hwang (2008) in the notation of the contribution schedules for the considered scenarios with respect to the firm owners' political organization. That is, if special interest groups are organized on a national level, the offered contributions are assumed to depend only on the policy instrument the jurisdiction decides upon, i.e. $\varsigma_g^i(\tau^i)$. In contrast, through its national representations, the firm owners' international lobby offers contribution schedules to both governments at the same time.[12] However, the governments decide unilaterally on corporate taxation and are not able to observe the contribution schedule that is offered to the government in the other jurisdiction. Hence, the tax rate in the other country will be treated as parameter in that case. This is indicated by the semicolon in front of the second argument in the contribution functions in (2.12).[13]

2.3.2 Governments

The incumbent governments are assumed to have an implicit objective in being re-elected. Accordingly, the government in each country is primarily concerned about its overall political support G^i. This consists of the well-being of the domestic electorate, but the government also values the received contributions from the special interest group.[14] Faced with the contribution schedules, each government chooses its national corporate tax rate τ^i in order to maximize

$$G^i = \alpha^i W^i(\tau^i, \tau^j) + \sum_g \varsigma_g^i(\cdot), \tag{2.13}$$

where $\alpha^i > 0$ represents the government's valuation of a unit social welfare compared to the political contributions received. The only source of public income is corporate taxation. Accordingly, the budget constraint for the provision of the local public good

[12] Aidt and Hwang (2008) show that the policy implications of such an international lobbying set-up are the same as if the lobbies in each jurisdiction are allowed to lobby their own and the foreign jurisdiction directly. This is because for the equilibrium outcome matters only whose preferences are recognized by the governments. Consequently, in our model, it does not matter if the firm owners' contributions are transferred through an international organization or if they are offered directly to the government of the other jurisdiction.

[13] If governments negotiate over policies, special interest groups will be able to tie their contribution to the outcome of the process. In that case, the offered contribution schedules to each government depend directly on the the tax rates in both jurisdictions, i.e. $\varsigma_g^i(\tau^i, \tau^j)$. See Grossman and Helpman (1995) or Aidt and Hwang (2008) for more details.

[14] For example, contributions can be used to finance campaign spending in electoral competition as in Grossman and Helpman (1996).

is given by $y^i = \tau^i \pi_t^i$. Using equations (2.8) and (2.9), social welfare in country i reads

$$W^i = \sum_g W_g^i = r\,\overline{K}^i + \overline{Z}^i \Pi + n^i\, V(y^i). \tag{2.14}$$

We are interested in the political equilibrium of a three-stage game. In the first stage, the lobbies simultaneously set their contribution schedules contingent on the corporate tax rates that are non-cooperatively chosen by the governments in the second stage. As mentioned above, the firm owners' lobby offers a contribution schedule for each government in the case of an international organization. In contrast, if each national representation is restricted to influence only their domestic government, the firm owners take as given the political interaction of organized shareholders and the other government. In any case, the lobby group of the firm owners takes as given the contribution schedules offered by the nationally organized capital owners to the governments in both countries and vice versa. In the last stage, the multinational firm decides on investment and profit shifting and the residents' consumption takes place. Solving by backward induction then implies that the governments and lobby groups anticipate the behavior of the firm as already investigated in Section 2.2.1.[15]

2.3.3 Equilibrium of the political game

2.3.3.1 National Political Organization of the Firm Owners

When all special interest groups are restricted to lobby their respective national government, the political interaction has the structure of the common-agency game analyzed by Grossman and Helpman (1994, 1995). Following this, the equilibrium corporate tax policy is characterized by

Definition 2.1
A set of contribution functions $\left\{\widetilde{\varsigma}_g^i(\widetilde{\tau}^i), \widetilde{\varsigma}_g^j(\widetilde{\tau}^j)\right\}$ *and a set of corporate tax rates* $\{\widetilde{\tau}^i, \widetilde{\tau}^j\}$ *describe for* $i, j \in \{a, b\}$, $i \neq j$ *and* $g \in \{C, F\}$ *an equilibrium if (a)*

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i\, W^i(\tau^i, \widetilde{\tau}^j) + \sum_g \widetilde{\varsigma}_g^i(\tau^i), \tag{2.15}$$

[15] This political interaction has the structure of a menu auction with a first characterization of equilibria for a discrete set of choices by Bernheim and Whinston (1986a).

and (b) for every organized special interest group $g, h \in \{C, F\}$ and $g \neq h$, a contribution function $\varsigma_g^i(\tau^i)$ and a corporate tax rate does not exist that (i)

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \varsigma_g^i(\tau^i) + \widetilde{\varsigma}_h^i(\tau^i), \tag{2.16}$$

and (ii)

$$\theta_g^i W_g^i(\tau^i, \widetilde{\tau}^j) - \varsigma_g^i(\tau^i) \;>\; \theta_g^i W_g^i(\widetilde{\tau}^i, \widetilde{\tau}^j) - \widetilde{\varsigma}_g^i(\widetilde{\tau}^i). \tag{2.17}$$

Condition *(a)* states that the national government chooses its corporate tax rate in order to maximize its own objective, taking the contribution schedules and the corporate tax rate of the other jurisdiction as given. Condition *(b)* stipulates that no special interest group can improve the net welfare of its members in equilibrium by offering an alternative contribution schedule, thereby inducing the domestic government to change its corporate tax policy. If this were the case, a lobby group can always offer a new contribution schedule in a way that the government changes the policy in the group's favor. Consequently, the lobby can extract rents up to the point where the government remains indifferent to the initial corporate tax policy. As a result, the special interest group catches all of the potential surplus that is generated by the induced policy change. Of course, it cannot be an equilibrium if such an unexploited opportunity exists for any lobby. Given the above conditions, we know from Grossman and Helpman (1994, 1995) and Bernheim and Whinston (1986a) that the equilibrium corporate tax rate has to maximize the joint welfare of each special interest group and the government. That is

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \theta_g^i W_g^i(\tau^i, \widetilde{\tau}^j) - \widetilde{\varsigma}_g^i(\tau^i) + \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \sum_g \widetilde{\varsigma}_g^i(\tau^i), \tag{2.18}$$

for $g \in \{C, F\}$. The first-order condition to (2.18) is given by

$$\theta_g^i \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} - \frac{\partial \widetilde{\varsigma}_g^i(\tau^i)}{\partial \tau^i} + \alpha^i \frac{\partial W^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \sum_g \frac{\partial \widetilde{\varsigma}_g^i(\tau^i)}{\partial \tau^i} = 0. \tag{2.19}$$

In addition, the first-order condition according to equation (2.15) reads

$$\alpha^i \frac{\partial W^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \sum_g \frac{\partial \widetilde{\varsigma}_g^i(\tau^i)}{\partial \tau^i} = 0. \tag{2.20}$$

Equation (2.20) shows that each government chooses its corporate tax rate in order to equate the marginal welfare gain to the marginal contributions received. Since conditions (2.19) and (2.20) have to be fulfilled simultaneously in equilibrium, we insert (2.20) into (2.19). This yields

$$\frac{\partial \widetilde{\varsigma}_C^i(\tau^i)}{\partial \tau^i} = \theta_C^i \frac{\partial W_C^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i}, \tag{2.21}$$

$$\frac{\partial \widetilde{\varsigma}_F^i(\tau^i)}{\partial \tau^i} = \theta_F^i \frac{\partial W_F^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i}. \tag{2.22}$$

Equations (2.21) and (2.22) state that the offered contribution schedules are set in a way that the marginal change in the contribution matches the effect of its impact on the gross welfare of the lobby's members. Stated in the words of Dixit et al. (1997, p. 759.), "the shape of the payment schedules mirror the shape of the principal's indifference surface". Noting equation (2.14), the equilibrium corporate tax rate can be characterized by substituting equation (2.21) and (2.22) into (2.20). This gives

$$\sum_g \left[\alpha^i + \theta_g^i\right] \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} = 0. \tag{2.23}$$

Condition (2.23) shows that lobbying of an interest group acts as if the weight of this group in the government's welfare maximization increases. This increase is the higher, the more residents are politically organized, i.e. the higher θ_g^i.

2.3.3.2 International Political Organization of the Firm Owners

When the owners of the multinational firm are politically organized on an international level, the political interaction of the international lobby and both governments has the structure of a multiple-principal and multi-agent game. The equilibrium of this structure was first characterized by Prat and Rustichini (2003). However, as shown by Aidt and Hwang (2008), if each government only observes the contribution schedules that the special interest groups offer to him, and if the government has *passive beliefs* about the international lobby's strategy with respect to the offered contribution function to the other government,[16] the equilibrium tax policy is characterized by

[16] More precisely, in our model *passive beliefs* means that if the firm owners' international lobby offers an out-of-equilibrium contribution schedule, the government believes that the lobby does not change the contribution function offered to the government in the other jurisdiction at the same time. We refer to Segal (1999) and Prat and Rustichini (2003) for more details.

Definition 2.2
A set of contribution functions $\{\widetilde{\varsigma}_C^i(\widetilde{\tau}^i), \widetilde{\varsigma}_F^i(\widetilde{\tau}^i;\tau^j)\}$ *and a set of corporate tax rates* $\{\widetilde{\tau}^i, \widetilde{\tau}^j\}$ *describe for* $i,j \in \{a,b\}$, $i \neq j$ *an equilibrium if (a)*

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\tau^i) + \widetilde{\varsigma}_F^i(\widetilde{\tau}^i;\widetilde{\tau}^j). \tag{2.24}$$

(b) for the capital owners' special interest group, a feasible contribution function $\varsigma_C^i(\tau^i)$ *and a corporate tax rate does not exist that (i)*

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \varsigma_C^i(\tau^i) + \widetilde{\varsigma}_F^i(\tau^i;\widetilde{\tau}^j), \tag{2.25}$$

and (ii)

$$\theta_C^i W_C^i(\tau^i, \widetilde{\tau}^j) - \varsigma_C^i(\tau^i) \;>\; \theta_C^i W_C^i(\widetilde{\tau}^i, \widetilde{\tau}^j) - \widetilde{\varsigma}_C^i(\widetilde{\tau}^i). \tag{2.26}$$

(c) for the firm owners' international lobby there does not exist a feasible contribution function $\varsigma_F^i(\tau^i;\tau^j)$ *and a corporate tax rate that (i)*

$$\widetilde{\tau}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\tau^i) + \varsigma_F^i(\tau^i;\widetilde{\tau}^j), \tag{2.27}$$

and (ii)

$$\sum_i \theta_F^i W_F^i(\tau^i, \widetilde{\tau}^j) - \sum_i \varsigma_F^i(\tau^i;\widetilde{\tau}^j) \;>\; \sum_i \theta_F^i W_F^i(\widetilde{\tau}^i, \widetilde{\tau}^j) - \sum_i \widetilde{\varsigma}_F^i(\widetilde{\tau}^i;\widetilde{\tau}^j). \tag{2.28}$$

(d) the firm owners' international lobby offers the cost-minimizing contribution function to each government i

$$\alpha^i W^i(\widetilde{\tau}^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\widetilde{\tau}^i) + \widetilde{\varsigma}_F^i(\widetilde{\tau}^i;\widetilde{\tau}^j) = \alpha^i W^i(\widetilde{\tau}_{-g}^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\widetilde{\tau}_{-g}^i), \tag{2.29}$$

with

$$\widetilde{\tau}_{-g}^i \;=\; \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_h^i(\cdot), \tag{2.30}$$

for $g,h \in \{C,F\}$ *and* $g \neq h$.

The statements in conditions *(a)* to *(c)* are analogous to *(a)* and *(b)* in Definition 2.1. That is, the government taxes corporate profits in order to maximize its own objective and no lobby group can improve its members' net welfare by offering an alternative contribution function. Condition *(d)* states that the international lobby offers each

government just the payment that is necessary to ensure that the government does not neglect its political offers. Hence, the government has the same level of political support as if it neglects the offer from the internationally organized firm owners and chooses the corporate tax policy that maximizes its objective when only the capital owners influence policy. Given the above conditions *(a)* to *(d)*, we know from Aidt and Hwang (2008) that the equilibrium tax rate has to maximize the joint welfare of each special interest group and the government. For the capital owners that is

$$\widetilde{\tau}^i = \arg\max_{\tau^i} \; \theta_C^i \, W_C^i(\tau^i, \widetilde{\tau}^j) - \widetilde{\varsigma}_C^i(\tau^i) + \alpha^i \, W^i(\tau^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\tau^i) + \widetilde{\varsigma}_F^i(\tau^i; \widetilde{\tau}^j), \quad (2.31)$$

and for the internationally organized firm owners

$$\begin{aligned} \widetilde{\tau}^i = \arg\max_{\tau^i} \; & \theta_F^i \, W_F^i(\tau^i, \widetilde{\tau}^j) + \theta_F^j \, W_F^j(\widetilde{\tau}^j, \tau^i) - \widetilde{\varsigma}_F^i(\tau^i; \widetilde{\tau}^j) - \widetilde{\varsigma}_F^j(\widetilde{\tau}^j; \tau^i) \\ & + \alpha^i \, W^i(\tau^i, \widetilde{\tau}^j) + \widetilde{\varsigma}_C^i(\tau^i) + \widetilde{\varsigma}_F^i(\tau^i; \widetilde{\tau}^j) \\ & + \alpha^j \, W^j(\widetilde{\tau}^j, \tau^i) + \widetilde{\varsigma}_C^j(\widetilde{\tau}^j) + \widetilde{\varsigma}_F^j(\widetilde{\tau}^j; \tau^i). \end{aligned} \quad (2.32)$$

Of course, the international lobby interacts with the governments in both countries. Following this, an equilibrium according to (2.32) implies that the impact of the local corporate tax rate on the other country has to be considered as well. Otherwise the joint welfare of the international lobby and the government in the other country will be affected, and the international lobby can increase its net welfare if it redesigns its offered contribution functions. In equilibrium, the corporate tax rate has to fulfill (2.24), (2.31) and (2.32) simultaneously. However, noting the first-order condition to (2.30), the offered contribution schedule of the international lobby in (2.29) yields for a change in the coporate tax rate of country i

$$\frac{\partial \widetilde{\varsigma}_F^i(\tau^i; \widetilde{\tau}^j)}{\partial \tau^i} = -\frac{\partial \widetilde{\varsigma}_C^i(\tau^i)}{\partial \tau^i} - \alpha^i \frac{\partial W^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i}. \quad (2.33)$$

Equation (2.33) mirrors the above statement for the cost-minimizing contribution function. That is, if country i increases its corporate tax rate, the equilibrium payment of the internationally organized firm owners just ensures that the government has the same level of overall political support as if the firm owners do not influence policy.

Substituting (2.33) into the first-order conditions to (2.31) and (2.32), we get

$$\frac{\partial \widetilde{\varsigma}_C^i(\tau^i)}{\partial \tau^i} = \theta_C^i \frac{\partial W_C^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i}, \tag{2.34}$$

$$\frac{\partial \widetilde{\varsigma}_F^i(\tau^i; \widetilde{\tau}^j)}{\partial \tau^i} = \theta_F^i \frac{\partial W_F^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \theta_F^j \frac{\partial W_F^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i} + \alpha^j \frac{\partial W^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i}. \tag{2.35}$$

The equilibrium corporate tax rate can be characterized by inserting equations (2.34) and (2.35) into the first-order condition to (2.24). Noting equation (2.14) we get

$$\sum_g \left[\alpha^i + \theta_g^i\right] \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \theta_F^j \frac{\partial W_F^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i} + \alpha^j \frac{\partial W^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i} = 0. \tag{2.36}$$

Condition (2.36) shows that each residential group in country i receives a higher welfare weight on behalf of the organized members. In addition, international lobbying of the firm owners' implies that the impact on the organized shareholders and the welfare in the other country are taken into account. Hence, international lobbying serves as an instrument to internalize fiscal externalities on the other jurisdiction.[17] However, note that the impact on the politically organized capital owners in country j will not be considered as they only influence their respective domestic government. An investigation of equations (2.23) and (2.36) then immediately shows that we are able to catch the difference in political organization of the equilibrium corporate tax rates by simply introducing an indicator variable $\lambda \in \{0, 1\}$. For $\lambda = 1$, the firm owners are internationally organized, whereas they lobby only their respective domestic country in the case of $\lambda = 0$. This means that we can unify (2.23) and (2.36) by

$$\sum_g \left[\alpha^i + \theta_g^i\right] \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \lambda \left[\theta_F^j \frac{\partial W_F^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i} + \alpha^j \frac{\partial W^j(\widetilde{\tau}^j, \tau^i)}{\partial \tau^i}\right] = 0. \tag{2.37}$$

2.4 Corporate Taxation and Political Influence

2.4.1 The Government's First-Order Condition

In order to investigate the implications of political influence on corporate taxation, we take the derivatives of (2.10) and (2.11) with respect to τ^i. Noting equations (2.2),

[17] In context of labor market policy, this was first pointed out by Aidt and Hwang (2008).

(2.8) and (2.9) we get for the first-order condition (2.37) of the government in i

$$\begin{aligned}\Psi^i(\tau^i,\tau^j) := {} & (\alpha^i+\theta_F^i)\, n_F^i\, \overline{z}^i \frac{\partial \Pi}{\partial \tau^i} + \beta^i\, V'(y^i)\frac{dy^i}{d\tau^i} \\ & + \lambda\left[(\alpha^j+\theta_F^j)\, n_F^j\, \overline{z}^j \frac{\partial \Pi}{\partial \tau^i} + (\alpha^j\, n^j + \theta_F^j\, n_F^j)\, V'(y^j)\frac{dy^j}{d\tau^i}\right] = 0,\end{aligned} \tag{2.38}$$

where $\beta^i = \alpha^i\, n^i + \theta_C^i\, n_C^i + \theta_F^i\, n_F^i$ denotes the policy-influenced weight of all inhabitants of country i. Moreover, $\partial\Pi/\partial\tau^i = -\pi_t^i < 0$, $dy^j/d\tau^i = \tau^j/c > 0$ and

$$\frac{dy^i}{d\tau^i} \;=\; \pi_t^i + \tau^i\left[\left(F'(K^i) - \rho r\right)\frac{dK^i}{d\tau^i} - \frac{1}{c}\right]. \tag{2.39}$$

We start with the case where politically organized shareholders influence only their domestic government, i.e. $\lambda = 0$. According to equation (2.38), the equilibrium corporate tax rates of each government then equates the marginal change in private income of the firm owners and the marginal impact on the provision of the public good, each expressed in policy-influenced welfare terms. Note that the impact on the provision of the public good consists of the positive effect of higher tax revenues for a given tax base and the erosion of the tax base due to the decline in investment and the increase in profit shifting to the other country, as seen in (2.39). However, if the firm owners are politically organized on an international level, i.e. $\lambda = 1$, two additional effects will be recognized by each country's government. On the one hand, the private income loss of the politically organized foreign shareholders will be considered as well.[18] On the other hand, profit shifting leads to an increase in the foreign tax base and hence to a gain for the firm and capital owners in the other jurisdiction. However, the latter will be considered in terms of social welfare and the political organization of the international special interest group. In contrast, the impact on the politically organized capital owners in the other jurisdiction will not be recognized.

In order to get further insights in the properties of the equilibrium tax policies and contributions in the next sections, we follow most previous studies and focus on a symmetric Nash equilibrium with identical corporate tax rates, i.e. $\tau^i = \tau^j =: \tau$. Since both countries are assumed to be identical, this occurs for an equal distribution of residents, i.e. $n_g^i = n_g^j =: n_g$ and $n^i = n^j =: n$, as well as identical endowments with capital $\overline{k}^i = \overline{k}^j =: \overline{k}$ and profit shares $z^i = z^j =: z$. Moreover, the social welfare weights and the organizational degrees of the lobbies have to be the same, i.e.

[18] For analyses of tax exporting, see Huizinga and Nielsen (1997) and Wagner and Eijffinger (2008).

$\alpha^i = \alpha^j =: \alpha$ and $\theta_g^i = \theta_g^j =: \theta_g$. From equations (2.3) and (2.4) it then follows $\widetilde{K}^i = \widetilde{K}^j =: \widetilde{K}$ and $\widetilde{s} = 0$. Consequently, this implies $\pi_t^i = \pi_t^j =: \pi_t$. However, even if no profits will be shifted in equilibrium, the incentive to reduce tax rates as a way to increase the tax base is still at work. Conducting a comparative static analysis, we find for a symmetrical increase in the political organization in both jurisdictions and an increase in the marginal concealment cost

$$\frac{d\,\widetilde{\tau}}{d\,\theta_C} = -\frac{n_C}{D}\,V'(y)\,\frac{dy^i}{d\tau^i}\,, \tag{2.40}$$

$$\begin{aligned}\frac{d\widetilde{\tau}}{d\theta_F} &= -\frac{n_F}{D}\left[(1+\lambda)\,\overline{z}\,\frac{\partial\Pi}{\partial\tau^i} + V'(y)\left(\frac{dy^i}{d\tau^i} + \lambda\frac{dy^j}{d\tau^i}\right)\right] \\ &= -\frac{n_F n_C}{D\,(\alpha\,n + \theta_F\,n_F)}\left[(1+\lambda)\,\alpha\,\overline{z}\,\frac{\partial\Pi}{\partial\tau^i} - \theta_C\,n_C V'(y)\frac{dy^i}{d\tau^i}\right],\end{aligned} \tag{2.41}$$

$$\frac{d\,\widetilde{\tau}}{d\,c} = -\frac{(1-\lambda)(\alpha\,n + \theta_F\,n_F) + \theta_C\,n_C}{D}\,V'(y)\,\frac{\tau}{c^2} > 0\,, \tag{2.42}$$

for $D < 0$.[19] As long as we focus on the increasing part of the Laffer-Curve, i.e. $dy^i/d\tau^i > 0$, equation (2.40) states that the equilibrium corporate tax rate will be higher if the capital owners' organizational degree increases. The reason is that corporate taxation does not affect the market interest rate in the case of a small open economy. Hence, the owners of mobile capital bear no income loss and so they are only concerned about the utility from the provision of the local public good.

According to equation (2.41), the corporate tax rate will be reduced if the political organization of the firm owners increases. The reason is that the private income loss of the firm owners more than offsets the group-specific gain from the increase in the public good provision, because the government cares about the jurisdiction's capital owners as well. As a result, the firm owners lobby for a lower equilibrium corporate tax rate in case of $\lambda = 0$.[20] However, in the case of $\lambda = 1$, the positive fiscal externality due to profit shifting and the negative impact on the firm owners' income is recognized by each government in terms of social welfare and the politically organized firm owners in the other jurisdiction. Using additionally (2.38), the second line in (2.41) shows that, at home as well as abroad, the gain in the provision of the public good is not sufficient to compensate for the loss in the firm owners' income. Hence, the downward pressure on the equilibrium tax rate will be aggravated in case of international lobbying.

[19] The derivations of the comparative statics are given in the Appendix.

[20] Note that using (2.38) for $\lambda = 0$, the right hand side of the first line in (2.41) can be written as $[(\alpha + \theta_C)\,\theta_F\,n_C\,n_F/\beta]\,\overline{z}\,[d\,\Pi/d\tau^i] < 0$.

Equation (2.42) shows that the equilibrium corporate tax rates will be higher when the marginal costs for profit shifting increase. If c rises, more profits will be declared within the jurisdiction. In that respect, corporate taxation becomes comparably more 'effective' in raising tax revenue. This is beneficial for the jurisdiction's residents, since it increases the provision of the local public good, expressed for $\lambda = 0$ in policy-influenced welfare terms. However, in the case of $\lambda = 1$, each jurisdiction takes into account the positive fiscal externality due to profit shifting in terms of social welfare and the politically organized firm owners in the other jurisdiction. Consequently, the first term in the nominator of (2.42) cancels out in the symmetric equilibrium. Moreover, note that no profits will be shifted before and after the rise in c. This is because the impact of the increase in c is the same in both jurisdictions and because we are considering a symmetric equilibrium. Hence, the effect in (2.42) is solely expressed in terms of the implications from the provision of the public good. Summarizing the results, we can establish

Proposition 2.1

(a) An increase in the political organization of the capital owners leads to higher corporate tax rates in equilibrium.

(b) An increase in the political organization of the firm owners leads to lower corporate tax rates in equilibrium. The downward pressure will be intensified if the firm owners are organized on an international level.

(c) An increase in the marginal costs for profit shifting leads to higher corporate tax rates in equilibrium.

2.4.2 Efficiency Implications of Political Influence

In order to investigate the efficiency implications of lobbying, we first isolate the economic distortion due to non-cooperative governmental behavior and compare this afterwards to the impact of political influence. In our model, this can be done by setting θ_g^i equal to zero. In this case, each government is only concerned about its domestic welfare and does not take into account the impact of its corporate taxation on the other jurisdiction. It is well known that the efficiency properties of the equilibrium tax rates can then be analyzed by investigating the fiscal externalities. These externalities describe the deviation from the cooperative tax policy that is chosen in order to maximize the joint welfare of the residents in the two jurisdictions without political

influence, which in our model is given by $\alpha^i W^i(\tau^i, \tau^j) + \alpha^j W^j(\tau^i, \tau^j)$. We then find the fiscal externality in the symmetric equilibrium as

$$\alpha \frac{\partial W^j}{\partial \tau^i} = \alpha \sum_g \frac{\partial W_g^j}{\partial \tau^i} = \alpha \left[n_F \overline{z} \frac{\partial \Pi}{\partial \tau^i} + n V'(y) \frac{dy^j}{d\tau^i} \right]. \tag{2.43}$$

According to equation (2.43), the fiscal externality can be divided in two parts, a negative income externality and a positive profit shifting externality. A rise in the corporate tax rate of country i reduces the after-tax profit of the multinational firm. Consequently, the first term reflects the associated decrease in the shareholders' income in country j. However, a rise in (τ^i) increases profit shifting to the other country as well. As represented by the second term in (2.43), this constitutes a positive externality on country j as it broadens the tax base there. In comparison with the cooperative solution, the corporate tax rates are set inefficiently low (high) if the sum of these counteracting externalities is positive (negative). The efficiency implications of political influence can then be investigated when we compare the fiscal externality in (2.43) with the impact of political influence on the equilibrium corporate tax rates in (2.37).[21] For the case of a symmetric equilibrium, this yields

$$\alpha \frac{\partial W^j}{\partial \tau^i} (1 - \lambda) \gtrless \theta_C \frac{\partial W_C^i}{\partial \tau^i} + \theta_F \left[\frac{\partial W_F^i}{\partial \tau^i} + \lambda \frac{\partial W_F^j}{\partial \tau^i} \right] \gtrless 0 \quad \Leftrightarrow \quad \tau^* \gtrless \widetilde{\tau} \gtrless \widehat{\tau}, \tag{2.44}$$

where τ^* and $\widehat{\tau}$ denote the corporate tax rate in the cooperative and non-cooperative equilibrium without political influence. We begin with the case of $\lambda = 0$, where all special interest groups are restricted to lobby only their domestic government. Following this, equation (2.44) shows that political influence can counterbalance the fiscal externalities in the non-cooperative equilibrium. For example, if the positive profit shifting externality dominates, we have $\alpha \, \partial W^j / \partial \tau^i > 0$ and thus, without political influence, inefficiently low tax rates. Moderate unilateral lobbying of domestic capital owners then improves efficiency as it increases the equilibrium corporate tax rate. In contrast, the corporate tax rate will be pushed even more in the direction of inefficiency

[21] Alternatively, rewriting (2.37) by adding $\partial W^j / \partial \tau^i$ on both sides and employing symmetry gives

$$\alpha \left[\frac{\partial W^i}{\partial \tau^i} + \frac{\partial W^j}{\partial \tau^i} \right] = \alpha \frac{\partial W^j}{\partial \tau^i} - \theta_C \frac{\partial W_C^i}{\partial \tau^i} - \theta_F \frac{\partial W_F^i}{\partial \tau^i} - \lambda \left[\theta_F \frac{\partial W_F^j}{\partial \tau^i} + \alpha \frac{\partial W^j}{\partial \tau^i} \right].$$

In the cooperative equilibrium without lobbying, the left hand side of this equation has to be equal to zero. Consequently, the right hand side describes the deviations of the equilibrium corporate tax policy from the cooperative solution that are caused by the fiscal externality and political influence. Rearranging terms yields (2.44) as well.

if the firm owners are the only lobby group.[22] Consequently, the overall impact of political influence depends on the relative strength of the two lobbies. On the one hand, if $\theta_C \, \partial W_C^i / \partial \tau^i < |\theta_F \, \partial W_F^i / \partial \tau^i|$, the impact of corporate taxation on the organized firm owners' gross welfare dominates the effect on the capital owners' lobby in the government's first-order condition. Consequently, in this case the overall implication of political influence goes into the same direction as the fiscal externalities. On the other hand, if $\theta_C \, \partial W_C^i / \partial \tau^i > |\theta_F \, \partial W_F^i / \partial \tau^i|$ the relation in (2.44) shows that lobbying can improve the efficiency of corporate taxation. However, the impact of corporate taxation on the welfare of domestic capital owners receives a higher weight in the first-order condition of the government if the organizational degree of the lobby is large. As a result, if $\theta_C \, \partial W_C^i / \partial \tau^i + \theta_F \, \partial W_F^i / \partial \tau^i > \alpha \, \partial W^j / \partial \tau^i$ political influence pushes the equilibrium corporate tax rate even above the efficient level. In that case, the efficiency implications of lobbying will be reversed. That is, political influence of the firm owners improves efficiency, whereas lobbying of the capital owners gives rise to inefficient over-taxation.[23] However, in the case of $\alpha \, \partial W^j / \partial \tau^i = \theta_C \, \partial W_C^i / \partial \tau^i + \theta_F \, \partial W_F^i / \partial \tau^i$ political influence of the domestic residents fully internalizes the fiscal externalities.

For the case of $\alpha \, \partial W^j / \partial \tau^i < 0$, the negative income externality predominates the positive profit shifting externality and we have inefficiently high tax rates in the non-cooperative equilibrium. Accordingly, the efficiency implications of political influence by the two residential groups will be the other way round. Moreover, note that we get $\partial W^j / \partial \tau^i = 0$ if the two fiscal externalities in (2.43) outweigh each other. Without political influence, this implies that the corporate tax rates in the non-cooperative equilibrium are efficient. In that case, lobbying causes inefficient corporate taxation in the preferred direction of the politically stronger group. Finally, note from equation (2.37) that there will be no political distortion if $\theta_C = \theta_F$. This implies that the efficiency properties will be unaffected by lobbying at all if the share of politically organized residents of both lobby groups is of an equal size.

For the case of $\lambda = 1$, we know that the externality from an increase in the corporate tax rate will already be taken into account by each government. Hence, the term on the left hand side in (2.44) vanishes, since international lobbying serves as an instrument to internalize the fiscal externality. Consequently, lobbying of the residents causes a deviation from the efficient corporate tax policy into the preferred direction of the po-

[22] For $\lambda = 0$, note that $\theta_C \, \partial W_C^i / \partial \tau^i = \theta_C \, n_C \, V'(y) \, dy^i / d\tau^i > 0$ and when we use condition (2.38), we also have $\theta_F \, \partial W_F^i / \partial \tau^i = [(\alpha + \theta_C) \, \theta_F \, n_C \, n_F / \beta] \, \overline{z} \, [d\Pi / d\tau^i] < 0$.

[23] Nevertheless, as long as $2 \, \alpha \, \partial W^j / \partial \tau^i > \theta_C \, \partial W_C^i / \partial \tau^i + \theta_F \, \partial W_F^i / \partial \tau^i$, the corporate tax rate will still be closer to the efficient level than without political influence at all, i.e. $|\tau^* - \widetilde{\tau}| < |\tau^* - \widehat{\tau}|$.

litically stronger group, as shown by the right hand side in (2.44). However, in the case of $\lambda = 1$ this implies that the political opponent of the domestic capital owners becomes stronger as it now consists of the organized shareholders in both jurisdictions.[24]

Proposition 2.2

(a) Suppose that $\lambda = 0$.

(i) If $\alpha\, \partial W^j/\partial \tau^i = \theta_C\, \partial W_C^i/\partial \tau^i + \theta_F\, \partial W_F^i/\partial \tau^i > (<)\, 0$, *the fiscal externalities will be fully internalized due to the political influence of domestic residents.*

(ii) If $\alpha\, \partial W^j/\partial \tau^i > (<)\, \theta_C\, \partial W_C^i/\partial \tau^i + \theta_F\, \partial W_F^i/\partial \tau^i > (<)\, 0$, *lobbying by domestic capital (firm) owners improves the efficiency of corporate taxation, whereas lobbying by the firm (capital) owners pushes corporate taxation even more in the direction of inefficiently low (high) tax rates.*

(iii) If $\theta_C\, \partial W_C^i/\partial \tau^i + \theta_F\, \partial W_F^i/\partial \tau^i > (<)\, \alpha\, \partial W^j/\partial \tau^i > (<)\, 0$, *lobbying by domestic firm (capital) owners improves the efficiency of corporate taxation, whereas political influence of the capital (firm) owners gives rise to inefficiently high (low) tax rates.*

(iv) If $\alpha\, \partial W^j/\partial \tau^i > (<)\, 0 > (<)\, \theta_C\, \partial W_C^i/\partial \tau^i + \theta_F\, \partial W_F^i/\partial \tau^i$, *the overall implications of political influence aggravate the inefficiency in corporate taxation.*

(v) For $\alpha\, \partial W^j/\partial \tau^i = 0$, *the equilibrium corporate tax rates will be inefficently low (high) if* $|\theta_F\, \partial W_F^i/\partial \tau^i| > (<)\, \theta_C\, \partial W_C^i/\partial \tau^i$.

(vi) The efficiency properties of corporate taxation are not affected by political influence if $\theta_C = \theta_F$.

(b) Suppose that $\lambda = 1$. *The equilibrium corporate tax rates will be inefficiently low (high) if* $|\theta_F(\partial W_F^i/\partial \tau^i + \partial W_F^j/\partial \tau^i)| > (<)\, \theta_C\, \partial W_C^i/\partial \tau^i$.

So far, we have analyzed the structure and outcome of the political interaction of governments and special interest groups in terms of the equilibrium corporate tax policy. However, profit shifting and political influence can both be seen as instruments of tax avoiding behavior by a multinational firm. Hence, it seems reasonable to investigate their connection in more detail.

[24] For $\lambda = 1$, note that using the government's first-order condition in (2.38) yields $\theta_F\,[\partial W_F^i/\partial \tau^i + \partial W_F^j/\partial \tau^i] = (\theta_F\, n_C\, n_F)/(\alpha\, n + \theta_F\, n_F)[2\,\alpha\, \overline{z}\, d\Pi/d\tau^i - \theta_C\, V'(y)\, dy^i/d\tau^i] < 0$.

2.5 Profit Shifting and Political Influence

We know from equation (2.4) that profits will only be shifted if the corporate tax rates of the two countries are not equal. Hence, we analyze the connection of profit shifting and lobbying by investigating how profit shifting of the multinational firm is affected by an unilateral increase in the political organization of the lobbies.[25] Using (2.4), we find the comparative statics for a small deviation from the symmetric equilibrium as

$$\frac{d\,\widetilde{s}}{d\,\theta_C^a} = -\frac{d\,\widetilde{s}}{d\,\theta_C^b} = -\frac{n_C}{E\,c}\,V'(y)\,\frac{dy^i}{d\tau^i}, \tag{2.45}$$

$$\frac{d\,\widetilde{s}}{d\,\theta_F^a} = -\frac{d\,\widetilde{s}}{d\,\theta_F^b} = -\frac{n_F}{E\,c}\left[(1-\lambda)\,\overline{z}\,\frac{\partial\Pi}{\partial\tau^i} + V'(y)\left(\frac{dy^i}{d\tau^i} - \lambda\frac{dy^j}{d\tau^i}\right)\right], \tag{2.46}$$

for $E < 0$.[26] Starting from a symmetric equilibrium with initially identical corporate tax rates, a unilateral increase in the political organization of the capital owners in i leads to more profit shifting to the other jurisdiction, as stated by (2.45). This is because the capital owners' lobby seeks to increase the provision of the local public good, since their private income will not be affected. As long as $dy^i/d\tau^i > 0$, this gives rise to a unilateral increase in the jurisdiction's corporate tax rate and thus profit shifting to the other country.

From the comparative static result in (2.41), we know that the provision of the local public good is too high from the perspective of politically organized firm owners. Accordingly, the firm owners lobby for less corporate taxation and profits will be shifted into the country. However, the direction of profit shifting can change when the shareholders of the firm coordinate their interests in an international lobby, i.e. $\lambda = 1$. In that case, we know from (2.38) that each jurisdiction becomes aware of the impact of its corporate tax policy on social welfare and the politically organized firm owners in the other jurisdiction. Accordingly, the effect of a unilateral increase in θ_F^i with respect to the loss in the firm owners' income is the same for two identical jurisdictions. All other things being equal, the associated decline of the corporate tax rates is thus the same as well. In response to this, profit shifting does not react and the first term in (2.46) vanishes for $\lambda = 1$. However, the impact of the jurisdiction's tax rate on the marginal gain from the provision of the local public good in the other jurisdiction is not the same. Whereas $dy^i/d\tau^i$ will be considered in the country in which the orga-

[25] For example, Haufler (1997) considers an unilateral increase in the political weight of a residential group in a two-country model as well.

[26] The derivation of the comparative statics can be found in the Appendix.

nizational degree of the firm owners increases, the impact from profit shifting on the other jurisdiction is given by $dy^j/d\tau^i$. Following (2.46), this implies that profit shifting to the other country increases, if the provision of the public good rises in the original country by more than the magnitude of the positive fiscal externality that is considered in the case of international lobbying and vice versa. Or stated in other words, the non-cooperative governmental behavior will be exploited if the shareholders' domestic lobby groups organize on an international level. Since special interest groups seek to maximize the joint welfare of the politically organized firm owners in both countries, in case of $\lambda = 1$ political influence goes along with the tax avoiding strategy of the multinational firm.

Proposition 2.3
The following statements hold with respect to a small deviation from the symmetric equilibrium.

(a) A unilateral increase in the political organization of the capital owners leads to profit shifting to the other country.

(b) If the firm owners' special interest groups are restricted to influence only national governments, a unilateral increase in its organizational degree leads to profit shifting into the country.

(c) If the firm owners' special interest groups are politically organized on an international level, for $dy^i/d\tau^i > dy^j/d\tau^i$ a unilateral increase in political organization in country i leads to profit shifting to the country j and vice versa.

So far, we have analyzed the outcome of the political interaction between governments and special interest groups in terms of the equilibrium corporate tax rates and profit shifting. However, we have not analyzed how the equilibrium rent in this political game will be distributed between the different actors.

2.6 Profit Shifting and Political Contributions

With respect to the distribution of rents in the political equilibrium, Grossman and Helpman (1994) suggest that the lobbies' contributions are determined by the excess of the special interest groups welfare over a fixed level B_g^i, the associated equilibrium

rent. In our model, this can be written as

$$\varsigma_C^i(\widetilde{\tau}^i, B_C^i; \widetilde{\tau}^j) = \max\left[0, \theta_C^i W_C^i(\widetilde{\tau}^i, \widetilde{\tau}^j) - B_C^i\right], \tag{2.47}$$

$$\varsigma_F^i(\widetilde{\tau}^i, B_F^i; \widetilde{\tau}^j) = \max\left[0, \theta_F^i W_F^i(\widetilde{\tau}^i, \widetilde{\tau}^j) + \lambda\, \theta_F^j W_F^j(\widetilde{\tau}^i, \widetilde{\tau}^j) - B_F^i\right]. \tag{2.48}$$

According to equations (2.47) and (2.48), each lobby seeks to increase B_g^i to its maximum.[27] However, each special interest group can extract rents up to the point where the government is indifferent to neglect political influence from the lobby completely. This can be expressed as

$$\alpha^i W^i(\widetilde{\tau}^i, \widetilde{\tau}^j) + \sum_g \varsigma_g^i(\widetilde{\tau}^i, \widetilde{B}_g^i; \widetilde{\tau}^j) = \alpha^i W^i(\widetilde{\tau}_{-g}^i, \widetilde{\tau}^j) + \varsigma_h^i(\widetilde{\tau}_{-g}^i, \widetilde{B}_h^i; \widetilde{\tau}^j), \tag{2.49}$$

for $g, h \in \{C, F\}$ and $g \neq h$. Of course, for $g = F$, equation (2.49) is a tautological statement of condition *(d)* in Definition 2.2. Since contributions have to be positive, we use (2.47) and (2.48) to rewrite (2.49) as

$$\begin{aligned}\widetilde{\varsigma}_C^i(\widetilde{\tau}^i, \widetilde{B}_C^i; \widetilde{\tau}^j) = {} & \alpha^i\big[W^i(\widetilde{\tau}_{-C}^i, \widetilde{\tau}^j) - W^i(\widetilde{\tau}^i, \widetilde{\tau}^j)\big] + \theta_F^i\big[W_F^i(\widetilde{\tau}_{-C}^i, \widetilde{\tau}^j) - W_F^i(\widetilde{\tau}^i, \widetilde{\tau}^j)\big] \\ & + \lambda\, \theta_F^j\big[W_F^j(\widetilde{\tau}^j, \widetilde{\tau}_{-C}^i) - W_F^j(\widetilde{\tau}^j, \widetilde{\tau}^i)\big],\end{aligned} \tag{2.50}$$

$$\widetilde{\varsigma}_F^i(\widetilde{\tau}^i, \widetilde{B}_F^i; \widetilde{\tau}^j) = \alpha^i\big[W^i(\widetilde{\tau}_{-F}^i, \widetilde{\tau}^j) - W^i(\widetilde{\tau}^i, \widetilde{\tau}^j)\big] + \theta_C^i\big[W_C^i(\widetilde{\tau}_{-F}^i, \widetilde{\tau}^j) - W_C^i(\widetilde{\tau}^i, \widetilde{\tau}^j)\big]. \tag{2.51}$$

Since each special interest group takes the offered schedules of the other politically organized residents as given, equations (2.50) and (2.51) show that each lobby has to compensate the government at least for what it can achieve solely together with the other special interest group in the non-cooperative equilibrium. This implies that the capital owners have to pay for the impact on the welfare of foreign organized shareholders as soon as they are internationally organized. Other things being equal, this increases their equilibrium contributions to the government.

However, profit shifting and lobbying on behalf of the shareholders of a multinational firm can be seen as instruments to avoid taxation. Hence, how are they connected with respect to the equilibrium contributions and thus the distribution of rents in the political equilibrium? In order to answer this question, we analyze the implications of an increase in c on each lobby group's contribution. However, in order to keep things tractable we follow Grossman and Helpman (1994) and Prat and Rustichini (2003) in

[27] Following the approach of Aidt and Hwang (2008), we assume that the international lobby group has an internal mechanism for allocating gains and costs of lobbying.

concentrating on the case of $\alpha^i = 0$ when we proceed to analyze the equilibrium outcome in more detail. In this case, the corporate tax policies are exclusively determined by their impact on the special interest groups' gross welfare. We differentiate equations (2.50) and (2.51) with respect to c and noting (2.38) for country i and j respectively. Employing $\alpha^i = 0$ as a last step we get

$$\begin{aligned}\frac{d\widetilde{\varsigma}_C^i}{dc} = \theta_C^i \frac{\partial W_C^i(\widetilde{\tau}^i, \widetilde{\tau}^j)}{\partial \tau^i}\frac{d\widetilde{\tau}^i}{dc} + \Bigg[\left(1-\lambda^2\right)\theta_F^i \left(\frac{\partial W_F^i(\widetilde{\tau}^i_{-C}, \widetilde{\tau}^j)}{\partial \tau^j} - \frac{\partial W_F^i(\widetilde{\tau}^i, \widetilde{\tau}^j)}{\partial \tau^j} \right) \\ + \lambda\,\theta_C^j \left(\frac{\partial W_C^j(\widetilde{\tau}^j, \widetilde{\tau}^i)}{\partial \tau^j} - \frac{\partial W_C^j(\widetilde{\tau}^j, \widetilde{\tau}^i_{-C})}{\partial \tau^j} \right) \Bigg] \frac{d\widetilde{\tau}^j}{dc},\end{aligned} \tag{2.52}$$

$$\begin{aligned}\frac{d\widetilde{\varsigma}_F^i}{dc} = &\left[\theta_F^i \frac{\partial W_F^i(\widetilde{\tau}^i, \widetilde{\tau}^j)}{\partial \tau^i} + \lambda\,\theta_F^j \frac{\partial W_F^j(\widetilde{\tau}^j, \widetilde{\tau}^i)}{\partial \tau^i} \right] \frac{d\widetilde{\tau}^i}{dc} \\ &+ \theta_C^i \left[\frac{\partial W_C^i(\widetilde{\tau}^i_{-F}, \widetilde{\tau}^j)}{\partial \tau^j} - \frac{\partial W_C^i(\widetilde{\tau}^i, \widetilde{\tau}^j)}{\partial \tau^j} \right] \frac{d\widetilde{\tau}^j}{dc}.\end{aligned} \tag{2.53}$$

According to (2.52) and (2.53), the impact of an increase in c on the equilibrium contributions of each lobby can be divided into two parts. Since $d\widetilde{\tau}^i/dc > 0$, the first terms show that the reaction of the payments are directly related to the impact on a lobby group's gross welfare. The capital owners will thus increase their contributions to the government, whereas the firm owners reduce their payments in equilibrium. However, the tax rate in the other country will rise as well, since the increase in c is symmetrical in the two countries. Since governments can always neglect political influence, we know from (2.50) and (2.51) that lobby g has to compensate its government for what it can achieve together with the other lobby. This is also true for the difference in fiscal externalities from the increase in $d\widetilde{\tau}^j/dc$ that can be related to lobbying of group g in country i, as stated by the second terms in the square brackets of (2.52) and (2.53).[28] Hence, the equilibrium contributions and the distribution of rents changes if the externality is affected by political influence of lobby g.

We begin with the impact on the equilibrium contributions of the capital owners' special interest group. If profit shifting becomes more costly, equation (2.52) shows that the fiscal externality on the shareholders has to be considered only if they are organized on a national level, i.e. $\lambda = 0$. In that case, the impact of $d\widetilde{\tau}^j/dc > 0$ on the gross welfare of organized firm owners in country i has to be compensated by the organized capital owners in the magnitude that is related to their political influence,

[28] Evidence for the impact of lobbying on externalities can be found in Guriev et al. (2010).

as represented by the difference in the fiscal externalities. However, each government already considers the externality on the gross welfare of the firm owners' special interest group in the other country when they are internationally organized. Hence, the first term in square brackets of (2.52) cancels out for $\lambda = 1$ and the externality can be expressed in terms of the difference of the impact on the organized capital owners' gross welfare in country j, as represented by the second line in (2.52). This can be explained as follows. We know from equation (2.40) that the equilibrium tax rate increases when the capital owners influence policy. This implies that the marginal corporate tax rate in jurisdiction j collects more tax revenue when the capital owners in country i engage in political influence. Consequently, corporate taxation is comparably more 'effective' in that respect and the equilibrium tax rate in country j will be higher if the curvature of the function V is not too strong. More precisely, we have $\partial^2 W_C^j / (\partial \tau^j \partial \tau^i) = n_C^j / c \, [V''(y^j) \, dy^j / d\tau^j + V'(y^j)]$, which will be positive for a sufficiently low V''.[29] In this case, $\widetilde{\tau}^i > \widetilde{\tau}^i_{-C}$ implies that the second line in (2.52) is positive. Consequently, corporate taxation in country i becomes comparably more 'effective' as well and the difference in the second line of (2.52) causes a positive effect on country i that can be related to political influence of the domestic capital owners. Of course, this pushes the tax rate in the desired direction of the lobby. The contributions of the capital owners thus increase unambiguously in equilibrium, since this impact on the lobby's gross welfare goes along with the effect of a rise in c on the local corporate tax rate. As we will see, this is not the case for the firm owners' lobby group.

If the costs for profit shifting rise, the second term in square brackets of (2.53) shows an impact on the equilibrium contributions that comes from a similar fiscal externality which can be attributed to the political influence of the shareholders. This externality can be related to the difference in the impact on the organized capital owners' gross welfare, but in a different way. The impact of a rise in c on country j's tax rate implies that more profits will be shifted to jurisdiction i. This constitutes a positive externality on the domestic capital owners. However, equation (2.41) shows that the equilibrium tax rate will be lower if the firm owners influence policy. Accordingly, the positive externality will be smaller in that case. Since this implies a reduction in the welfare of the residing capital owners, the contributions of the politically organized firm owners have to rise in order to compensate the government. Otherwise the government will neglect its political offers completely. More formally, we have $\partial^2 W_C^i / (\partial \tau^j \partial \tau^i) =$

[29] In contrast to our model, Riedel and Runkel (2007) and Nielsen et al. (2010) weight corporate tax revenue by a parameter that reflects the country's marginal cost of public funds. This corresponds to $V''(y^i) = 0$ in our model.

$n_C^i/c\,[V''(y^i)\,dy^i/d\tau^i + V'(y^i)]$. As before, this will be positive for a sufficiently low V''. In this case, $\widetilde{\tau}^i_{-F} > \widetilde{\tau}^i$ implies that the second term in square brackets of (2.53) is positive. Of course, this is in contrast to the impact of $d\widetilde{\tau}^i/dc$ on the gross welfare of the special interest group.

However, what is the implication for the total contributions to the government? In the case of $\alpha^i = 0$, the governments consider only the welfare of the politically organized firm and capital owners. The first terms in (2.52) and (2.53) will thus together be zero due to the government's first-order condition. Following this, the overall political contributions will unambiguously increase when profit shifting becomes more costly. Summarizing, we establish

Proposition 2.4

(a) An international organization of the firm owners increases the contributions of the capital owners in equilibrium.

(b) For $\alpha^i = 0$, an increase in the marginal concealment costs leads to a rise in the overall contributions to the government in equilibrium.

Even if it is useful to investigate the connection of profit shifting and political influence, the assumption of $\alpha^i = 0$ seems rather restrictive, since this implies that governments are only concerned about campaign contributions. However, if $\alpha^i \neq 0$, our argument with respect to an international organization of shareholders will apply, since the government in country i becomes still aware of the impact of $d\widetilde{\tau}^j/dc > 0$ on the organized firm owners' gross welfare in country j. Hence, the negative impact on politically organized shareholders will be considered by the governments in that case as well. However, there are now politically unorganized residents that have to be considered and eventually compensated. This implies that statement (b) of Proposition 2.4 does not hold in general, but an international lobby of the firm owners still neutralizes a negative impact that has to be compensated by the capital owners' lobby in equilibrium.

2.7 Conclusion

In this paper, we analyzed non-cooperative corporate income tax determination in the presence of political influence. Politically organized are the owners of mobile capital and the shareholders of a multinational firm that has the opportunity to shift declared profits between two small open economies. In such a setting, lobbying of the capital

owners unambiguously increases the equilibrium corporate tax rate, since the members bear no loss in private income. In contrast, political influence of the firm owners' reduces corporate tax rates because each government is concerned about the welfare of all residents. As a result, moderate political influence pushes the local corporate tax rates closer to the efficient level if the lobby's desired direction has the same sign as the fiscal externality. Hence, political influence can distort corporate tax rates in a way to mitigate the inefficiencies caused by non-cooperative governmental behavior in corporate taxation.

However, since the income from holding assets of the multinational firm is directly connected to the corporate tax policy of both countries, an international coordination of policy-influencing activities by the firm owners was also considered. This can fundamentally change the connection between profit shifting and political influence. Of course, when the firm owners are restricted to influence only their domestic government, more profits will be declared within its jurisdiction. In contrast, an international lobby group becomes aware of the implications of national corporate taxation on the welfare of organized shareholders in both countries. Hence, the opportunities for profit-reallocation of the multinational firm will be recognized as well. Consequently, strengthened political pressure by the shareholders in one jurisdiction can even increase profit shifting to the other country in that case. Therefore, our results indicate an important link between corporate taxation and profit shifting behavior in the presence of political influence. This carries important tax policy implications, since, beside the well-known inefficiencies due to non-cooperative taxation behavior on an international level, transnational political influence affects the global corporate taxation scheme in a direct way. A reduction in the corporate tax rate can then actually decrease the declared profits of the multinational firm within its jurisdiction if it is caused by political influence on behalf of a multinational firm.

Appendix

A Comparative statics of the equilibrium corporate tax rate

Differentiating equation (2.38) with respect to τ^i, τ^j, δ^i and δ^j, where $\delta^i \in \{\theta_C^i, \theta_F^i, c\}$ and $\delta^j \in \{\theta_C^j, \theta_F^j, c\}$, yields for $i, j \in \{a, b\}$ and $i \neq j$ the matrix equation

$$\begin{bmatrix} \dfrac{\partial \Psi^i}{\partial \tau^i} & \dfrac{\partial \Psi^i}{\partial \tau^j} \\ \dfrac{\partial \Psi^j}{\partial \tau^i} & \dfrac{\partial \Psi^j}{\partial \tau^j} \end{bmatrix} \begin{bmatrix} d\tau^i \\ d\tau^j \end{bmatrix} = \begin{bmatrix} -\dfrac{\partial \Psi^i}{\partial \delta^i} & -\dfrac{\partial \Psi^i}{\partial \delta^j} \\ -\dfrac{\partial \Psi^j}{\partial \delta^i} & -\dfrac{\partial \Psi^j}{\partial \delta^j} \end{bmatrix} \begin{bmatrix} d\delta^i \\ d\delta^j \end{bmatrix}. \tag{2.A.1}$$

For the components on the right hand side of (2.A.1), we get after employing symmetry as a last step

$$\frac{\partial \Psi^i}{\partial \theta_C^i} = n_C\, V'(y) \frac{dy^i}{d\tau^i} \quad ; \quad \frac{\partial \Psi^i}{\partial \theta_C^j} = 0, \tag{2.A.2}$$

$$\frac{\partial \Psi^i}{\partial \theta_F^i} = n_F \left[\overline{z}\, \frac{d\Pi}{d\tau^i} + V'(y) \frac{dy^i}{d\tau^i} \right] \quad ; \quad \frac{\partial \Psi^i}{\partial \theta_F^j} = \lambda\, n_F \left[\overline{z}\, \frac{d\Pi}{d\tau^i} + V'(y) \frac{dy^j}{d\tau^i} \right]. \tag{2.A.3}$$

Noting from (2.4) that $d\widetilde{s}/dc = 0$ in the symmetric equilibrium, we additionally find

$$\frac{\partial \Psi^i}{\partial c} = \left[(\alpha\, n + \theta_F\, n_F)\,(1 - \lambda) + \theta_C\, n_C \right] V'(y) \frac{\tau}{c^2}. \tag{2.A.4}$$

With respect to the matrix on the left hand side of (2.A.1), we know from the stability conditions in Dixit (1986) that its determinant has to be positive, that is

$$\frac{\partial \Psi^i}{\partial \tau^i} \frac{\partial \Psi^j}{\partial \tau^j} - \frac{\partial \Psi^i}{\partial \tau^j} \frac{\partial \Psi^j}{\partial \tau^i} > 0. \tag{2.A.5}$$

With $\partial \Psi^j / \partial \tau^j = \partial \Psi^i / \partial \tau^i$ and $\partial \Psi^j / \partial \tau^i = \partial \Psi^i / \partial \tau^j$ by symmetry, we rewrite (2.A.5) as

$$\underbrace{\left[\frac{\partial \Psi^i}{\partial \tau^i} + \frac{\partial \Psi^i}{\partial \tau^j} \right]}_{:=D} \underbrace{\left[\frac{\partial \Psi^i}{\partial \tau^i} - \frac{\partial \Psi^i}{\partial \tau^j} \right]}_{:=E} > 0. \tag{2.A.6}$$

Since $\partial \Psi^i / \partial \tau^i < 0$ from second-order conditions, the expression in (2.A.6) is only fulfilled for $|\partial \Psi^i / \partial \tau^i| > |\partial \Psi^i / \partial \tau^j|$. Hence, $D < 0$ and $E < 0$ which Dixit (1986) already pointed out as the stability conditions of diagonal dominance in the coefficient matrix.

A.1 The impact of a symmetrical change in political organization

For the impact of a symmetrical increase in the political organization of lobby group g, we set $\delta^i = \theta_g^i$ and $\delta^j = \theta_g^j$. This yields

$$\frac{d\tau}{d\theta_g} = \frac{d\tau^i}{d\theta_g^i} + \frac{d\tau^i}{d\theta_g^j} = -\frac{\dfrac{\partial\Psi^i}{\partial\theta_g^i} + \dfrac{\partial\Psi^i}{\partial\theta_g^j}}{\dfrac{\partial\Psi^i}{\partial\tau^i} + \dfrac{\partial\Psi^i}{\partial\tau^j}}. \tag{2.A.7}$$

The expression on the right hand side of the second equality sign can be found by using Cramer's rule for $d\tau^i/d\theta_g^i$ and $d\tau^i/d\theta_g^j$ and employing afterwards the symmetry assumption. The comparative static results in (2.40) and (2.41) follow then by substituting (2.A.2) and (2.A.3) into (2.A.7).

A.2 The impact of a change in the marginal cost for profit shifting

To investigate the impact of a rise in the marginal cost for profit shifting, we set $\delta^i = c$ and $\delta^j = c$. Since the increase in c is already symmetric in the two countries, we get

$$\frac{d\tau}{dc} = \frac{d\tau^i}{dc} = \frac{d\tau^j}{dc} = -\frac{\dfrac{\partial\Psi^i}{\partial c}}{\dfrac{\partial\Psi^i}{\partial\tau^i} + \dfrac{\partial\Psi^i}{\partial\tau^j}}. \tag{2.A.8}$$

The expression on the right hand side of the last equality sign can be found by using Cramer's rule and employing afterwards the symmetry assumption. The comparative static result in (2.42) follows then by substituting (2.A.4) into (2.A.8).

A.3 The impact of a unilateral change in θ_g^i on profit shifting

Noting (2.4), the impact of an unilateal increase in θ_g^i can be found as

$$\frac{ds}{d\theta_g^a} = \frac{1}{c}\left[\frac{d\tau^a}{d\theta_g^a} - \frac{d\tau^b}{d\theta_g^a}\right] = -\frac{1}{E\,c}\left[\frac{\partial\Psi^a}{\partial\theta_g^a} - \frac{\partial\Psi^b}{\partial\theta_g^a}\right], \tag{2.A.9}$$

$$\frac{ds}{d\theta_g^b} = \frac{1}{c}\left[\frac{d\tau^a}{d\theta_g^b} - \frac{d\tau^b}{d\theta_g^b}\right] = \frac{1}{E\,c}\left[\frac{\partial\Psi^b}{\partial\theta_g^b} - \frac{\partial\Psi^a}{\partial\theta_g^b}\right]. \tag{2.A.10}$$

The expressions on the right hand side of the last equality sign in (2.A.9) and (2.A.10) can be found by using Cramer's rule for $d\tau^i/d\theta_g^i$ and $d\tau^j/d\theta_g^i$, employing afterwards the symmetry assumption and using E from (2.A.6). The results in (2.45) and (2.46) follow then by substituting (2.A.2) and (2.A.3) into (2.A.9) and (2.A.10).

Chapter 3

Formula Apportionment for Sale

3.1 Introduction

Corporate income taxation in the U.S. is based on Formula Apportionment. According to this taxation principle, the overall profit of a multi-regionally operating firm is consolidated in a common tax base and then apportioned to the jurisdictions according to a certain formula that reflects the economic activity of the firm in that region. In order to encourage taxation uniformity, the Multistate Tax Compact in 1967 assessed that three apportionment factors should be used: the relative property, sales and payroll shares of the firm, each with an equal weight in the formula. However, in 1978 the U.S. Supreme Court delegated the determination of the apportionment formula to the state governments. As a result, most U.S. states deviated from the initial formula structure.[1] More precisely, in 2012, only 9 out of the 47 U.S. state authorities with a corporate income tax use a formula with equal weights of the three apportionment factors. As a matter of fact, 25 authorities at least doubled their weight on the sales factor, and the remaining 13 states rely on the relative sales share as only apportionment factor.[2]

In the European Union, the European Commission (2011) facilitates the proposal of a common consolidated tax base with Formula Apportionment on a supranational level. Nevertheless, national governments will still have the authority to decide on corporate tax rates. As initially embodied in U.S. corporate taxation, the suggested apportionment formula for the European Union contains three equally weighted apportionment factors. These are the relative property and sales shares of the multi-regional firm and an apportionment factor that is related to the firms' labor input, subdivided into the relative payroll and employment shares. However, since the implementation of Formula Apportionment has not yet been decided, the proposal can be seen as part of a political process for the reformation of corporate income taxation in the European Union.[3] So why do we observe a deviation from equal weights in the apportionment formula in the U.S., whereas an equally weighted formula structure is discussed for the implementation of Formula Apportionment in the European Union? This is the main question we will investigate in this article.

As pointed out first by McLure (1980) and Mieszkowski and Zodrow (1985), Formula Apportionment essentially transforms the corporate income tax into separate taxes on the factors that are used for the allocation of the tax base. As a result, implicit taxation

[1] See Weiner (2005) and Pinto (2007).

[2] See Federation of Tax Administrators (2012).

[3] Note that a coordination of corporate income taxation in the European Union was already triggered in 2001, e.g. European Commission (2001). See Fuest (2008) for a review with respect to the introduction of Formula Apportionment.

of apportionment factors constitutes a connection between corporate taxation and the income of residents. Based on the core findings in the political economy literature,[4] this link may be important in explaining the structures of apportionment formulas.

We develop a simple model with two jurisdictions that decide on the corporate tax rates as well as the weights of the apportionment factors. Since the income of residents is implicitly affected by the apportionment formula, an incentive to organize into a special interest group in order to influence the tax policy is obvious.[5] This implies a lobbying incentive with respect to the corporate tax rate and the formula weights on the apportionment factors, since both policy instruments are decisive for the effective taxation of corporate profits. In our model, the owners of immobile labor, mobile capital, and the shareholders of a multinational firm are allowed to influence policy. With respect to the decision about the formula weights, we include in a stylized way the actual situation in the U.S. and the proposal from the European Commission (2011). Namely, we distinguish with respect to a centralized and decentralized jurisdictional competence in the formula determination. However, in the U.S. and in the proposal of the European Commission, the corporate tax rates are determined on a decentralized level. Consequently, we analyze the case of a simultaneous non-cooperative governmental behavior with respect to tax rates and the formula weights for the U.S. scenario. In contrast, based on the dynamic common agency approach by Bergemann and Välimäki (2003), we use a sequential lobbying approach to fit the proposal of the European Commission (2011), where a central government chooses the apportionment weights in the first stage and the jurisdictions non-cooperatively decide on corporate tax rates in the second stage.

For a given apportionment formula, the incentive with respect to the equilibrium tax rate is determined for each lobby by a group-specific comparison of the private income loss to the gain from the provision of a local public good. In case of a central formula determination, we then show that the residential group with the comparably larger loss in private income lobbies for lower corporate tax rates in equilibrium. However, with respect to the decision about the structure of the apportionment formula, the implications of political influence are sensitive to the jurisdictional setting. For example, suppose that the possible set of apportionment factors consists of capital and labor or capital and sales. Then, in the decentralized setting, we show that if the governments are solely interested in contributions, capital is only used as an apportionment factor

[4] See for example Persson and Tabellini (2000a) or Grossman and Helpman (2001).

[5] Evidence of political influence on corporate taxation can be found in the recent working papers of Gerard and Ruiz (2009) and Hill et al. (2011).

if the domestic labor owners influence policy. This is because more of the firm's rent will be allocated to workers in equilibrium, since the increase in the capital weight leads to an increase in the firm's regional labor demand. In contrast, lobbying of the firm owners reduces the relative welfare weight of this impact and hence increases the formula weight of the other apportionment factors, as for example the relative sales share of the firms. However, if the apportionment formula is determined on a central level, political influence of the labor owners may decrease the formula weight of capital, whereas the firm owners may lobby for an increase in the capital weight in equilibrium. This is because the central government recognizes that the impact of a change in the relative formula weights is just a regional redistribution and hence is only concerned about the impact of the formula structure on the cross-jurisdictional externality due to the non-cooperative taxation behavior. Consequently, when corporate taxation causes a positive externality on wage income and a negative externality on the shareholder's income, the central government reduces the formula weight of capital on behalf of the organized labor owners, but increases it in response to lobbying by the firm owners, if an increase of the capital weight reduces the equilibrium corporate tax rate. As a result, the lobbying-induced direction of the formula weights can be reversed when a central government becomes aware of the implications for the other jurisdiction.

Our analysis is related to the literature on the efficiency implications of Formula Apportionment. Starting with McLure (1980) and Mieszkowski and Zodrow (1985), these have been investigated by subsequent studies, e.g. Gordon and Wilson (1986), Pethig and Wagener (2007), Kolmar and Wagener (2007), Eichner and Runkel (2008, 2009) or Wildasin (2010). However, all studies take the structure of the apportionment factors as given. An endogenous choice of apportionment factors was first analyzed by Anand and Sansing (2000) and Wellisch (2004). Anand and Sansing (2000) set up a model with one immobile input factor and constant corporate tax rates. They show that importing states have an incentive to increase the apportionment factor on sales, whereas exporting states will increase the apportionment factor that relates to the input that is used for production. Consequently, different apportionment formulas are used in the decentralized equilibrium, even if social welfare will be maximized when all states employ the same formula. Wellisch (2004) restates the conventional wisdom that mobile production factors should not be taxed in a small open economy, even if the taxation principle is Formula Apportionment. In his study, the apportionment factors are mobile capital and immobile labor. The result then follows directly from the implicit tax on the chosen apportionment factors. However, it is derived for a constant return to scale production technology, which of course implies zero profits in equilibrium.

Our model is closest to the recent studies of Pinto (2007) and Runkel and Schjelderup (2011), who both consider a multinational firm that produces with a decreasing returns to scale production technology. As shown by Pinto (2007), if the formula is determined on a regional level and the possible set of apportionment factors consists of capital and sales, relative sales will be the only apportionment factor in equilibrium. However, it should be noted that capital is the only input factor in his model. Moreover, since capital is supplied at a constant interest rate, there is no implicit tax on the income of domestic residents in his analysis. Runkel and Schjelderup (2011) show that a positive weight on capital occurs in equilibrium if workers are considered and the possible set of apportionment factors consist of capital and labor. This is because a positive weight on capital partially shifts the rent of the multinational firm to the labor owners. This may increase overall welfare so that a positive capital weight persists in equilibrium. Moreover, they show that welfare can be improved when the decision on apportionment factors is delegated to the central level.

The studies of Pinto (2007) and Runkel and Schjelderup (2011) offer important insights with respect to the efficiency implications of an endogenous choice of formula weights. However, they do not consider the implications of political influence on corporate tax rates or the equilibrium structure of the apportionment formula. With respect to the observed deviations from the equal weights of the apportionment factors in U.S. corporate taxation and the discussed formula structure for the European Union, this will be the core issue of our analysis.[6]

The remainder of the paper is structured as follows. In Section 3.2, we set up a simple theoretical model. In Section 3.3 and Section 3.4, we investigate how lobbying affects the structure of the apportionment formula in a centralized and decentralized setting. Section 3.5 compares the two settings. Finally, Section 3.6 contains our conclusion.

3.2 The Model

3.2.1 Production

Consider a simple model of two jurisdictions, labeled a and b. The jurisdictions are identical in all respects and constitute together a small part of the world. A representative multinational firm operates a subsidiary in each jurisdiction $i \in \{a, b\}$ and produces a single good which price is normalized to 1. Input factors are capital K^i

[6] However, we do not investigate if a decision should or will be delegated to a supranational level in the presence of lobbying, as for example discussed by Bordignon et al. (2008) or Ruta (2010).

and labor L^i. The production technology is given by $F(K^i, L^i)$, with $F_K, F_L > 0$ and $F_{KK} < 0, F_{LL} < 0$. Furthermore, we assume that the production factors are complements, i.e. $F_{LK} > 0$, and that $F(K^i, L^i)$ exhibits decreasing returns to scale.[7] Capital is assumed to be perfectly mobile and supplied to the firm at a constant per unit cost of $r > 0$. Labor is assumed to be immobile and supplied to the firm at a wage rate of w^i. Consequently, the equilibrium wage rate will be determined by the domestic labor market condition $\overline{L} = L^i$, where $\overline{L}$ denotes the total labor supply in each jurisdiction. Therefore, the gross profit of the multinational firm in i can be written as

$$\pi^i = F(K^i, L^i) - rK^i - w^i L^i. \tag{3.1}$$

Taxable profits may differ from economic profits, e.g. because of depreciation allowances. Hence, we introduce a share $\rho \in [0, 1]$ of the true user costs of capital that can be deducted from the tax base in each jurisdiction.[8] The tax base of the multinational firm in i is then given by

$$\pi_t^i = F(K^i, L^i) - \rho\, rK^i - w^i L^i. \tag{3.2}$$

For convenience, we write the total gross profit of the multinational firm as $\pi^{ab} = \pi^a + \pi^b$ and the consolidated tax base as $\pi_t^{ab} = \pi_t^a + \pi_t^b$.

The multinational firm is taxed according to the Formula Apportionment principle. According to this principle, the share of profits that will be allocated to a jurisdiction for corporate taxation is determined by a certain formula that reflects the economic activity of the firm in that jurisdiction. However, the Multistate Tax Compact (1967) as well as the recent proposal of the European Commission (2011) for a Common Consolidated Corporate Tax Base recommend an equal weight of three apportionment factors. These are the firm's relative capital and sales shares and a third apportionment factor that is related to the firm's domestic employment. Considering a general apportionment formula that contains this three elements, the share of taxable profits γ^i that is apportioned to jurisdiction i is denoted by

$$\begin{aligned} \gamma^i &= m_K^i \frac{K^i}{K^a + K^b} + m_S^i \frac{F(K^i, L^i)}{F(K^a, L^a) + F(K^b, L^b)} + m_P^i \frac{w^i L^i}{w^a L^a + w^b L^b} \\ &= m_K^i\, a_K^i + m_S^i\, a_S^i + m_P^i\, a_P^i. \end{aligned} \tag{3.3}$$

[7] This implies that there is an additional fixed production factor that gives rise to pure profits in equilibrium. For example, this could be taken into account as entrepreneurial services.

[8] See Gordon and Wilson (1986) and Runkel and Schjelderup (2011).

The weight of the factor $q \in \{K, S, P\}$ in the apportionment formula is denoted by m_q^i, where $\sum_q m_q^i = 1$, and the share of factor q is denoted by a_q^i, with $a_q^a + a_q^b = 1$. However, in U.S. corporate taxation the labor apportionment factor consists of the relative payroll shares of the firm, whereas the European Commission (2011) proposes a subdivision into the relative payroll and employment shares of the firm. Nevertheless, we are able to consider the implications of this difference in the structure of apportionment formulas qualitatively, since it is directly related to the wage levels. Consequently, we can focus on the firm's relative employment as the labor-related apportionment factor by occasionally setting $\partial a_P^i / \partial w^i = \partial a_P^i / \partial w^j = 0$.

Let τ^i denote the corporate tax rate of jurisdiction i. Using equations (3.1)-(3.3), the total net profit of the multinational firm can be written as

$$\Pi = \pi^{ab} - \overline{\tau}\, \pi_t^{ab}, \tag{3.4}$$

where

$$\overline{\tau} = \tau^a \gamma^a + \tau^b \gamma^b \tag{3.5}$$

describes the effective tax rate from the perspective of the multinational firm. Taking r and w^i as given, the multinational firm chooses investment (K^i) and labor (L^i) in each jurisdiction in order to maximize (3.4). The first-order conditions are

$$\frac{\partial \Pi}{\partial K^i} = (1-\overline{\tau})\,(F_K - r) - \overline{\tau}\, r(1-\rho) - \frac{\partial \overline{\tau}}{\partial K^i}\, \pi_t^{ab} = 0, \tag{3.6}$$

$$\frac{\partial \Pi}{\partial L^i} = (1-\overline{\tau})\,\left(F_L - w^i\right) - \frac{\partial \overline{\tau}}{\partial L^i}\, \pi_t^{ab} = 0, \tag{3.7}$$

with

$$\frac{\partial \overline{\tau}}{\partial K^i} = (\tau^i m_K^i - \tau^j m_K^j)\frac{\partial a_K^i}{\partial K^i} + (\tau^i m_S^i - \tau^j m_S^j)\frac{\partial a_S^i}{\partial K^i}, \tag{3.8}$$

$$\frac{\partial \overline{\tau}}{\partial L^i} = (\tau^i m_P^i - \tau^j m_P^j)\frac{\partial a_P^i}{\partial L^i} + (\tau^i m_S^i - \tau^j m_S^j)\frac{\partial a_S^i}{\partial L^i}, \tag{3.9}$$

and

$$\frac{\partial a_K^i}{\partial K^i} = \frac{K^j}{[K^i + K^j]^2} > 0 \;;\; \frac{\partial a_P^i}{\partial L^i} = \frac{w^i w^j L^j}{[w^i L^i + w^j L^j]^2} > 0, \tag{3.10}$$

$$\frac{\partial a_S^i}{\partial K^i} = \frac{F_K(K^i, L^i)\; F(K^j, L^j)}{[F(K^i, L^i) + F(K^j, L^j)]^2} > 0 \;;\; \frac{\partial a_S^i}{\partial L^i} = \frac{F_L(K^i, L^i)\; F(K^j, L^j)}{[F(K^i, L^i) + F(K^j, L^j)]^2} > 0, \tag{3.11}$$

for $i, j \in \{a, b\}$, $i \neq j$. The first terms in (3.6) and (3.7) show that the firm chooses capital and labor in a way that each factors' marginal return equates its respective user costs. However, the user costs of capital may only be partially deductible. Consequently, for $\rho < 1$ the definition of the tax base causes a distortion of the firm's investment in jurisdiction i. The last terms containing the derivatives in (3.8) and (3.9) reveal an incentive of the multinational firm to exploit the apportionment formula in order to save tax payments. If the effective tax burden with respect to an apportionment factor q is higher in region i than in region j, i.e. $\tau^i m_q^i > \tau^j m_q^j$, it follows from (3.6) to (3.11) that in response to an inclusion of factor q in the apportionment formula the multinational firm tends to increase its employment of the related input factor in region j. For $\tau^i m_q^i < \tau^j m_q^j$ it will be the other way round. However, sales as an apportionment factor causes an implicit tax on the regional production. As a consequence, the second terms in (3.8) and (3.9) show that both input factors will be adjusted.

The first-order conditions (3.6) and (3.7) together with the two domestic labor market conditions $\overline{L} = L^i$ determine the investment of the multinational firm and the wage rates in the market equilibrium. For the analysis in the next sections, it will be useful to investigate the implications of a change in the local corporate tax system. This includes the corporate tax rate as well as the structure of the apportionment formula, determined by its formula weights. In order to keep things tractable, and to focus on the strategic incentives under political influence, we follow previous studies in concentrating on a symmetric situation with identical tax rates and formula weights, that is $\tau^a = \tau^b = \overline{\tau} = \tau$ and $m_q^a = m_q^b = m_q$. Conducting a comparative static analysis of (3.6) and (3.7) and applying symmetry as a last step, we derive in Appendix A

$$\frac{\partial K^i}{\partial \tau^i} = \frac{1}{(1-\tau)F_{KK}} \left(\sigma + \frac{\partial \gamma^i}{\partial K^i} \pi_t^{ab} \right), \tag{3.12}$$

$$\frac{\partial K^j}{\partial \tau^i} = \frac{1}{(1-\tau)F_{KK}} \left(\sigma - \frac{\partial \gamma^i}{\partial K^i} \pi_t^{ab} \right), \tag{3.13}$$

$$\frac{\partial w^i}{\partial \tau^i} = \frac{1}{(1-\tau)F_{KK}} \left[\left(\sigma + \frac{\partial \gamma^i}{\partial K^i} \pi_t^{ab} \right) F_{LK} - \frac{\partial \gamma^i}{\partial L^i} \pi_t^{ab} F_{KK} \right], \tag{3.14}$$

$$\frac{\partial w^j}{\partial \tau^i} = \frac{1}{(1-\tau)F_{KK}} \left[\left(\sigma - \frac{\partial \gamma^i}{\partial K^i} \pi_t^{ab} \right) F_{LK} + \frac{\partial \gamma^i}{\partial L^i} \pi_t^{ab} F_{KK} \right], \tag{3.15}$$

with $\sigma = [r\,(1-\rho)]\,/\,[2\,(1-\tau)]$, and

$$\frac{\partial \gamma^{\,i}}{\partial K^{\,i}} = m_K \frac{\partial\, a_K^i}{\partial K^{\,i}} + m_S \frac{\partial\, a_S^i}{\partial K^{\,i}} > 0, \tag{3.16}$$

$$\frac{\partial \gamma^{\,i}}{\partial L^{\,i}} = m_P \frac{\partial\, a_P^i}{\partial L^{\,i}} + m_S \frac{\partial\, a_S^i}{\partial L^{\,i}} > 0. \tag{3.17}$$

Following Runkel and Schjelderup (2011), the impact of a unilateral increase in i's corporate tax rate on the optimal investment levels can be decomposed into a tax base effect and a formula effect. If the user costs of capital are not fully deductible, that is $\rho < 1$ and hence $\sigma > 0$, a rise in $\tau^{\,i}$ increases the effective tax on capital. Consequently, investment in both jurisdictions will be reduced by the multinational firm due to the definition of the tax base, as represented by the first term in brackets of (3.12) and (3.13). The formula effect is represented by the second term. The unilateral rise in $\tau^{\,i}$ increases the effective tax burden with respect to the apportionment factors q, as long as they are contained in the formula, i.e. $m_q > 0$. Noting (3.16), the investment decision of the multinational firm exploits the apportionment formula. That is, capital will be reallocated from region i to region j. Accordingly, in order to save tax payments, the share of consolidated profits that is taxed in region i is reduced.

Considering the expressions in (3.14) and (3.15), there is no direct tax base effect on the equilibrium wage levels since labor costs are fully deductible. Nevertheless, as the apportionment factors sales and payroll are related to labor, a unilateral increase in $\tau^{\,i}$ causes a formula effect due to the rise in the effective tax burden as well. Hence, the multinational firm demands less labor in i and more in j, as represented by the second term in the square brackets of (3.14) and (3.15). In addition, the impact of an increase in the tax rate on the firm's investment decision in (3.12) and (3.13) has an aligned effect of the same sign on the equilibrium wage levels. This is because labor and capital are assumed to be complements, i.e. $F_{LK} > 0$. To sum up, equations (3.12)-(3.15) show that a unilateral increase in $\tau^{\,i}$ reduces the equilibrium investment and wage rate in region i. However, as long as the user costs of capital are not fully deductible, the impacts on investment and the wage level in j remain ambiguous.

With respect to a unilateral change in region i's formula weight, we get

$$\frac{dK^{\,i}}{dm_q^i} = \frac{\tau}{(1-\tau)F_{KK}} \left(\sigma + \frac{\partial a_q^i}{\partial K^{\,i}}\, \pi_t^{ab}\right), \tag{3.18}$$

$$\frac{dK^{\,j}}{dm_q^i} = \frac{\tau}{(1-\tau)F_{KK}} \left(\sigma - \frac{\partial a_q^i}{\partial K^{\,i}}\, \pi_t^{ab}\right), \tag{3.19}$$

$$\frac{dw^i}{dm_q^i} = \frac{\tau}{(1-\tau)F_{KK}} \left[\left(\sigma + \frac{\partial a_q^i}{\partial K^i} \pi_t^{ab} \right) F_{LK} - \frac{\partial a_q^i}{\partial L^i} \pi_t^{ab} F_{KK} \right], \tag{3.20}$$

$$\frac{dw^j}{dm_q^i} = \frac{\tau}{(1-\tau)F_{KK}} \left[\left(\sigma - \frac{\partial a_q^i}{\partial K^i} \pi_t^{ab} \right) F_{LK} + \frac{\partial a_q^i}{\partial L^i} \pi_t^{ab} F_{KK} \right], \tag{3.21}$$

noting from (3.3) that $\partial a_P^i / \partial K^i = 0$ and $\partial a_K^i / \partial L^i = 0$. All other things being equal, a rise in m_q^i leads to an increase in the effective tax rate. In response to this, investment in both jurisdictions will be reduced as long as the user costs of capital are not fully deductible, i.e. $\rho < 1$. This is represented by the first term in brackets of (3.18) and (3.19). Furthermore, since the effective tax burden rises with respect to the apportionment factor, the formula will be exploited by reallocating capital from region i to region j. This is reflected by the second term in brackets of (3.18) and (3.19).

Considering the expressions in (3.20) and (3.21), there is no direct effect on the equilibrium wage levels due to the definition of the tax base. However, if the rise in m_q^i corresponds to an apportionment factor that is related to labor, the multinational firm demands less labor in i and more in j, as represented by the second term in the square brackets. Moreover, the impact on the firm's investment in (3.18) and (3.19) still has an aligned effect of the same sign on the equilibrium wage levels.

Since $\sum_q m_q^i = 1$, an increase in m_q^i always goes along with a decrease of the other formula weights. In order to keep things tractable, we focus on two scenarios with respect to the possible structure of the apportionment formula. First, following Runkel and Schjelderup (2011), with capital and payroll as apportionment factors, i.e. $m_S^i = 0$ and $m_K^i + m_P^i = 1$. Second, following Pinto (2007), with capital and sales as apportionment factors, i.e. $m_P^i = 0$ and $m_K^i + m_S^i = 1$. Hence, for $m_S^i = 0$ we have $dm_K^i = -dm_P^i$ and for $m_P^i = 0$ it follows $dm_K^i = -dm_S^i$. From (3.18) to (3.21) we then get

$$\left.\frac{dK^i}{dm_K^i}\right|_{m_S^i=0} = -\left.\frac{dK^j}{dm_K^i}\right|_{m_S^i=0} = \frac{\tau}{(1-\tau)F_{KK}} \frac{\partial a_K^i}{\partial K^i} \pi_t^{ab}, \tag{3.22}$$

$$\left.\frac{dK^i}{dm_K^i}\right|_{m_P^i=0} = -\left.\frac{dK^j}{dm_K^i}\right|_{m_P^i=0} = \frac{\tau}{(1-\tau)F_{KK}} \left(\frac{\partial a_K^i}{\partial K^i} - \frac{\partial a_S^i}{\partial K^i} \right) \pi_t^{ab}, \tag{3.23}$$

$$\left.\frac{dw^i}{dm_K^i}\right|_{m_S^i=0} = -\left.\frac{dw^j}{dm_K^i}\right|_{m_S^i=0} = \frac{\tau}{(1-\tau)F_{KK}} \left(\frac{\partial a_K^i}{\partial K^i} F_{LK} + \frac{\partial a_P^i}{\partial L^i} F_{KK} \right) \pi_t^{ab}, \tag{3.24}$$

$$\left.\frac{dw^i}{dm_K^i}\right|_{m_P^i=0} = -\left.\frac{dw^j}{dm_K^i}\right|_{m_P^i=0} = \frac{\tau}{(1-\tau)F_{KK}} \left[\left(\frac{\partial a_K^i}{\partial K^i} - \frac{\partial a_S^i}{\partial K^i} \right) F_{LK} + \frac{\partial a_S^i}{\partial L^i} F_{KK} \right] \pi_t^{ab}. \tag{3.25}$$

Equations (3.22) and (3.23) show that an increase in region i's relative formula weight on capital leads to a reallocation of capital to region j, that is $dK^i/dm_K^i|_{m_S^i=0} < 0$ and $dK^i/dm_K^i|_{m_P^i=0} < 0$.[9] With respect to the domestic wage rates, the overall redistributional effect depends on the relative strength of two counteracting implications. On the one hand, as $F_{LK} > 0$ the decrease in the local investment reduces the wage rate in region i. On the other hand, the associated decrease in the formula weight that is related to the input factor labor leads to an increase in the demand for labor. As shown by Runkel and Schjelderup (2011), the second effect dominates if the apportionment factor is directly related to the input factor labor. The reason is that more of the economic rent will be allocated to workers because of the decreasing returns to scale production technology. However, if $m_P^i = 0$ the second impact depends on the characteristics of the production function, since the associated decrease in the formula weight of the relative sales share makes the production in region i comparably cheaper. Consequently, $dw^i/dm_K^i|_{m_P^i=0} > 0$ only if the reduction in region i's wage rate due to the reallocation of the firm's investment to region j is overcompensated by the increase in the labor demand that comes from the comparably cheaper production in region i that is caused by the aligned decrease of m_S^i. However, in general we have $dw^i/dm_K^i|_{m_S^i=0} > 0$ whereas the sign of $dw^i/dm_K^i|_{m_P^i=0}$ remains ambiguous.

Finally, note from equations (3.12)-(3.15) and (3.22)-(3.25) that in all formula scenarios the overall impact of a change in the relative weight of capital on the firm's investment and the wage rates is purely redistributive. In contrast, as long as a tax base effect occurs, i.e. $\rho \in [0, 1[$ and thus $\sigma > 0$, there remains a negative impact of the tax rates on the firm's investment and the wage rates in equilibrium. That is

$$\left.\frac{dK^i}{dm_K^i}\right|_{m_S^i=0} + \left.\frac{dK^j}{dm_K^i}\right|_{m_S^i=0} = \left.\frac{dK^i}{dm_K^i}\right|_{m_P^i=0} + \left.\frac{dK^j}{dm_K^i}\right|_{m_P^i=0} = 0, \tag{3.26}$$

$$\left.\frac{dw^i}{dm_K^i}\right|_{m_S^i=0} + \left.\frac{dw^j}{dm_K^i}\right|_{m_S^i=0} = \left.\frac{dw^i}{dm_K^i}\right|_{m_P^i=0} + \left.\frac{dw^j}{dm_K^i}\right|_{m_P^i=0} = 0, \tag{3.27}$$

$$\frac{\partial K^i}{\partial \tau^i} + \frac{\partial K^j}{\partial \tau^i} = \frac{2\sigma}{(1-\tau)F_{KK}}; \qquad \frac{\partial w^i}{\partial \tau^i} + \frac{\partial w^j}{\partial \tau^i} = \frac{2\sigma F_{LK}}{(1-\tau)F_{KK}}. \tag{3.28}$$

[9] For the case of a symmetric equilibrium, note from (3.10) and (3.11) that $\partial a_K^i/\partial K^i - \partial a_S^i/\partial K^i > 0$ if $F(K, L) > F_K K$. This is always fulfilled in the case of a production function with decreasing returns to scale.

3.2.2 Residents

In each jurisdiction, there are n^i immobile residents, divided with respect to their source of income into n_L^i labor owners, n_C^i capital owners and n_F^i shareholders of the multinational firm.[10] They receive income from their endowment of $\overline{l}^i$ units of labor, $\overline{k}^i$ units of capital and $\overline{z}^i$ shares of the multinational enterprise respectively. All n_g^i individuals within group $g \in H = \{L, C, F\}$ are assumed to be homogenous. In each jurisdiction, the total labor force is thus given by $\overline{L}^i = n_L^i \, \overline{l}^i$, the capital supply by $\overline{K}^i = n_C^i \, \overline{k}^i$ and the total ownership share by $\overline{Z}^i = n_F^i \, \overline{z}^i$.[11] All residents are assumed to have identical preferences given by

$$U_g^i(x_g^i, y^i) \;\; = \;\; x_g^i + V(y^i), \tag{3.29}$$

where an individual's consumption of the private good is given by x_g^i, with $x_L^i = w^i \, \overline{l}^i$, $x_C^i = r \, \overline{k}^i$ and $x_F^i = \overline{z}^i \Pi$. The provision of the local public good y^i yields utility $V(y^i)$, with $V' > 0 > V''$. Accordingly, the welfare of residential group g is

$$W_g^i = n_g^i \, U_g^i. \tag{3.30}$$

Using equations (3.29) and (3.30), social welfare in region i can be written as

$$W^i = \sum_g W_g^i = w^i \, \overline{L}^i + r \, \overline{K}^i + \overline{Z}^i \Pi + n^i \, V(y^i). \tag{3.31}$$

We are interested in the implications of political influence on corporate tax rates as well as the structure of the apportionment formula. However, U.S. states are allowed to determine the structure of the apportionment formula regionally, whereas the proposal of the European Commission (2011) implies a determination of the formula at the supranational level. In order to capture both situations, we thus analyze the implications of decentralized and centralized settings with respect to the decision of the formula weights.[12]

[10] Note that $n_L^i + n_C^i + n_F^i = n^i$.

[11] We assume $\overline{Z}^i + \overline{Z}^j = 1$, so the firm is exclusively owned by the shareholders of the two regions.

[12] Note that even if the Multistate Tax Compact (1967) recommends an equal weight of apportionment factors, U.S. state governments can still change its local apportionment formula as well as corporate tax rates. In the proposal of the European Commission (2011), an equal weight of the apportionment factors is discussed for the European Union. However, a central determination of the corporate tax rates is not embedded.

3.3 Decentralized Choice of Formula Weights

When regional governments are allowed to decide on the local corporate tax rates as well as the structure of the apportionment formula, we are interested in the political equilibrium of a three-stage game. In stage 0, the domestic lobbies set their contribution schedules, contingent on the chosen policy instruments in the subsequent stages. In stage one, the regional governments simultaneously choose corporate tax rates and the formula weights. Finally, in the last stage, the firm decides on investment and labor employment, the factor markets clear and consumption takes place. Hence, solving by backward induction implies that governments and lobbies anticipate the behavior of the firm and the labor market adjustments, as already investigated in Section 3.2.1.

Since all individuals in our model have the same preferences, we distinguish residents with respect to the source of income when we intend to analyze the implications of political influence.[13] Following Grossman and Helpman (1994, 1995), we do not investigate the incentives to organize into a lobby group and assume that residents with a common source of income are able to overcome the free-rider problem as first discussed by Olson (1965). More precisely, we henceforth assume that only a share $\theta_g^i \in [0,1]$ of each residential group g is politically organized.[14] Given this, we can analyze the implications of a change in political influence on corporate taxation, since we know from Grossman and Helpman (1994) that no political distortion occurs in equilibrium if all residents are politically organized.[15] Moreover, this is in accordance with Olson (1965) as it comprises in a stylized way his argument that the political organization of residents is closely related to the number of represented individuals. According to his logic, because of free-riding and higher administrative costs, it will get more difficult to coordinate interests when there are more people within the same group.

With respect to the regional governments' decision on corporate tax rates and the formula weights in the decentralized setting, we follow the approach of Grossman and Helpman (1994, 1995). That is, each domestic special interest group offers a contribution function ς_g^i to its domestic government that is not negative or greater than the aggregate income of the lobby and that depends on the policy the government decides upon. Each special interest group does this in a way to maximize the joint welfare of

[13] Lobbying based on the source of income can also be found in Rama and Tabellini (1998).

[14] This can be interpreted as a measure of a residential group's policy-relevant size, as for example used in a similar way by Haufler (1997) or Mitra (1999).

[15] Note that equilibrium welfare is still affected since each residential group has to pay contributions.

its members, net of contributions.[16] This reads

$$\Theta_g^i = \theta_g^i W_g^i(\tau^i, \tau^j, m_q^i, m_q^j) - \varsigma_g^i(\tau^i, m_q^i), \tag{3.32}$$

where $\theta_g^i W_g^i(\tau^i, \tau^j, m_q^i, m_q^j)$ represents the gross welfare of lobby g in region i. Note that the gross welfare depends on the corporate tax rates and the formula weights of both countries. However, we follow Aidt and Hwang (2008) in the notation of the contribution schedules. That is, the offered payments of the special interest groups depend only on the domestic government's policy variables, i.e. $\varsigma_g^i(\tau^i, m_q^i)$. This is because the governments and the lobbies in both jurisdictions are assumed to influence only their domestic government and are not able to observe each other's political interaction. According to Grossman and Helpman (1994, 1995) and Aidt and Hwang (2008), this is reasonable for the case of non-cooperatively chosen policies.[17]

The incumbent governments are assumed to have an implicit objective in being re-elected. Hence, they are concerned about the well-being of its domestic electorate. In any case, electoral competition is expensive, so they value received contributions from the special interest groups that can be used to finance campaign spending.[18] Hence, faced with the contribution schedules, each government seeks to maximize its overall political support. However, since $\sum_q m_q^i = 1$, the government has to take into account that an increase in m_K^i is always accompanied by a decrease in the other formula weights. In order to keep things tractable, we restrict our analysis to two scenarios. If $m_S^i = 0$, we have $m_P^i = 1 - m_K^i$ and the weight of payroll responds to the increase in m_K^i. In contrast, if $m_P^i = 0$, we have $m_S^i = 1 - m_K^i$ and the weight of the apportionment factor sales will be reduced. Accordingly, the government in region i chooses τ^i and m_q^i in order to maximize

$$G^i(\tau^i, \tau^j, m_K^i, m_K^j)|_\circ = \alpha^i W^i(\tau^i, \tau^j, m_K^i, m_K^j)|_\circ + \sum_g \varsigma_g^i(\tau^i, m_K^i)|_\circ, \tag{3.33}$$

where we introduced $|_\circ$ as shortcut for $|_{m_S=0 \vee m_P=0}$, containing the two scenarios with

[16] Evidence on the interdependence of governmental policy and contribution payments can be found in Snyder (1990), Spiller and Liao (2008), Richter et al. (2009) or Chirinko and Wilson (2010). In the case of $g = F$ this implies political influence on behalf of the shareholders of the multinational firm. Evidence on this can be found in the recent working paper of Hill et al. (2011).

[17] If governments negotiate over policies or if governments decide cooperatively, special interest groups will be able to tie their contribution to the policies of both regions. As a result, the offered contribution schedules depend directly on the policies of both jurisdictions. See Grossman and Helpman (1995) or Aidt and Hwang (2008) for more details.

[18] An explicit treatment of an electoral stage can be found in Grossman and Helpman (1996).

respect to the apportionment formula. Equation (3.33) is a weighted sum of social welfare W^i and contributions, where $\alpha^i > 0$ represents the government's valuation of one unit of social welfare relative to political contributions. Since the only source of public income is corporate taxation, the implied budget constraint of each region is given by $y^i = \tau^i \gamma^i \pi_t^{ab}$.

The political interaction in the decentralized setting has the structure of the common-agency game analyzed by Grossman and Helpman (1994, 1995). Following this, the corporate tax policy in equilibrium can be characterized by

Definition 3.1
A set of feasible contribution functions $\{\widetilde{\varsigma}_g^i(\widetilde{\tau}^i, \widetilde{m}_K^i)|_\circ, \widetilde{\varsigma}_g^j(\widetilde{\tau}^j, \widetilde{m}_K^j)|_\circ\}$ *and a set of corporate tax rates and relative formula weights on capital* $\{\widetilde{\tau}^i, \widetilde{\tau}^j, \widetilde{m}_K^i, \widetilde{m}_K^j\}$ *describe for* $i, j \in \{a, b\}$, $i \neq j$ *and* $g \in H = \{L, C, F\}$ *an equilibrium if (a)*

$$\{\tau^i, m_K^i\} = \underset{\tau^i, m_K^i}{\arg\max} \quad \widetilde{G}^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)|_\circ + \sum_g \widetilde{\varsigma}_g^i(\tau^i, m_K^i)|_\circ, \tag{3.34}$$

and (b) for every lobby $g, h \in H = \{L, C, F\}$ *and* $g \neq h$*, a feasible contribution function* $\varsigma_g^i(\tau^i, m_K^i)|_\circ$ *and a set of corporate tax rates and relative formula weights on capital does not exist that (i)*

$$\{\tau^i, m_K^i\} = \underset{\tau^i, m_K^i}{\arg\max} \quad \widetilde{G}^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)|_\circ + \varsigma_g^i(\tau^i, m_K^i)|_\circ + \sum_{H \setminus \{g\}} \widetilde{\varsigma}_h^i(\tau^i, m_K^i)|_\circ, \tag{3.35}$$

and (ii)

$$\begin{aligned} & \theta_g^i W_g^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)|_\circ - \varsigma_g^i(\tau^i, m_K^i)|_\circ \\ > \quad & \theta_g^i W_g^i(\widetilde{\tau}^i, \widetilde{\tau}^j, \widetilde{m}_K^i, \widetilde{m}_K^j)|_\circ - \widetilde{\varsigma}_g^i(\widetilde{\tau}^i, \widetilde{m}_K^i)|_\circ. \end{aligned} \tag{3.36}$$

In Definition 3.1, we introduced the tilde to denote equilibrium values. Condition *(a)* states that the regional governments simultaneously choose the corporate tax rates and the formula weights on capital in order to maximize their overall political support, taking the contribution schedules, the corporate tax rate and the formula weights of the other jurisdiction as given. Condition *(b)* stipulates that in equilibrium no special interest group can improve the net welfare of its members by offering an alternative contribution function, thereby inducing the government to change its policy decisions. If this were the case, a lobby can always offer a new contribution schedule in a way to

induce the government to change the tax rate and the formula weights in the group's favor. Consequently, the lobby can extract rents up to the point where the government remains just indifferent to its initial policy decisions. As a result, the special interest group catches all of the surplus that is generated by the induced policy changes. Of course, it cannot be an equilibrium if such an unexploited opportunity exists for any lobby. Given the above conditions, we know from Grossman and Helpman (1994, 1995) and Bernheim and Whinston (1986a) that the equilibrium policies have to maximize the joint welfare of each special interest group and the government. That is

$$\begin{aligned}\left\{\tau^i, m_K^i\right\} = \underset{\tau^i, m_K^i}{\arg\max} \quad & \theta_g^i \, W_g^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)|_\circ - \widetilde{\varsigma}_g^i(\tau^i, m_K^i)|_\circ \\ & + \alpha^i \, W^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)|_\circ + \sum_g \widetilde{\varsigma}_g^i(\tau^i, m_K^i)|_\circ.\end{aligned} \tag{3.37}$$

The first-order conditions to (3.37) are

$$\begin{aligned}& \theta_g^i \left. \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial \tau^i} \right|_\circ - \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial \tau^i} \right|_\circ \\ & + \alpha^i \left. \frac{\partial W^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial \tau^i} \right|_\circ + \sum_g \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial \tau^i} \right|_\circ = 0,\end{aligned} \tag{3.38}$$

$$\begin{aligned}& \theta_g^i \left. \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial m_K^i} \right|_\circ - \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial m_K^i} \right|_\circ \\ & + \alpha^i \left. \frac{\partial W^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial m_K^i} \right|_\circ + \sum_g \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial m_K^i} \right|_\circ = 0.\end{aligned} \tag{3.39}$$

In addition, the first-order conditions to (3.34) are given by

$$\alpha^i \left. \frac{\partial W^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial \tau^i} \right|_\circ + \sum_g \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial \tau^i} \right|_\circ = 0, \tag{3.40}$$

$$\alpha^i \left. \frac{\partial W^i(\tau^i, \widetilde{\tau}^j, m_K^i, \widetilde{m}_K^j)}{\partial m_K^i} \right|_\circ + \sum_g \left. \frac{\partial \widetilde{\varsigma}_g^i(\tau^i, m_K^i)}{\partial m_K^i} \right|_\circ = 0. \tag{3.41}$$

Since the conditions (3.38)-(3.41) have to be fulfilled simultaneously in a political equilibrium, we insert equations (3.40) and (3.41) into (3.38) and (3.39) respectively. This

gives

$$\left.\frac{\partial \widetilde{\varsigma}_g^{\,i}(\tau^{\,i}, m_K^i)}{\partial \tau^{\,i}}\right|_{\circ} = \theta_g^{\,i} \left.\frac{\partial W_g^{\,i}(\tau^{\,i}, \widetilde{\tau}^{\,j}, m_K^i, \widetilde{m}_K^{\,j})}{\partial \tau^{\,i}}\right|_{\circ}, \tag{3.42}$$

$$\left.\frac{\partial \widetilde{\varsigma}_g^{\,i}(\tau^{\,i}, m_K^i)}{\partial m_K^i}\right|_{\circ} = \theta_g^{\,i} \left.\frac{\partial W_g^{\,i}(\tau^{\,i}, \widetilde{\tau}^{\,j}, m_K^i, \widetilde{m}_K^{\,j})}{\partial m_K^i}\right|_{\circ}. \tag{3.43}$$

Equations (3.42) and (3.43) show that the offered schedules of each special interest group are set in a way that the impact of a small change in the corporate tax rate and the formula weight on the contributions matches the effect on the members' gross welfare. The equilibrium corporate tax rates and formula weights of region i in the decentralized setting can then be characterized by inserting equations (3.42) and (3.43) into (3.40) and (3.41) respectively. This gives

$$\sum_g \left(\alpha^{\,i} + \theta_g^{\,i}\right) \left.\frac{\partial W_g^{\,i}(\tau^{\,i}, \widetilde{\tau}^{\,j}, m_K^i, \widetilde{m}_K^{\,j})}{\partial \tau^{\,i}}\right|_{\circ} = 0, \tag{3.44}$$

$$\sum_g \left(\alpha^{\,i} + \theta_g^{\,i}\right) \left.\frac{\partial W_g^{\,i}(\tau^{\,i}, \widetilde{\tau}^{\,j}, m_K^i, \widetilde{m}_K^{\,j})}{\partial m_K^i}\right|_{\circ} = 0. \tag{3.45}$$

According to (3.44) and (3.45), each residential group receives a higher welfare weight in the maximization of the government. The higher the share of organized residents in a lobby group, the higher is the welfare weight.

3.3.1 Corporate Taxation

In order to get some further insights in the equilibrium tax rate, we follow the literature on corporate tax competition in focusing on a symmetric equilibrium. Noting (3.29) and using the envelope theorem, we take the derivatives of (3.30). Applying symmetry as a final step, the first-order condition in (3.44) can be written as

$$(\alpha + \theta_L)\frac{dw^{\,i}}{d\tau^{\,i}}\overline{L} + (\alpha + \theta_F)\frac{d\Pi}{d\tau^{\,i}}\overline{Z} + \beta\, V'(y)\frac{dy^{\,i}}{d\tau^{\,i}} = 0, \tag{3.46}$$

where $\beta = \alpha\, n + \theta_L\, n_L + \theta_C\, n_C + \theta_F\, n_F$ denotes the overall policy-influenced weight of all domestic residents. In addition we have

$$\frac{d\Pi}{d\tau^i} = -\,\gamma\,\pi_t^{ab} - (1-\tau)\,\overline{L}\left(\frac{dw^i}{d\tau^i} + \frac{dw^j}{d\tau^i}\right), \tag{3.47}$$

$$\begin{aligned}\frac{dy^i}{d\tau^i} = {} & \gamma\,\pi_t^{ab} + \tau\,\pi_t^{ab}\left[\frac{d\gamma^i}{dK^i}\left(\frac{dK^i}{d\tau^i} - \frac{dK^j}{d\tau^i}\right) + \frac{d\gamma^i}{dw^i}\left(\frac{dw^i}{d\tau^i} - \frac{dw^j}{d\tau^i}\right)\right] \\ & + \tau\,\gamma\left[2\,\sigma\left(\frac{dK^i}{d\tau^i} + \frac{dK^j}{d\tau^i}\right) - \overline{L}\left(\frac{dw^i}{d\tau^i} + \frac{dw^j}{d\tau^i}\right)\right].\end{aligned} \tag{3.48}$$

According to equation (3.46), each government increases its corporate tax rate until the marginal gain from the last unit of the public good is outweighed by the induced change in private income of the domestic residents.[19] Concerning the labor owners, we know from (3.14) that $dw^i/d\tau^i < 0$.

Investigating (3.47), we observe two terms relating to the firm owners' income. First, by the part of the consolidated tax base that is allocated for taxation to region i, an increase in τ^i reduces the after-tax profit of the firm. However, we know from (3.28) that the overall wage payments in equilibrium will be reduced if the user costs of capital are not fully deductible, i.e. $\rho \in [0,1[$ and thus $\sigma > 0$. This increases the after-tax profit of the firm. However, in order to keep things tractable, it seems reasonable to assume that the first impact dominates, so that an increase in the corporate tax rate reduces the after-tax profit of the firm and hence the private income of the shareholders.

The impact on the provision of the public good can be divided into three parts. As represented by the first term in equation (3.48), the provision of the public good increases by the part of the consolidated tax base that is allocated to jurisdiction i. Nevertheless, the apportioned tax base will be affected by the increase in τ^i. On the one hand, for a given structure of the apportionment formula, the effective tax burden on the apportionment factors increases. In response to this, the firm reduces the employment of the input factors that are related to the apportionment factors. Consequently, less of the consolidated tax base will be apportioned for taxation to region i.[20] On the other hand, (3.28) shows that an increase in the corporate tax rate reduces total investment and wage payments in equilibrium as long as the user costs of capital are

[19] Note that (3.46) implicitly constitutes government i's reaction function to the other jurisdiction, since they take as given the corporate tax rate and the formula weights from the political interaction with the special interest groups and the government in region j.

[20] Note from (3.16) that $d\gamma^i/dK^i > 0$ and from (3.3) that $d\gamma^i/dw^i = m_P\, da_P^i/dw^i > 0$ in the symmetric equilibrium.

not fully deductible. Hence, the consolidated tax base decreases with the reduction of investment, but raises with the reduction of the wage payments, as represented by the second line in (3.48). However, we focus on an interior solution of the non-cooperative corporate taxation game and assume that in total a rise in the regional corporate tax rate increases the provision of the local public good, i.e. $dy^i/d\tau^i > 0$.

3.3.2 Political Influence and the Apportionment Formula

In order to get some further insights in the equilibrium formula weights, we take the derivatives of (3.30), noting (3.29) and using symmetry as a last step. The first-order condition in (3.45) can then be written as

$$(\alpha + \theta_L)\frac{dw^i}{dm_K^i}\bigg|_\circ \overline{L} + \beta\, V'(y)\frac{dy^i}{m_K^i}\bigg|_\circ = 0. \tag{3.49}$$

Note that $dw^i/dm_K^i|_\circ$ is given by (3.24) and (3.25) respectively. Moreover, we get $dy^i/dm_K^i|_\circ = \tau\,(\partial\gamma^i/\partial m_K^i|_\circ)\,\pi_t^{ab}$.[21] Evaluating this for the two scenarios, we get

$$\begin{aligned}\frac{dy^i}{dm_K^i}\bigg|_{m_S^i=0} = \tau\Bigg[& m_K\frac{\partial a_K^i}{\partial K^i}\left(\frac{\partial K^i}{\partial m_K^i}\bigg|_{m_S^i=0} - \frac{\partial K^j}{\partial m_K^i}\bigg|_{m_S^i=0}\right) \\ & + m_P\frac{\partial a_P^i}{\partial w^i}\left(\frac{\partial w^i}{\partial m_K^i}\bigg|_{m_S^i=0} - \frac{\partial w^j}{\partial m_K^i}\bigg|_{m_S^i=0}\right)\Bigg]\pi_t^{ab},\end{aligned} \tag{3.50}$$

$$\frac{dy^i}{dm_K^i}\bigg|_{m_P^i=0} = \tau\left[\left(m_K\frac{\partial a_K^i}{\partial K^i} + m_S\frac{\partial a_S^i}{\partial K^i}\right)\left(\frac{\partial K^i}{\partial m_K^i}\bigg|_{m_P^i=0} - \frac{\partial K^j}{\partial m_K^i}\bigg|_{m_P^i=0}\right)\right]\pi_t^{ab}. \tag{3.51}$$

Note that the private income of the firm owners is unaffected in the symmetric equilibrium, that is $d\Pi/dm_K^i|_\circ = 0$. This is because the change in the relative formula weight of capital does not cause a tax base effect. Consequently, the firm's overall investment and the wage payments remain the same. Hence, when determined locally, the structure of the apportionment formula is exclusively a matter of the impact on wage income and of the provision of the public good.

Suppose that $m_S^i = 0$ and hence $m_P^i = 1 - m_K^i$. In that case we know from (3.24) that $dw^i/dm_K^i|_{m_S^i=0} > 0$ and, noting (3.26) and (3.27), it additionally follows from (3.50) that in general $dy^i/dm_K^i|_{m_S^i=0}$ is ambiguous. An increase in m_K^i leads to a higher implicit tax on capital. The multinational firm thus reallocates investment to the other

[21] The derivation can be found in Appendix B

jurisdiction, thereby reducing the share of the apportioned tax base. This will be counteracted by a reduction in the associated weight on the apportionment factor that relates to the input factor labor. The reallocation of the firm's rent thus leads to an increase in the relative payroll share that may even be large enough to increase the overall apportioned share of the tax base, as stated by (3.50). However, whereas the overall impact is thus sensitive with respect to the reaction on the apportioned share of the tax base, when we evaluate (3.49) at $m_K^i = 0$ we have $dw^i/dm_K^i|_{m_S^i=0 \wedge m_K^i=0} > 0$ and $dy^i/dm_K^i|_{m_S^i=0 \wedge m_K^i=0} > 0$ for the case of capital and payroll as apportionment factors and $dw^i/dm_K^i|_{m_S^i=0 \wedge m_K^i=0} > 0$ and $dy^i/dm_K^i|_{m_S^i=0 \wedge m_K^i=0} = 0$ for an apportionment formula that contains capital and labor.[22] Consequently, the sum of the two decisive components in (3.49) is unambiguously positive and we can conclude that the equilibrium formula will contain mobile capital as an apportionment factor as long as a regional government is interested in social welfare, i.e. $\alpha > 0$.[23] Hence, we set $\alpha = 0$ in order to focus on the implications for the structure of the apportionment formula due to political influence.[24] All other things being equal, equation (3.49) shows that lobbying by the labor owners implies a higher weight of capital, since in that case the positive impact on wage income receives a higher weight in the governments maximization. In contrast, political influence by the firm owners implies a lower weight of the positive wage impact in the governments maximization.[25] Moreover, without lobbying by the labor owners, mobile capital will not be contained in the equilibrium formula if the set of apportionment factors consists of capital and labor. An allocation of the consolidated tax base according to the relative labor share alone is thus a possible solution in the political equilibrium. In contrast, for capital and payroll as possible apportionment factors we have $dy^i/dm_K^i|_{m_S^i=0 \wedge m_K^i=0} > 0$ and mobile capital will thus be contained in the apportionment formula even if the regional governments are only interested in political contributions.

Now suppose that the set of possible apportionment factors consists of capital and sales, i.e. $m_P^i = 0$ and thus $m_S^i = 1 - m_K^i$. When we evaluate (3.49) at $m_K^i = 0$ we see from (3.25) that $dw^i/dm_K^i|_{m_P^i=0 \wedge m_K^i=0}$ remains ambiguous but, noting (3.26) and (3.27), it

[22] Recall that we are able to investigate relative labor as an apportionment factor by setting $\partial a_P^i/\partial w^i = \partial a_P^i/\partial w^j = 0$.

[23] See Runkel and Schjelderup (2011) for the same result when capital and labor are used as apportionment factors.

[24] In order to investigate the equilibrium policy, this is common in the literature on political influence, as for example used by Grossman and Helpman (1994) or Prat and Rustichini (2003) as well.

[25] This is true even if $\alpha > 0$. The relative weight of the impact on wage income in the government's maximization is given by $(\alpha + \theta_L)/\beta$. It is straightforward to show that this rises with an increase in θ_L and declines with a rise in θ_F, even if $\theta_L = 0$ initially.

follows from (3.51) that $dy^i/dm_K^i|_{m_P^i=0 \wedge m_K^i=0} < 0$. Equation (3.49) then shows that mobile capital can only be contained in the apportionment formula in jurisdiction i if $dw^i/dm_K^i|_{m_P^i=0 \wedge m_K^i=0} > 0$. In this case the reduction in i's wage rate due to the reallocation of the firm's investment to jurisdiction j will be overcompensated by the increase in the labor demand that comes from the comparably cheaper production in i due to the corresponding decrease of m_S^i. Moreover, the impact on the share of the apportioned tax base will be negative in this scenario. This is because the reallocation of the firm's investment to the jurisdiction j will only be dampened, but not neutralized, when the associated weight of sales decreases in response to the increase of m_K^i in the apportionment formula. Of course, since payroll is not contained as an apportionment factor, in this scenario the described implications for the wage rate do not affect the overall impact on the share of apportioned profits. As a consequence, the sum of the two decisive components in (3.49) is ambiguous and the equilibrium formula may or may not contain mobile capital as an apportionment factor as long as $\alpha > 0$. However, if a regional government is only interested in political contributions, i.e. $\alpha = 0$, equation (3.49) shows that mobile capital will definitely not be contained in the equilibrium apportionment formula if the domestic labor owners are not politically organized. In that case only the clear cut negative impact on the provision of the regional public good remains and the equilibrium apportionment formula contains only the relative sales share in the political equilibrium. Summarizing, we establish:

Proposition 3.1
For the case of regionally determined formula weights under political influence, the following statements hold with respect to the equilibrium apportionment formula.

(a) If social welfare is part of the government's objective function, mobile capital will be contained in the apportionment formula if the set of apportionment factors consists of capital and payroll or capital and labor. Mobile capital may or may not be contained in the equilibrium apportionment formula if the possible apportionment factors are capital and sales.

(b) Suppose that the regional government is only concerned about political contributions. If the set of possible apportionment factors consists of capital and payroll, mobile capital will be contained in the apportionment formula.

(c) Suppose that the regional government is only concerned about political contributions. If the set of possible apportionment factors consists of capital and labor or capital and sales, mobile capital will only be contained in the apportionment formula if the labor owners are politically organized.

Note that *(a)* differs from the result of Pinto (2007). In the case of capital and sales as possible apportionment factors, he shows that regional governments always reduce the weight on mobile capital to zero. However, since capital is the only production factor in his model, there is, from a welfare perspective, no reason to increase the formula weight of capital. Accordingly, his result persists in our more general framework for sure only if the associated special interest group of the labor owners refrains from political influence and if the government does not care about the well-being of the domestic electorate, as implied by condition *(c)*. Moreover, if $dw^i/dm_K^i|_{m_P^i=0 \wedge m_K^i=0} > 0$, in our model, political influence by the labor owners implies a higher weight of capital, since, all other things being equal, the positive impact on wage income receives a higher relative welfare weight in the governments maximization. Accordingly, political influence by the firm owners implies a lower relative welfare weight of the positive wage impact in the maximization of regional governments and hence a higher weight on the sales factor in equilibrium.

Runkel and Schjelderup (2011) show that mobile capital should be included in the equilibrium apportionment formula due to efficiency reasons. As a consequence, their result with respect to capital and labor as apportionment factors carries over to our model as long as the regional governments are concerned about social welfare, as shown by condition *(a)*. However, focusing on the implications from political influence in the case of $\alpha = 0$, condition *(c)* shows that their result only persists in our framework for sure if the labor owners are politically organized.

Our results in this section suggest that lobbying in particular on behalf of the domestic labor and firm owners seem to play an important role when it comes to the political determination of an apportionment formula. However, since the proposal of the European Commission (2011) implies a determination at the supranational level, we will now investigate the choice of apportionment factors in a centralized setting.

3.4 Centralized Choice of Formula Weights

When the structure of the apportionment formula is determined on a central level, whereas regional governments are allowed to decide on its regional corporate tax rate, we are interested in the political equilibrium of a four-stage game. In stage 0, the domestic lobbies simultaneously set their contribution schedules, contingent on the chosen policy instruments in the subsequent stages. In stage one, the central government

determines the structure of the apportionment formula in both jurisdictions. In the second stage, the regional governments choose corporate tax rates non-cooperatively. Finally, in the last stage, the firm decides on investment and labor employment, the factor markets clear and consumption takes place. Hence, solving by backward induction implies that governments and lobbies anticipate the behavior of the firm and the labor market adjustments, as already investigated in Section 3.2.1.

3.4.1 Corporate Taxation and Political Influence

With respect to the governments' decision on corporate tax rates in stage 2, we follow the approaches of Grossman and Helpman (1994, 1995) and Bergemann and Välimäki (2003). That is, each lobby offers a contribution function $\varsigma^i_{g,2}$ to its domestic government that is not negative or greater than the aggregate income of the lobby and that depends on the policy the government decides upon in this stage. This reads

$$\Theta^i_{g,2} = \theta^i_g W^i_g(\tau^i, \tau^j) - \varsigma^i_{g,2}(\tau^i). \tag{3.52}$$

Note that the gross welfare depends on the corporate tax rates of both countries. However, as before we follow Aidt and Hwang (2008) in the notation of the contribution schedules. That is, the offered payments of the lobbies in stage 2 depend only on the domestic government's tax rate, i.e. $\varsigma^i_{g,2}(\tau^i)$.

Given the implicit objective in being reelected, the regional governments choose their corporate tax rates in order to maximize their overall political support

$$G^i_2(\tau^i, \tau^j) = \alpha^i W^i(\tau^i, \tau^j) + \sum_g \varsigma^i_{g,2}(\tau^i). \tag{3.53}$$

The political interaction in stage 2 has the structure of the common-agency game analyzed by Grossman and Helpman (1994, 1995). Following this, the corporate tax policy in equilibrium is characterized by

Definition 3.2
A set of contribution functions $\{\widetilde{\varsigma}^i_{g,2}(\widetilde{\tau}^i), \widetilde{\varsigma}^j_{g,2}(\widetilde{\tau}^j)\}$ *and a set of corporate tax rates* $\{\widetilde{\tau}^i, \widetilde{\tau}^j\}$ *describe for* $i, j \in \{a, b\}$, $i \neq j$ *and* $g \in H = \{L, C, F\}$ *an equilibrium if (a)*

$$\widetilde{\tau}^i \quad = \quad \arg\max_{\tau^i} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \sum_g \widetilde{\varsigma}^i_{g,2}(\tau^i), \tag{3.54}$$

and (b) for every organized special interest group $g, h \in H = \{L, C, F\}$ and $g \neq h$, a contribution function $\varsigma^i_{g,2}(\tau^i)$ and a corporate tax rate does not exist that (i)

$$\widetilde{\tau}^i \;=\; \underset{\tau^i}{\arg\max} \quad \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \varsigma^i_{g,2}(\tau^i) + \sum_{H\setminus\{g\}} \widetilde{\varsigma}^i_{h,2}(\tau^i), \tag{3.55}$$

and (ii)

$$\theta^i_g W^i_g(\tau^i, \widetilde{\tau}^j) - \varsigma^i_{g,2}(\tau^i) \;>\; \theta^i_g W^i_g(\widetilde{\tau}^i, \widetilde{\tau}^j) - \widetilde{\varsigma}^i_{g,2}(\widetilde{\tau}^i). \tag{3.56}$$

Condition *(a)* states that the regional government taxes corporate profits in order to maximize its overall political support, taking the contribution schedules and the corporate tax rate of the other jurisdiction as given. Condition *(b)* stipulates that in equilibrium no special interest group can improve the net welfare of its members by offering an alternative contribution function, which induces the government to change its corporate tax rate in the group's favor. We then know from Grossman and Helpman (1994, 1995) and Bernheim and Whinston (1986a) that the equilibrium corporate tax rate has to maximize the joint welfare of each special interest group and the government. That is

$$\widetilde{\tau}^i \;=\; \underset{\tau^i}{\arg\max} \quad \theta^i_g W^i_g(\tau^i, \widetilde{\tau}^j) - \widetilde{\varsigma}^i_{g,2}(\tau^i) + \alpha^i W^i(\tau^i, \widetilde{\tau}^j) + \sum_g \widetilde{\varsigma}^i_{g,2}(\tau^i). \tag{3.57}$$

The first-order condition to (3.57) is given by

$$\theta^i_g \frac{\partial W^i_g(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} - \frac{\partial \widetilde{\varsigma}^i_{g,2}(\tau^i)}{\partial \tau^i} + \alpha^i \frac{\partial W^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \sum_g \frac{\partial \widetilde{\varsigma}^i_{g,2}(\tau^i)}{\partial \tau^i} = 0. \tag{3.58}$$

In addition, the first-order condition according to equation (3.54) reads

$$\alpha^i \frac{\partial W^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} + \sum_g \frac{\partial \widetilde{\varsigma}^i_{g,2}(\tau^i)}{\partial \tau^i} = 0. \tag{3.59}$$

That is, each government chooses its tax rate to equate the marginal welfare change to the sum of marginal contributions received. Since conditions (3.58) and (3.59) have to be fulfilled simultaneously in equilibrium, we insert (3.59) into (3.58). This yields

$$\frac{\partial \widetilde{\varsigma}^i_{g,2}(\tau^i)}{\partial \tau^i} = \theta^i_g \frac{\partial W^i_g(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i}. \tag{3.60}$$

Equation (3.60) reveals that the offered contribution schedules are set in a way that the

marginal change in the contribution matches its marginal effect on the lobby members' gross welfare. Or stated in the words of Dixit et al. (1997, p. 759.), "the shape of the payment schedule mirrors the shape of the principal's indifference surface". The equilibrium corporate tax rate of region i can then be characterized by substituting (3.60) into (3.59). This gives

$$\Psi_2^i := \sum_g \left[\alpha^i + \theta_g^i\right] \frac{\partial W_g^i(\tau^i, \widetilde{\tau}^j)}{\partial \tau^i} = 0. \tag{3.61}$$

Condition (3.61) shows that each residential group receives in equilibrium a larger policy-relevant welfare weight on behalf of the organized members.

In order to investigate the implications of political influence on corporate tax rates in more detail, we take the derivatives of (3.30). Noting equation (3.29) and using the envelope theorem, the first-order condition of the government in region i is obviously similar to (3.46)-(3.48). The reason is that even in case of a central determination of formula weights, the corporate tax rates are determined by the regional governments. Consequently, our interpretation with respect to the equilibrium tax rates in Section 3.3.1 applies here as well. Accordingly, each government increases its corporate tax rate until the marginal gain from the last unit of the public good is outweighed by the induced change in private income of the domestic residents. However, since there is no decision about the formula weights at this stage, we are now able to investigate how a change in political influence affects the corporate tax rates in the centralized setting. Conducting a comparative static analysis, we get for a symmetric change in the lobbies' degree of political organization in both jurisdictions

$$\frac{d\tau}{d\theta_L} = -\frac{n_L}{D}\left(\frac{dw^i}{d\tau^i}\bar{l} + V'(y)\frac{dy^i}{d\tau^i}\right), \tag{3.62}$$

$$\frac{d\tau}{d\theta_C} = -\frac{n_C}{D}V'(y)\frac{dy^i}{d\tau^i}, \tag{3.63}$$

$$\frac{d\tau}{d\theta_F} = -\frac{n_F}{D}\left(\frac{d\Pi}{d\tau^i}\,\overline{z} + V'(y)\frac{dy^i}{d\tau^i}\right), \tag{3.64}$$

after applying the symmetry property as a last step.[26] Since $D < 0$, we establish:

[26] The derivations of the comparative statics are given in Appendix C.

Proposition 3.2
For the case of a central determination of the formula weights under political influence, the following statements hold with respect to the equilibrium corporate tax rates.

(a) An increase in political organization of the capital owners leads to a higher corporate tax rate in equilibrium.

(b) An increase in political organization of the labor (firm) owners leads to a higher (lower) corporate tax rate in equilibrium if $|d\Pi/d\tau^i| > V'(y)dy^i/d\tau^i > |dw^i/d\tau^i|$.

According to equations (3.62)-(3.64), the equilibrium corporate tax rate will not be affected by an increase in the political organization of lobby group g, if it was already chosen optimally from the special interest groups' point of view. This is because each group values consumption of the private and the public good. Hence, the terms in brackets cancel out when the tax-induced change in the group members' private income matches their marginal utility from the last unit of the public good.[27] However, $r = const.$ implies that there occurs no loss in the private income of the capital owners. Consequently, they will always lobby for an increase in the corporate tax rate, as stated by (3.63). Concerning the labor and firm owners, the desired direction of political influence depends on the group-specific benefits and costs of lobbying. This is because both residential groups' income is affected by corporate taxation. Hence, the special interest group that bears the higher marginal loss in private income, relative to its group-specific marginal gain from the increased public good supply, will lobby for a lower corporate tax rate in equilibrium. It will be the other way round for the lobby that bears the comparably lower loss in private income.

Before we analyze how the central government chooses the formula weights in stage one, it will be useful to know more about the impact of a change in the relative formula weights on the equilibrium corporate tax rate. For a symmetrical increase in the relative formula weight on capital in both jurisdictions, we derive the comparative static effect in Appendix C.[28] The result is

$$\left.\frac{d\tau}{dm_K}\right|_{\circ} = -\frac{1}{D}\left[(\alpha+\theta_L)\left.\frac{\partial^2 w^i}{\partial\tau^i\partial m_K}\right|_{\circ}\overline{L} + \beta\, V'(y)\,\tau\left.\frac{\partial^2\gamma^i}{\partial\tau^i\partial m_K}\right|_{\circ}\pi_t^{ab}\right]. \tag{3.65}$$

Since there is no tax base effect, a change in the relative formula weight on capital is only redistributive. Consequently, in that respect the overall investment and total

[27] This corresponds to a group-specific Samuelson-Condition in the provision of the public good.

[28] Recall that we introduced $|_{\circ}$ as a shortcut for $|_{m_S=0\,\vee\, m_P=0}$.

wage payments are unaffected by a variation in the formula weights. This implies that the after-tax profit of the multinational firm will be the same as well. Hence, the overall implication in equation (3.65) comes solely from a change in the marginal effects of the corporate tax rate on the domestic wage income and the provision of the public good. Unfortunately, equation (3.65) cannot be signed in general, because it crucially depends on the implications from the change in the relative formula weight on capital and on the magnitude of these two components. Nevertheless, it will be useful to evaluate the expression in the subsequent sections.

3.4.2 Political Influence and the Apportionment Formula

In order to investigate the impact of political influence on the structure of the apportionment formula, we first have to define the objective function of the special interest groups at stage 1. Consequently, we need to determine the equilibrium contributions to the regional governments in order to get the rent of each special interest group in stage 2. Following the apporach of Grossman and Helpman (1994, 1995), the contributions offered by lobby g to the government in region i in the political equilibrium are given by

$$\varsigma^i_{g,2}(\widetilde{\tau}^i, B^i_{g,2}) = \max\left[0, \theta^i_g\, W^i_g(\widetilde{\tau}^i, \widetilde{\tau}^j) - B^i_{g,2}\right]. \tag{3.66}$$

According to equation (3.66), each special interest group contributes the surplus of the lobby's welfare relative to some fixed value $B^i_{g,2}$ to its domestic government. Hence, $B^i_{g,2}$ represents the equilibrium rent of special interest group g in stage 2. Of course, each lobby wishes to increase $B^i_{g,2}$ to its maximum. However, they can extract rents only up to the point where the government is indifferent to neglect political influence from the lobby completely. For $g, h \in H = \{L, C, F\}$ and $g \neq h$, this indifference can be expressed as

$$\alpha^i\, W^i(\widetilde{\tau}^i, \widetilde{\tau}^j) + \sum_g \varsigma^i_{g,2}(\widetilde{\tau}^i, \widetilde{B}^i_{g,2}) = \alpha^i\, W^i(\widetilde{\tau}^i_{-g}, \widetilde{\tau}^j) + \sum_{H\setminus\{g\}} \varsigma^i_{h,2}(\widetilde{\tau}^i_{-g}, \widetilde{B}^i_{h,2}). \tag{3.67}$$

In equation (3.67), we introduced $\widetilde{\tau}^i_{-g}$ as determined by

$$\widetilde{\tau}^i_{-g} \;=\; \arg\max_{\tau^i} \quad \alpha^i\, W^i(\tau^i, \widetilde{\tau}^j) + \sum_{H\setminus\{g\}} \widetilde{\varsigma}^i_{h,2}(\tau^i). \tag{3.68}$$

Assuming positive equilibrium contributions, we use (3.66) to rewrite (3.67) as

$$\widetilde{\varsigma}^{i}_{g,2}(\widetilde{\tau}^{i},\widetilde{B}^{i}_{g,2}) = \alpha^{i}\big[W^{i}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j}) - W^{i}(\widetilde{\tau}^{i},\widetilde{\tau}^{j})\big] + \sum_{H\setminus\{g\}} \theta^{i}_{h}\big[W^{i}_{h}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j}) - W^{i}_{h}(\widetilde{\tau}^{i},\widetilde{\tau}^{j})\big]. \quad (3.69)$$

Since each special interest group takes the offered schedules of the other politically organized residents as given, condition (3.69) states that each lobby has to compensate its government for what it can achieve solely together with the other lobby in the non-cooperative equilibrium. Using equation (3.66), the rent of lobby g in the political equilibrium of stage 2 can be written as

$$\widetilde{B}^{i}_{g,2} = \alpha^{i} W^{i}(\widetilde{\tau}^{i},\widetilde{\tau}^{j}) + \sum_{g} \theta^{i}_{g} W^{i}_{g}(\widetilde{\tau}^{i},\widetilde{\tau}^{j}) - \left[\alpha^{i} W^{i}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j}) + \sum_{H\setminus\{g\}} \theta^{i}_{h} W^{i}_{h}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j})\right]. \quad (3.70)$$

Equation (3.70) implies that in equilibrium a small change in the regional corporate tax rate does not affect $\widetilde{B}^{i}_{g,2}$. This can be seen when differentiating (3.70) with respect to τ^{i}, given by

$$\begin{aligned} \frac{\partial \widetilde{B}^{i}_{g,2}}{\partial \tau^{i}} &= \alpha^{i} \frac{\partial W^{i}(\widetilde{\tau}^{i},\widetilde{\tau}^{j})}{\partial \tau^{i}} + \sum_{g} \theta^{i}_{g} \frac{\partial W^{i}_{g}(\widetilde{\tau}^{i},\widetilde{\tau}^{j})}{\partial \tau^{i}} \\ &\quad - \left[\alpha^{i} \frac{\partial W^{i}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j})}{\partial \tau^{i}} + \sum_{H\setminus\{g\}} \theta^{i}_{h} \frac{\partial W^{i}_{h}(\widetilde{\tau}^{i}_{-g},\widetilde{\tau}^{j})}{\partial \tau^{i}}\right] = 0. \end{aligned} \quad (3.71)$$

The first and the second term form together the first-order condition in (3.61). Moreover, noting (3.60), the first-order condition to (3.68) implies that the second term in square brackets are together zero. When it comes to the decision about the structure of the apportionment formula, recall from equation (3.65) that the equilibrium corporate tax rates will generally be affected. Equation (3.71) thus shows that when the formula weights are chosen by the governments, an indirect effect on $\widetilde{B}^{i}_{g,2}$ via an impact on τ^{i} does not occur in equilibrium. Nevertheless, $\widetilde{B}^{i}_{g,2}$ depends directly on the regional structure of the apportionment formula in place.

With respect to the decision about the structure of the apportionment formula on the centralized level, we follow the approach of Aidt and Hwang (2008) in assuming that the overall electorate and the decisive government on the central level consist of the residents and the politicians of the two jurisdictions, for example, due to delegation of politicians to the central government. Consequently, the special interest groups in the two jurisdictions will be able to tie their contributions to both policy instruments

that are chosen by the central government. That is, the offered contribution schedule of each lobby g depends directly on the relative formula weights on capital in both jurisdictions, i.e. $\varsigma^i_{g,1}(m^i_q, m^j_q)$. The objective of lobby g in region i for the case of a centralized decision at stage 1 is thus given by

$$\Theta^i_{g,1} = \widetilde{B}^i_{g,2}(m^i_q, m^j_q) - \varsigma^i_{g,1}(m^i_q, m^j_q). \tag{3.72}$$

Hence, we follow the approach of Bergemann and Välimäki (2003) in defining the equilibrium rent in stage 2 as the gross payoff when it comes to the decision about the formula weights in stage 1.

However, it seems reasonable to assume that the objective of the governments does not change with the choice of the policy variable. Therefore, it still seeks to maximize its overall political support when it comes to the decision about the formula weights. As before, since $\sum_q m^i_q = 1$, the central government has to take into account that an increase in m^i_K is always accompanied by a decrease in the other formula weights.[29] Furthermore, with respect to the political interaction of lobby groups and the central government, it is assumed that each special interest group cannot observe the political offers of the other lobbies. Taking the contribution schedules as given, the central government chooses the relative formula weights of capital in both jurisdictions, that is m^i_K and m^j_K, in order to maximize

$$\begin{aligned} G^{ij}_1(m^i_K, m^j_K)|_\circ = \widetilde{G}^i_2(m^i_K, m^j_K)|_\circ + \sum_g \varsigma^i_{g,1}(m^i_K, m^j_K)|_\circ \\ + \widetilde{G}^j_2(m^j_K, m^i_K)|_\circ + \sum_g \varsigma^j_{g,1}(m^j_K, m^i_K)|_\circ. \end{aligned} \tag{3.73}$$

In equation (3.73), we introduced $\widetilde{G}^i_2(m^i_K, m^j_K)|_\circ = \alpha^i \widetilde{W}^i(m^i_K, m^j_K)|_\circ + \sum_g \widetilde{\varsigma}^i_{g,2}(\widetilde{\tau}^i)|_\circ$ as the government's overall political support in the equilibrium of stage 2, where $\widetilde{W}^i(m^i_K, m^j_K)|_\circ = \sum_g \widetilde{W}^i_g(m^i_K, m^j_K)|_\circ$ denotes the equilibrium social welfare level with $\widetilde{W}^i_g(m^i_K, m^j_K)|_\circ = W^i_g(\widetilde{\tau}^i, \widetilde{\tau}^j)$ defined as the equilibrium welfare level of residential group g. Note that the central government thus takes into account how a change in the structure of the apportionment formula affects the subsequent payoff of the regional governments in both jurisdictions, as well as the contributions received at this stage. Since the central government thus recognizes the impact on equilibrium continuation payoffs, we know from Bergemann and Välimäki (2003) that a equilibrium at this stage

[29] Recall that we introduced $|_\circ$ as a shortcut for $|_{m_S=0 \vee m_P=0}$.

can be found by using a straightforward application of Definition 3.2.[30] That is

Definition 3.3
A set of feasible contribution functions $\left\{\widetilde{\varsigma}^i_{g,1}(\widetilde{m}^i_K, \widetilde{m}^j_K)|_\circ, \widetilde{\varsigma}^j_{g,1}(\widetilde{m}^j_K, \widetilde{m}^i_K)|_\circ\right\}$ *and a set of relative formula weights on capital* $\left\{\widetilde{m}^i_K, \widetilde{m}^j_K\right\}$ *describe for* $i, j \in \{a, b\}$, $i \neq j$ *and* $g \in H = \{L, C, F\}$ *an equilibrium if (a)*

$$\begin{aligned}\left\{m^i_K, m^j_K\right\} = \underset{m^i_K, m^j_K}{\arg\max} \quad & \widetilde{G}^i_2(m^i_K, m^j_K)|_\circ + \sum_g \widetilde{\varsigma}^i_{g,1}(m^i_K, m^j_K)|_\circ \\ & + \widetilde{G}^j_2(m^j_K, m^i_K)|_\circ + \sum_g \widetilde{\varsigma}^j_{g,1}(m^j_K, m^i_K)|_\circ,\end{aligned} \tag{3.74}$$

and (b) for every lobby $g, h \in H = \{L, C, F\}$ *and* $g \neq h$, *a feasible contribution function* $\varsigma^i_{g,1}(m^i_K, m^j_K)|_\circ$ *and relative formula weights on capital does not exist that (i)*

$$\begin{aligned}\left\{m^i_K, m^j_K\right\} = \underset{m^i_K, m^j_K}{\arg\max} \quad & \widetilde{G}^i_2(m^i_K, m^j_K)|_\circ + \varsigma^i_{g,1}(m^i_K, m^j_K)|_\circ + \sum_{H\setminus\{g\}} \widetilde{\varsigma}^i_{h,1}(m^i_K, m^j_K)|_\circ \\ & + \widetilde{G}^j_2(m^j_K, m^i_K)|_\circ + \sum_g \widetilde{\varsigma}^j_{g,1}(m^j_K, m^i_K)|_\circ,\end{aligned} \tag{3.75}$$

and (ii)

$$\begin{aligned}& \theta^i_g \widetilde{W}^i_g(m^i_K, m^j_K)|_\circ - \widetilde{\varsigma}^i_{g,2}(\widetilde{\tau}^i)|_\circ - \varsigma^i_{g,1}(m^i_K, m^j_K)|_\circ \\ > \; & \theta^i_g \widetilde{W}^i_g(\widetilde{m}^i_K, \widetilde{m}^j_K)|_\circ - \widetilde{\varsigma}^i_{g,2}(\widetilde{\tau}^i)|_\circ - \widetilde{\varsigma}^i_{g,1}(\widetilde{m}^i_K, \widetilde{m}^j_K)|_\circ.\end{aligned} \tag{3.76}$$

According to condition *(a)* the central government chooses the relative formula weights of capital in both jurisdictions in order to maximize the overall political support. Condition *(b)* states that in a political equilibrium no lobby can improve the net welfare of its members by offering an alternative contribution function. Consequently, the equilibrium apportionment formulas have to maximize the joint welfare of each special

[30] More precisely, Bergemann and Välimäki (2003) show that multi-period games in common agency can be treated as a single stage game if the impact on equilibrium continuation payoffs are recognized. Hence, the theorems of Bernheim and Whinston (1986a) and thus Grossman and Helpman (1994, 1995) apply in that case as well. Consequently, we can use a straightforward application to Definition 3.2 for the political equilibrium in stage 2.

interest group and the central government. That is

$$\begin{aligned}\left\{m_K^i, m_K^j\right\} = \underset{m_K^i, m_K^j}{\arg\max} \quad & \theta_g^{\,i}\, \widetilde{W}_g^{\,i}(m_K^i, m_K^j)|_\circ - \widetilde{\varsigma}_{g,2}^{\,i}(\widetilde{\tau}^{\,i})|_\circ - \widetilde{\varsigma}_{g,1}^{\,i}(m_K^i, m_K^j)|_\circ \\ & + \alpha^{\,i}\, \widetilde{W}^{\,i}(m_K^i, m_K^j)|_\circ + \sum_g \left[\widetilde{\varsigma}_{g,2}^{\,i}(\widetilde{\tau}^{\,i})|_\circ + \widetilde{\varsigma}_{g,1}^{\,i}(m_K^i, m_K^j)|_\circ\right] \\ & + \alpha^{\,j} \widetilde{W}^{\,j}(m_K^j, m_K^i)|_\circ + \sum_g \left[\widetilde{\varsigma}_{g,2}^{\,j}(\widetilde{\tau}^{\,j})|_\circ + \widetilde{\varsigma}_{g,1}^{\,j}(m_K^j, m_K^i)|_\circ\right].\end{aligned} \tag{3.77}$$

Noting equations (3.58) and (3.59), we derive in Appendix D that the first-order conditions to (3.74) and (3.77) imply

$$\begin{aligned}\left.\frac{\partial \widetilde{\varsigma}_{g,1}^{\,i}(m_K^i, m_K^j)}{\partial m_K^i}\right|_\circ = \theta_g^{\,i} \Bigg(& \left.\frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial m_K^i}\right|_\circ + \left.\frac{\partial \widetilde{W}^{\,i}(m_K^i, m_K^j)}{\partial \tau^{\,j}} \frac{d\tau^{\,j}}{dm_K^i}\right|_\circ \Bigg) \\ & - \left.\frac{\partial \widetilde{\varsigma}_{g,2}^{\,i}(\tau^{\,i})}{\partial m_K^i}\right|_\circ - \left.\frac{\partial \widetilde{\varsigma}_{g,2}^{\,i}(\tau^{\,i})}{\partial \tau^{\,j}} \frac{d\tau^{\,j}}{dm_K^i}\right|_\circ,\end{aligned} \tag{3.78}$$

$$\begin{aligned}\left.\frac{\partial \widetilde{\varsigma}_{g,1}^{\,i}(m_K^i, m_K^j)}{\partial m_K^j}\right|_\circ = \theta_g^{\,i} \Bigg(& \left.\frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial m_K^j}\right|_\circ + \left.\frac{\partial \widetilde{W}^{\,i}(m_K^i, m_K^j)}{\partial \tau^{\,j}} \frac{d\tau^{\,j}}{dm_K^j}\right|_\circ \Bigg) \\ & - \left.\frac{\partial \widetilde{\varsigma}_{g,2}^{\,i}(\tau^{\,i})}{\partial m_K^j}\right|_\circ - \left.\frac{\partial \widetilde{\varsigma}_{g,2}^{\,i}(\tau^{\,i})}{\partial \tau^{\,j}} \frac{d\tau^{\,j}}{dm_K^j}\right|_\circ.\end{aligned} \tag{3.79}$$

Equations (3.78) and (3.79) show that each lobby at stage 1 sets its contributions in a way that the impact of a small change in the formula weight on the payments matches the effect on the members' gross welfare, net of the impact on the contributions in stage 2. Note that this also contains the direct and indirect impacts of change in the relative formula weight of capital of both regions, since each special interest group offers contributions that relate to both policy instruments in the centralized setting. Referring to Bergemann and Välimäki (2003), this adheres to the notion of *recursive contributions* in the sense that each lobby is able to claim its marginal contribution in the subsequent stage 2. A characterization of the equilibrium formula weights in the centralized setting can then be found by substituting (3.78) and (3.79) into the first-order condition to (3.74).[31] Applying symmetry as a last step,[32] we get

$$\sum_g (\alpha + \theta_g) \left.\frac{\partial \widetilde{W}_g^{\,j}}{\partial \tau^{\,i}} \frac{d\tau^{\,i}}{dm_K}\right|_\circ = 0, \tag{3.80}$$

[31] See equation (3.D.3) in Appendix D.

[32] Note that symmetry implies $\partial \widetilde{W}_g^{\,i}/\partial \tau^{\,j} = \partial \widetilde{W}_g^{\,j}/\partial \tau^{\,i}$ and $d\tau^{\,j}/dm_K^i|_\circ = d\tau^{\,i}/dm_K^j|_\circ$.

where $\partial\tau^i/\partial m_K$ is determined by (3.65) in the symmetric equilibrium. Note that the direct implications of a change in the relative formula weight of capital are not contained in the first-oder condition of the central government, since we know that they are only redistributive between the two jurisdictions. Due to the sequential structure of the game, only the indirect effect remains from the impact of a change in the formula weights on the non-cooperative corporate tax rates. However, in stage 2, each regional government already optimized the policy decision with respect to its regional corporate tax rate. As a consequence, only the externality on the other jurisdiction that originates from a change in the formula weights has to be considered by the central government. Nevertheless, each residential group still gets a higher political weight due to political organization. In order to get more insight, we use (3.29) and (3.30) to rewrite (3.80) as

$$\left[(\alpha+\theta_L)\frac{dw^j}{d\tau^i}\bigg|_\circ \overline{L} + (\alpha+\theta_F)\frac{d\Pi}{d\tau^i}\bigg|_\circ \overline{Z} + \beta\, V'(y)\frac{dy^j}{d\tau^i}\bigg|_\circ\right]\frac{d\tau^i}{dm_K}\bigg|_\circ = 0, \tag{3.81}$$

with

$$\begin{aligned}\frac{dy^j}{d\tau^i} = & -\tau\,\pi_t^{ab}\left[\frac{d\gamma^i}{dK^i}\left(\frac{dK^i}{d\tau^i}-\frac{dK^j}{d\tau^i}\right)+\frac{d\gamma^i}{dw^i}\left(\frac{dw^i}{d\tau^i}-\frac{dw^j}{d\tau^i}\right)\right]\\ & +\tau\,\gamma\left[2\,\sigma\left(\frac{dK^i}{d\tau^i}+\frac{dK^j}{d\tau^i}\right)-\overline{L}\left(\frac{dw^i}{d\tau^i}+\frac{dw^j}{d\tau^i}\right)\right],\end{aligned} \tag{3.82}$$

in the symmetric equilibrium. Assuming that the externality is concave in the relative formula weight of capital,[33] the central government tries to minimize the externality due to the non-cooperative governmental behavior with respect to the regional corporate tax rates in stage 2. This externality is represented by the terms in the square brackets of (3.81) and consists of three components. Starting with the impact on the labor owners, we know from (3.15) that $dw^j/d\tau^i$ is ambiguous. On the one hand, the impact on the equilibrium corporate tax rate causes a formula effect that constitutes a positive externality. On the other hand, as long as the user costs of capital are not fully deductible, a tax base effect leads to a negative externality. The second term in square brackets of (3.81) represents the impact of a rise in τ^i of the firm owners' income in the other jurisdiction. We argued above that, due to tractability, it seems reasonable to assume that the overall effect of a rise in τ^i on corporate profits is negative. Accordingly, this second term represents a negative externality. Finally, the third term in square brackets represents the externality on the local provision of the public

[33] See Runkel and Schjelderup (2011).

good. As shown by the first line in (3.82), an increase in τ^i affects the apportioned tax base of the multinational firm, since this implies a rise in the effective tax burden. In response to this, more of the consolidated tax base will be apportioned to the other jurisdiction.[34] This constitutes a positive externality. Nevertheless, as long as the user costs of capital are not fully deductible, equation (3.28) shows that an increase in the corporate tax rate reduces total investment and wage payments. Consequently, the consolidated tax base decreases with the impact on investment, but increases with the reduction of wage payments, as shown by the second line in (3.82).

Concerning the implications of the central decision with respect to the equilibrium corporate tax rate, recall from (3.65) that the effect cannot be signed in general, since it comes solely from a change in the impact of the corporate tax rate on the domestic wage income and the provision of the public good. As a consequence, $\partial\tau^i/\partial m_K|_\circ$ depends on the formula weights itself and can be positive or negative. However, note that the central government only indirectly influences the externality via choosing the structure of the apportionment formula, and that for the evaluation of the overall externality, the political organization of the residential groups obviously plays an important role.

In order to gain some insight of the consequences of political influence on the formula weights, suppose that no special interest group is politically active in the initial equilibrium and that $\rho = 1$. In that case, we unambiguously have $dw^j/d\tau^i > 0$ and $dy^j/d\tau^i > 0$, thereby both constituting a positive externality, and $d\Pi/d\tau^i < 0$, which represents a negative externality. Hence, if $d\tau^i/dm_K|_\circ > 0$, political influence by the labor owners implies that a positive component receives a higher weight in the overall externality. In contrast, lobbying by the firm owners implies that a negative component receives more attention from the perspective of the central government. However, if $d\tau^i/dm_K|_\circ < 0$, an increase in the formula weight that is directly related to mobile capital reduces the equilibrium tax rate, and lobbying of the labor owners reduces m_K^i. In contrast, political influence by the firm owners increases the formula weight of capital in that case. Note that this is true for each possible set of the considered apportionment factors. This completes

Proposition 3.3

For the case of a centralized choice of formula weights, the following statements hold with respect to the equilibrium apportionment formula without political influence initially, irrespective of the considered scenario for the possible apportionment factors.

[34] Recall from (3.16) that $d\gamma^i/dK^i > 0$ and from (3.3) that $d\gamma^i/dw^i = m_P\, da_P^i/dw^i > 0$ in the symmetric equilibrium.

(a) For $\rho = 1$ and $d\tau/dm_K|_\circ < 0$, political organization of the labor (firm) owners decreases (increases) the formula weight of capital.

(b) For $\rho = 1$ and $d\tau/dm_K|_\circ > 0$, political organization of the labor (firm) owners increases (decreases) the formula weight of capital.

3.5 Centralized vs. Decentralized Choice of Formula Weights

In order to examine the relation of the choice of apportionment factors under political influence, we evaluate the central governments first-order condition at the equilibrium capital weight of the decentralized setting. Using (3.45), condition (3.81) is then given by

$$\left[(\alpha^j + \theta_L^j)\frac{dw^j}{d\tau^i}\bigg|_\circ^R \overline{L} + (\alpha^j + \theta_F^j)\frac{d\Pi}{d\tau^i}\bigg|_\circ^R \overline{Z} + \beta\, V'(y)\frac{dy^j}{d\tau^i}\bigg|_\circ^R\right] \frac{d\tau^i}{dm_K}\bigg|_\circ^R, \tag{3.83}$$

with

$$\frac{d\tau}{dm_K}\bigg|_{m_S^i=0}^R = -\frac{\beta}{D}V'(y)\,\tau\left[\frac{\partial a_K^i}{\partial K^i}\left(\frac{\partial K^i}{\partial \tau^i} - \frac{\partial K^j}{\partial \tau^i}\right) - \frac{\partial a_P^i}{\partial w^i}\left(\frac{\partial w^i}{\partial \tau^i} - \frac{\partial w^j}{\partial \tau^i}\right)\right]\pi_t^{ab}, \tag{3.84}$$

$$\frac{d\tau}{dm_K}\bigg|_{m_P^i=0}^R = -\frac{\beta}{D}V'(y)\,\tau\left(\frac{\partial a_K^i}{\partial K^i} - \frac{\partial a_S^i}{\partial K^i}\right)\left(\frac{\partial K^i}{\partial \tau^i} - \frac{\partial K^j}{\partial \tau^i}\right)\pi_t^{ab}, \tag{3.85}$$

for $D < 0$.[35] In (3.83)-(3.85) we introduced $|_\circ^R$ as a shortcut for $|_{m_S=0\,\vee\, m_P=0}^R$, denoting in both formula scenarios the values at the equilibrium of a decentralized formula determination. Equations (3.84) and (3.85) then show that the impact of a symmetrical increase of the relative weight of capital unambiguously decreases the tax rate if the set of apportionment factors consists of capital and sales or capital and labor.[36] It then follows that only if the set of apportionment factors consists of capital and payroll, an increase in the relative weight of capital may increase the equilibrium tax rate. However, compared to a situation without any political influence, by investigating the associated sign in (3.83), we find for an identical political organization in the decentralized and centralized setting:

[35] The derivation of $d\tau/dm_K|_\circ|_\circ^R$ can be found in Appendix E.

[36] Recall that $\partial a_P^i/\partial w^i = 0$ when relative labor instead of relative payroll is considered.

Proposition 3.4

(a) For $\rho = 1$ and $d\tau/dm_K|_{\circ}^{R} < 0$, political influence of the labor (firm) owners reduces (increases) the relative weight of capital when the apportionment formula is determined by a central government.

(b) For $\rho = 1$ and $d\tau/dm_K|_{\circ}^{R} > 0$, political influence of the labor (firm) owners increases (decreases) the relative weight of capital when the formula is determined by a central government.

It is important to note that the central government recognizes the effect of a change in the capital weight on the other jurisdiction. However, political influence implies that the components of this externality receive a welfare weight that is related to their political organization. The implications are quite clear for the case of a full deductibility of capital costs. If the labor owners influence policy, a positive externality receives a comparably larger welfare weight, whereas it will be a negative component in the case of politically organized firm owners. However, as the lobbying-influenced welfare weight increases more with respect to the source of private income than with respect to the gain in the provision of the public good,[37] we get the results in Proposition 3.4. Consequently, in comparison with the equilibrium apportionment formula in the decentralized setting, if $d\tau/dm_K|_{\circ}^{R} < 0$ the central government chooses a lower equilibrium capital weight because of lobbying by the labor owners. In contrast, it will be higher if the firm owners influence policy. If $d\tau/dm_K|_{\circ}^{R} > 0$, it will be the other way round. However, tax competition of the regional governments implies a lower loss in the group-specific welfare if the residents are politically organized. Consequently, the central government receives a higher political support, since the implications of the change in the relative formula weight on capital are considered with respect to the impact on the overall contributions from the lobbies in both jurisdictions. This was first pointed out by Bergemann and Välimäki (2003) for the general case of a multistage common agency game.

3.6 Conclusion

We have developed a simple model of political influence that may give an alternative explanation for the observed apportionment formulas under different jurisdictional settings. Based on a two-stage approach, the considered special interest groups are allowed

[37] Recall that the relative weight of the impact on income in the government's maximization is given by $(\alpha + \theta_g)/\beta$. It is straightforward to show that this rises with an increase in the political organization of group g, even if $\theta_g = 0$ initially.

to influence the regionally chosen corporate tax rates as well as the weights of the apportionment factors prior to that. However, since the structure of the apportionment formula is determined on a regional level in the U.S., whereas it may be determined at a central level in Europe, we included both settings in our framework.

For the case of a central formula determination, we first find that the residents who bear the comparably larger loss in private income will lobby their regional government for lower corporate tax rates. However, when it comes to the decision about the structure of the apportionment formula, the impact of political influence is sensitive with respect to the jurisdictional competence. In that respect, we showed that when governments are only interested in political contributions, in the decentralized setting lobbying of the domestic labor owners increases the relative welfare weight of the wage impact, which may increase the equilibrium formula weight of capital. In contrast, the impact of the firm owners special interest group reduces this relative welfare weight in the governments maximization and hence increases the equilibrium formula weight of the other apportionment factors, as for example the relative sales share of the firms. However, if the apportionment formula is determined on a central level, it may actually be the political influence of the labor owners that decreases the formula weight of capital, whereas the firm owners may lobby for an increase in the capital weight in equilibrium. The difference is that the central government recognizes that the impact of a change in the relative formula weight on capital is just a redistribution between the jurisdictions. Consequently, on a central level the equilibrium structure of the apportionment formula will be adjusted in order to reduce the externality caused by non-cooperative governmental behavior, but under political influence. This bears an important implication. Since the central government recognizes the implications of a change in the weight of the apportionment factors in both jurisdictions, the structure of the apportionment formula will rather be used to maximize its overall political support than social welfare alone. This implies with respect to the political influence of a single special interest group that the equilibrium structure of the formula will be adjusted in order to induce the regional governments to behave comparably more in favor of the lobbies. This increases the gross welfare of the lobbies as well as the equilibrium contributions. In that sense, when it comes to the regional decision on corporate tax rates, Formula Apportionment on a central level may in the presence of political influence be used to exploit more rents from the special interest groups. This carries important implications for the current debate on introducing Formula Apportionment for the European Union in particular with respect to its welfare effects, since the structure of the debated proposal originates from a political process.

Appendix

A Comparative statics of the firm's investment decision and wage levels in equilibrium

Substituting the labor market condition $\overline{L} = L^i$ into (3.6) and (3.7) and differentiating with respect to K^i, K^j, w^i, w^j, τ^i and m_q^i and applying symmetry as a last step yields the matrix equation

$$\begin{bmatrix} (1-\tau)F_{KK} & 0 & 0 & 0 \\ 0 & (1-\tau)F_{KK} & 0 & 0 \\ (1-\tau)F_{LK} & 0 & -(1-\tau) & 0 \\ 0 & (1-\tau)F_{LK} & 0 & -(1-\tau) \end{bmatrix} \begin{bmatrix} dK^i \\ dK^j \\ dw^i \\ dw^j \end{bmatrix} =$$

$$\begin{bmatrix} \sigma + \frac{\partial \gamma^i}{\partial K^i}\pi_t^{ab} & \tau\left(\sigma + \frac{\partial a_K^i}{\partial K^i}\pi_t^{ab}\right) & \tau\left(\sigma + \frac{\partial a_S^i}{\partial K^i}\pi_t^{ab}\right) & \tau\sigma \\ \sigma - \frac{\partial \gamma^i}{\partial K^i}\pi_t^{ab} & \tau\left(\sigma - \frac{\partial a_K^i}{\partial K^i}\pi_t^{ab}\right) & \tau\left(\sigma - \frac{\partial a_S^i}{\partial K^i}\pi_t^{ab}\right) & \tau\sigma \\ \frac{\partial \gamma^i}{\partial L^i}\pi_t^{ab} & 0 & \tau\frac{\partial a_S^i}{\partial L^i}\pi_t^{ab} & \tau\frac{\partial a_P^i}{\partial L^i}\pi_t^{ab} \\ -\frac{\partial \gamma^i}{\partial L^i}\pi_t^{ab} & 0 & -\tau\frac{\partial a_S^i}{\partial L^i}\pi_t^{ab} & -\tau\frac{\partial a_P^i}{\partial L^i}\pi_t^{ab} \end{bmatrix} \begin{bmatrix} d\tau^i \\ dm_K^i \\ dm_S^i \\ dm_P^i \end{bmatrix},$$

for $i, j \in \{a, b\}$, $i \neq j$ and $q \in \{K, S, P\}$, where $\partial\gamma^i/\partial K^i$ and $\partial\gamma^i/\partial L^i$ are determined by (3.16) and (3.17) respectively. Using Cramer's rule, we get the comparative static effects in (3.12)-(3.15) and (3.18)-(3.21).

B Derivation of $dy^i/dm_K^i|_\circ$

Since an increase in m_K^i is always accompanied by a reduction in the formula weight on the other apportionment factors, we get

$$\left.\frac{dy^i}{dm_K^i}\right|_\circ = \tau^i \left.\frac{\partial \gamma^i}{\partial m_K^i}\right|_\circ \pi_t^{ab} + \tau^i \gamma^i \left.\frac{\partial \pi_t^{ab}}{\partial m_K^i}\right|_\circ . \tag{3.B.1}$$

Noting (3.26) and (3.27) and employing symmetry, we can see in (3.C.21) that the second term is equal to zero. Evaluating yields the terms in (3.50) and (3.51) directly.

C Comparative statics of the equilibrium corporate tax rate

Differentiating (3.61) with respect to τ^i, τ^j, δ^i and δ^j, with $\delta^i \in \left\{\theta_g^i, m_q^i\right\}$ and $\delta^j \in \left\{\theta_g^j, m_q^j\right\}$ for $g \in H = \{L, C, F\}$ and $q \in \{K, S, P\}$, yields

$$\begin{bmatrix} \dfrac{\partial \Psi_2^i}{\partial \tau^i} & \dfrac{\partial \Psi_2^i}{\partial \tau^j} \\ \dfrac{\partial \Psi_2^j}{\partial \tau^i} & \dfrac{\partial \Psi_2^j}{\partial \tau^j} \end{bmatrix} \begin{bmatrix} d\tau^i \\ d\tau^j \end{bmatrix} = \begin{bmatrix} -\dfrac{\partial \Psi_2^i}{\partial \delta^i} & -\dfrac{\partial \Psi_2^i}{\partial \delta^j} \\ -\dfrac{\partial \Psi_2^j}{\partial \delta^i} & -\dfrac{\partial \Psi_2^j}{\partial \delta^j} \end{bmatrix} \begin{bmatrix} d\delta^i \\ d\delta^j \end{bmatrix}, \tag{3.C.1}$$

for $i, j \in \{a, b\}$ and $i \neq j$. With respect to the matrix on the left hand side of (3.C.1), we know from the stability conditions in Dixit (1986) that its determinant has to be positive, that is

$$\frac{\partial \Psi_2^i}{\partial \tau^i}\frac{\partial \Psi_2^j}{\partial \tau^j} - \frac{\partial \Psi_2^i}{\partial \tau^j}\frac{\partial \Psi_2^j}{\partial \tau^i} > 0. \tag{3.C.2}$$

With $\partial \Psi_2^j/\partial \tau^j = \partial \Psi_2^i/\partial \tau^i$ and $\partial \Psi_2^j/\partial \tau^i = \partial \Psi_2^i/\partial \tau^j$ by symmetry, we rewrite (3.C.2) as

$$\underbrace{\left[\frac{\partial \Psi_2^i}{\partial \tau^i} + \frac{\partial \Psi_2^i}{\partial \tau^j}\right]}_{:=D} \underbrace{\left[\frac{\partial \Psi_2^i}{\partial \tau^i} - \frac{\partial \Psi_2^i}{\partial \tau^j}\right]}_{:=E} > 0. \tag{3.C.3}$$

Since $\partial \Psi_2^i/\partial \tau^i < 0$ from second-order conditions, the expression in (3.C.3) is only fulfilled for $|\partial \Psi_2^i/\partial \tau^i| > |\partial \Psi_2^i/\partial \tau^j|$. Consequently, $D < 0$ and $E < 0$ which Dixit (1986) already pointed out as the stability conditions of diagonal dominance in the

coefficient matrix. We then get

$$\frac{d\tau}{d\delta} = \frac{d\tau^i}{d\delta^i} + \frac{d\tau^i}{d\delta^j} = -\frac{\dfrac{\partial \Psi_2^i}{\partial \delta^i} + \dfrac{\partial \Psi_2^i}{\partial \delta^j}}{\dfrac{\partial \Psi_2^i}{\partial \tau^i} + \dfrac{\partial \Psi_2^i}{\partial \tau^j}}. \tag{3.C.4}$$

The expression on the right hand side of the second equality sign can be found by using Cramer's rule for $d\tau^i/d\delta^i$ and $d\tau^i/d\delta^j$ and employing afterwards the symmetry assumption.

C.1 The impact of a symmetric change in political organization

Set $\delta^i = \theta_g^i$ and $\delta^j = \theta_g^j$. Differentiating (3.61), noting (3.29) and (3.30) yields

$$\frac{\partial \Psi_2^i}{\partial \theta_L^i} = n_L^i \left(\frac{dw^i}{d\tau^i} \bar{l}^i + V'(y) \frac{dy^i}{d\tau^i} \right), \tag{3.C.5}$$

$$\frac{\partial \Psi_2^i}{\partial \theta_C^i} = n_C^i \, V'(y) \frac{dy^i}{d\tau^i}, \tag{3.C.6}$$

$$\frac{\partial \Psi_2^i}{\partial \theta_F^i} = n_F^i \left(\frac{d\Pi}{d\tau^i} \, \overline{z}^i + V'(y) \frac{dy^i}{d\tau^i} \right), \tag{3.C.7}$$

$$\frac{\partial \Psi_2^i}{\partial \theta_g^j} = 0. \tag{3.C.8}$$

Using the symmetry property, substituting (3.C.5)-(3.C.8) into (3.C.4) and employing the definition of D from (3.C.3), we get the comparative static effects in (3.62)-(3.64).

C.2 The impact of a symmetric change in the formula weight on capital

Set $\delta^i = m_q^i$ and $\delta^j = m_q^j$. Differentiating (3.61), noting (3.29) and (3.30), using the envelope theorem and the symmetry property as last step, we get for $q \in \{K, S, P\}$

$$\begin{aligned} \frac{\partial \Psi_2^i}{\partial m_q^i} = &(\alpha + \theta_L) \frac{\partial^2 w^i}{\partial \tau^i \partial m_q^i} \overline{L} + (\alpha + \theta_F) \frac{\partial^2 \Pi}{\partial \tau^i \partial m_q^i} \overline{Z} \\ &+ \beta \left[V''(y) \frac{dy^i}{d\tau^i} \frac{dy^i}{dm_q^i} + V'(y) \frac{\partial^2 y^i}{\partial \tau^i \partial m_q^i} \right], \end{aligned} \tag{3.C.9}$$

$$\begin{aligned}\frac{\partial \Psi_2^i}{\partial m_q^j} =& (\alpha+\theta_L)\frac{\partial^2 w^i}{\partial \tau^i \partial m_q^j}\overline{L} + (\alpha+\theta_F)\frac{\partial^2 \Pi}{\partial \tau^i \partial m_q^j}\overline{Z} \\ &+ \beta\left[V''(y)\frac{dy^i}{d\tau^i}\frac{dy^i}{dm_q^j} + V'(y)\frac{\partial^2 y^i}{\partial \tau^i \partial m_q^j}\right],\end{aligned} \tag{3.C.10}$$

with the derivatives for $i, j \in \{a, b\}$ and $i \neq j$ given by

$$\begin{aligned}\frac{\partial^2 \Pi}{\partial \tau^i \partial m_q^i} =& \frac{\partial \overline{\tau}}{\partial m_q^i}\overline{L}\left(\frac{\partial w^i}{\partial \tau^i} + \frac{\partial w^j}{\partial \tau^i}\right) - (1-\tau)\,\overline{L}\left(\frac{\partial^2 w^i}{\partial \tau^i \partial m_q^i} + \frac{\partial^2 w^j}{\partial \tau^i \partial m_q^i}\right) \\ &- \left(\frac{\partial w^i}{\partial \tau^i} - \frac{\partial w^j}{\partial \tau^i}\right)\frac{\partial^2 \overline{\tau}}{\partial w^i \partial m_q^i}\pi_t^{ab} - \frac{\partial \gamma^i}{\partial m_q^i}\pi_t^{ab},\end{aligned} \tag{3.C.11}$$

$$\begin{aligned}\frac{\partial^2 \Pi}{\partial \tau^i \partial m_q^j} =& \frac{\partial \overline{\tau}}{\partial m_q^j}\overline{L}\left(\frac{\partial w^i}{\partial \tau^i} + \frac{\partial w^j}{\partial \tau^i}\right) - (1-\tau)\,\overline{L}\left(\frac{\partial^2 w^i}{\partial \tau^i \partial m_q^j} + \frac{\partial^2 w^j}{\partial \tau^i \partial m_q^j}\right) \\ &- \left(\frac{\partial w^i}{\partial \tau^i} - \frac{\partial w^j}{\partial \tau^i}\right)\frac{\partial^2 \overline{\tau}}{\partial w^i \partial m_q^j}\pi_t^{ab} - \frac{\partial \gamma^i}{\partial m_q^j}\pi_t^{ab},\end{aligned} \tag{3.C.12}$$

$$\begin{aligned}\frac{\partial^2 y^i}{\partial \tau^i \partial m_q^i} =& \frac{\partial \gamma^i}{\partial m_q^i}\left(\pi_t^{ab} + \tau\frac{\partial \pi_t^{ab}}{\partial \tau^i}\right) + \frac{\partial \pi_t^{ab}}{\partial m_q^i}\left(\gamma + \tau\frac{\partial \gamma^i}{\partial \tau^i}\right) \\ &+ \tau\frac{\partial^2 \gamma^i}{\partial \tau^i \partial m_q^i}\,\pi_t^{ab} + \tau\gamma\frac{\partial^2 \pi_t^{ab}}{\partial \tau^i \partial m_q^i},\end{aligned} \tag{3.C.13}$$

$$\begin{aligned}\frac{\partial^2 y^i}{\partial \tau^i \partial m_q^j} =& \frac{\partial \gamma^i}{\partial m_q^j}\left(\pi_t^{ab} + \tau\frac{\partial \pi_t^{ab}}{\partial \tau^i}\right) + \frac{\partial \pi_t^{ab}}{\partial m_q^j}\left(\gamma + \tau\frac{\partial \gamma^i}{\partial \tau^i}\right) \\ &+ \tau\frac{\partial^2 \gamma^i}{\partial \tau^i \partial m_q^j}\,\pi_t^{ab} + \tau\gamma\frac{\partial^2 \pi_t^{ab}}{\partial \tau^i \partial m_q^j},\end{aligned} \tag{3.C.14}$$

$$\frac{dy^i}{dm_q^i} = \tau\frac{\partial \gamma^i}{\partial m_q^i}\pi_t^{ab} + \tau\gamma\frac{\partial \pi_t^{ab}}{\partial m_q^i}, \tag{3.C.15}$$

$$\frac{dy^i}{dm_q^j} = \tau\frac{\partial \gamma^i}{\partial m_q^j}\pi_t^{ab} + \tau\gamma\frac{\partial \pi_t^{ab}}{\partial m_q^j}. \tag{3.C.16}$$

Furthermore, using $a_q^i + \alpha_q^j = 1$ and that in the symmetric equilibrium $\partial K^i/\partial m_q^i = \partial K^j/\partial m_q^j$ and $\partial K^i/\partial m_q^j = \partial K^j/\partial m_q^i$, we get

$$\begin{aligned}\frac{\partial \gamma^i}{\partial m_q^i} =& a_q^i + \left(m_K\frac{\partial a_K^i}{\partial K^i} + m_S\frac{\partial a_S^i}{\partial K^i}\right)\left(\frac{\partial K^i}{\partial m_q^i} - \frac{\partial K^j}{\partial m_q^i}\right) \\ &+ m_P\frac{\partial a_P^i}{\partial w^i}\left(\frac{\partial w^i}{\partial m_q^i} - \frac{\partial w^j}{\partial m_q^i}\right),\end{aligned} \tag{3.C.17}$$

$$\begin{aligned}\frac{\partial\gamma^{i}}{\partial m_{q}^{j}} = -\Bigg[&\left(m_{K}\frac{\partial a_{K}^{i}}{\partial K^{i}} + m_{S}\frac{\partial a_{S}^{i}}{\partial K^{i}}\right)\left(\frac{\partial K^{i}}{\partial m_{q}^{i}} - \frac{\partial K^{j}}{\partial m_{q}^{i}}\right)\\ &+ m_{P}\frac{\partial a_{P}^{i}}{\partial w^{i}}\left(\frac{\partial w^{i}}{\partial m_{q}^{i}} - \frac{\partial w^{j}}{\partial m_{q}^{i}}\right)\Bigg],\end{aligned} \tag{3.C.18}$$

and finally

$$\begin{aligned}\frac{\partial^{2}\pi_{t}^{ab}}{\partial\tau^{i}\partial m_{q}^{i}} =& F_{KK}\frac{\partial K^{i}}{\partial m_{q}^{i}}\left(\frac{\partial K^{i}}{\partial\tau^{i}} - \frac{\partial K^{j}}{\partial\tau^{i}}\right) + 2\,\sigma\left(\frac{\partial^{2}K^{i}}{\partial\tau^{i}\partial m_{q}^{i}} + \frac{\partial^{2}K^{j}}{\partial\tau^{i}\partial m_{q}^{i}}\right)\\ &- \overline{L}\left(\frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{q}^{i}} + \frac{\partial^{2}w^{j}}{\partial\tau^{i}\partial m_{q}^{i}}\right),\end{aligned} \tag{3.C.19}$$

$$\begin{aligned}\frac{\partial^{2}\pi_{t}^{ab}}{\partial\tau^{i}\partial m_{q}^{j}} =& F_{KK}\frac{\partial K^{i}}{\partial m_{q}^{j}}\left(\frac{\partial K^{i}}{\partial\tau^{i}} - \frac{\partial K^{j}}{\partial\tau^{i}}\right) + 2\,\sigma\left(\frac{\partial^{2}K^{i}}{\partial\tau^{i}\partial m_{q}^{j}} + \frac{\partial^{2}K^{j}}{\partial\tau^{i}\partial m_{q}^{j}}\right)\\ &- \overline{L}\left(\frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{q}^{j}} + \frac{\partial^{2}w^{j}}{\partial\tau^{i}\partial m_{q}^{j}}\right),\end{aligned} \tag{3.C.20}$$

$$\frac{\partial\pi_{t}^{ab}}{\partial m_{q}^{i}} = (F_{K} - \rho\, r)\left(\frac{\partial K^{i}}{\partial m_{q}^{i}} + \frac{\partial K^{j}}{\partial m_{q}^{i}}\right) - \overline{L}\left(\frac{\partial w^{i}}{\partial m_{q}^{i}} + \frac{\partial w^{j}}{\partial m_{q}^{i}}\right). \tag{3.C.21}$$

In order to investigate how a change in the relative weight on capital affects the corporate tax rate in the symmetric equilibrium, we have to take into account that an increase in m_{K}^{i} is always accompanied by a reduction in the weight on the other apportionment factors. Noting (3.26) and (3.27), we then have $dK^{i}/dm_{K}^{i}|_{\circ} = -dK^{i}/dm_{K}^{j}|_{\circ}$, from (3.C.21) that $\partial\pi_{t}^{ab}/\partial m_{q}^{i}|_{\circ} = 0$ and from (3.C.17) and (3.C.18) that $\partial\gamma^{i}/\partial m_{K}^{i}|_{\circ} = -\partial\gamma^{i}/\partial m_{K}^{j}|_{\circ}$. Furthermore, a change in the relative formula weights causes no tax base effect. Hence, $\frac{\partial^{2}K^{i}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}K^{j}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}K^{i}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} + \frac{\partial^{2}K^{j}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} = 0$ and $\frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}w^{j}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} + \frac{\partial^{2}w^{j}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} = 0$. Together, this implies $dy^{i}/dm_{K}^{i}|_{\circ} + dy^{i}/dm_{K}^{j}|_{\circ} = 0$ and $\frac{\partial^{2}y^{i}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}y^{i}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} = \tau\left(\frac{\partial^{2}\gamma^{i}}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}\gamma^{i}}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ}\right)\pi_{t}^{ab}$. Finally, note from (3.3) and (3.5) that $\partial\overline{\tau}/\partial m_{q}^{i} = \tau/2$, $\frac{\partial^{2}\overline{\tau}}{\partial w^{i}\partial m_{q}^{i}} = \frac{\partial^{2}\overline{\tau}}{\partial w^{i}\partial m_{q}^{j}} = 0$ for $q = K, S$ and $\frac{\partial^{2}\overline{\tau}}{\partial w^{i}\partial m_{q}^{i}} = -\frac{\partial^{2}\overline{\tau}}{\partial w^{i}\partial m_{q}^{j}}$ for $q = P$. Hence, $\frac{\partial^{2}\Pi}{\partial\tau^{i}\partial m_{K}^{i}}|_{\circ} + \frac{\partial^{2}\Pi}{\partial\tau^{i}\partial m_{K}^{j}}|_{\circ} = 0$. Adding up (3.C.9) and (3.C.10) it follows

$$\left.\frac{\partial\Psi_{2}^{i}}{\partial m_{K}^{i}}\right|_{\circ} + \left.\frac{\partial\Psi_{2}^{i}}{\partial m_{K}^{j}}\right|_{\circ} =$$

$$(\alpha+\theta_{L})\left(\left.\frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{K}^{i}}\right|_{\circ} + \left.\frac{\partial^{2}w^{i}}{\partial\tau^{i}\partial m_{K}^{j}}\right|_{\circ}\right)\overline{L} + \beta\,V'(y)\,\tau\left(\left.\frac{\partial^{2}\gamma^{i}}{\partial\tau^{i}\partial m_{K}^{i}}\right|_{\circ} + \left.\frac{\partial^{2}\gamma^{i}}{\partial\tau^{i}\partial m_{K}^{j}}\right|_{\circ}\right)\pi_{t}^{ab}.$$

Substituting this into (3.C.4) and using D from (3.C.3), we get the comparative static effect in (3.65) with $\frac{\partial^2 w^i}{\partial \tau^i \partial m_K} := \frac{\partial^2 w^i}{\partial \tau^i \partial m_K^i} + \frac{\partial^2 w^i}{\partial \tau^i \partial m_K^j}$ and $\frac{\partial^2 \gamma^i}{\partial \tau^i \partial m_K} := \frac{\partial^2 \gamma^i}{\partial \tau^i \partial m_K^i} + \frac{\partial^2 \gamma^i}{\partial \tau^i \partial m_K^j}$.

D Derivation of equations (3.78) and (3.79)

Noting equations (3.58) and (3.59), the first-order conditions to (3.77) are

$$
\begin{aligned}
&\theta_g^i \left[\frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^i}\bigg|_\circ \right] \\
&- \left[\frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^i}\bigg|_\circ \right] - \frac{\partial \widetilde{\varsigma}_{g,1}^i(m_K^i, m_K^j)}{\partial m_K^i}\bigg|_\circ \\
&+ \alpha^i \left[\frac{\partial \widetilde{W}^{\,i}(m_K^i, m_K^j)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{W}^{\,i}(m_K^i, m_K^j)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^i}\bigg|_\circ \right] \\
&+ \sum_g \left[\frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,1}^i(m_K^i, m_K^j)}{\partial m_K^i}\bigg|_\circ \right] \\
&+ \alpha^j \left[\frac{\partial \widetilde{W}^{\,j}(m_K^j, m_K^i)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{W}^{\,j}(m_K^j, m_K^i)}{\partial \tau^i} \frac{\partial \tau^i}{\partial m_K^i}\bigg|_\circ \right] \\
&+ \sum_g \left[\frac{\partial \widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial \tau^i} \frac{\partial \tau^i}{\partial m_K^i}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,1}^j(m_K^j, m_K^i)}{\partial m_K^i}\bigg|_\circ \right] = 0,
\end{aligned}
\tag{3.D.1}
$$

$$
\begin{aligned}
&\theta_g^i \left[\frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^j}\bigg|_\circ \right] \\
&- \left[\frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^j}\bigg|_\circ \right] - \frac{\partial \widetilde{\varsigma}_{g,1}^i(m_K^i, m_K^j)}{\partial m_K^j}\bigg|_\circ \\
&+ \alpha^i \left[\frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{W}_g^{\,i}(m_K^i, m_K^j)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^j}\bigg|_\circ \right] \\
&+ \sum_g \left[\frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial \tau^j} \frac{\partial \tau^j}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,1}^i(m_K^i, m_K^j)}{\partial m_K^j}\bigg|_\circ \right] \\
&+ \alpha^j \left[\frac{\partial \widetilde{W}^{\,j}(m_K^j, m_K^i)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{W}^{\,j}(m_K^j, m_K^i)}{\partial \tau^i} \frac{\partial \tau^i}{\partial m_K^j}\bigg|_\circ \right] \\
&+ \sum_g \left[\frac{\partial \widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial \tau^i} \frac{\partial \tau^i}{\partial m_K^j}\bigg|_\circ + \frac{\partial \widetilde{\varsigma}_{g,1}^j(m_K^j, m_K^i)}{\partial m_K^j}\bigg|_\circ \right] = 0.
\end{aligned}
\tag{3.D.2}
$$

Noting (3.59), the central government's first-order conditions to (3.74) are

$$\begin{aligned}
&\alpha^i\left[\frac{\partial\widetilde{W}^i(m_K^i,m_K^j)}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{W}^i(m_K^i,m_K^j)}{\partial\tau^j}\frac{\partial\tau^j}{\partial m_K^i}\bigg|_\circ\right]\\
&+\sum_g\left[\frac{\partial\widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{\varsigma}_{g,2}^i(\widetilde{\tau}^i)}{\partial\tau^j}\frac{\partial\tau^j}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{\varsigma}_{g,1}^i(m_K^i,m_K^j)}{\partial m_K^i}\bigg|_\circ\right]\\
&+\alpha^j\left[\frac{\partial\widetilde{W}^j(m_K^j,m_K^i)}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{W}^j(m_K^j,m_K^i)}{\partial\tau^i}\frac{\partial\tau^i}{\partial m_K^i}\bigg|_\circ\right]\\
&+\sum_g\left[\frac{\partial\widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{\varsigma}_{g,2}^j(\widetilde{\tau}^j)}{\partial\tau^i}\frac{\partial\tau^i}{\partial m_K^i}\bigg|_\circ+\frac{\partial\widetilde{\varsigma}_{g,1}^j(m_K^j,m_K^i)}{\partial m_K^i}\bigg|_\circ\right]=0,
\end{aligned}\tag{3.D.3}$$

for $i,j\in\{a,b\}$, $i\neq j$. Since conditions (3.D.1)-(3.D.3) have to be fulfilled simultaneously in equilibrium, we insert (3.D.3) into (3.D.1) and (3.D.2). This immediately yields (3.78) and (3.79).

E Derivation of $d\tau/dm_K|_\circ$ in the decentralized equilibrium

Since no tax base effect occurs with respect to a change in the relative weight on capital we know from (3.26) and (3.27) that overall investment and wage payments are not affected. In Appendix C.2 we then showd that the consolidated tax base remains unaffected as well. Noting this, for the case of a symmetrical increase in m_K we get

$$\frac{\partial^2K^i}{\partial\tau^i\partial m_K}\bigg|_{m_S^i=0}=-\frac{\partial^2K^j}{\partial\tau^i\partial m_K}\bigg|_{m_S^i=0}=\frac{\pi_t^{ab}}{(1-\tau)F_{KK}}\frac{\partial a_K^i}{\partial K^i}<0,\tag{3.E.1}$$

$$\frac{\partial^2K^i}{\partial\tau^i\partial m_K}\bigg|_{m_P^i=0}=-\frac{\partial^2K^j}{\partial\tau^i\partial m_K}\bigg|_{m_P^i=0}=\frac{\pi_t^{ab}}{(1-\tau)F_{KK}}\left(\frac{\partial a_K^i}{\partial K^i}-\frac{\partial a_S^i}{\partial K^i}\right)<0,\tag{3.E.2}$$

$$\frac{\partial^2w^i}{\partial\tau^i\partial m_K}\bigg|_{m_S^i=0}=-\frac{\partial^2w^j}{\partial\tau^i\partial m_K}\bigg|_{m_S^i=0}=\frac{\pi_t^{ab}}{(1-\tau)F_{KK}}\left(\frac{\partial a_K^i}{\partial K^i}F_{LK}+\frac{\partial a_P^i}{\partial L^i}F_{KK}\right),\tag{3.E.3}$$

$$\frac{\partial^2w^i}{\partial\tau^i\partial m_K}\bigg|_{m_P^i=0}=-\frac{\partial^2w^j}{\partial\tau^i\partial m_K}\bigg|_{m_P^i=0}=\frac{\pi_t^{ab}}{(1-\tau)F_{KK}}\left[\left(\frac{\partial a_K^i}{\partial K^i}-\frac{\partial a_S^i}{\partial K^i}\right)F_{LK}+\frac{\partial a_S^i}{\partial L^i}F_{KK}\right],\tag{3.E.4}$$

$$\begin{aligned}\left.\frac{\partial^2\gamma^i}{\partial\tau^i\partial m_K}\right|_{m_S^i=0} &= \frac{\partial a_K^i}{\partial K^i}\left(\frac{\partial K^i}{\partial\tau^i}-\frac{\partial K^j}{\partial\tau^i}\right)-\frac{\partial a_P^i}{\partial w^i}\left(\frac{\partial w^i}{\partial\tau^i}-\frac{\partial w^j}{\partial\tau^i}\right)\\ &\quad+m_K\frac{\partial a_K^i}{\partial K^i}\left(\left.\frac{\partial^2 K^i}{\partial\tau^i\partial m_K}\right|_\circ-\left.\frac{\partial^2 K^j}{\partial\tau^i\partial m_K}\right|_\circ\right)\\ &\quad+m_P\frac{\partial a_P^i}{\partial w^i}\left(\left.\frac{\partial^2 w^i}{\partial\tau^i\partial m_K}\right|_{m_S^i=0}-\left.\frac{\partial^2 w^j}{\partial\tau^i\partial m_K}\right|_{m_S^i=0}\right),\end{aligned} \tag{3.E.5}$$

$$\begin{aligned}\left.\frac{\partial^2\gamma^i}{\partial\tau^i\partial m_K}\right|_{m_P^i=0} &= \left(\frac{\partial a_K^i}{\partial K^i}-\frac{\partial a_S^i}{\partial K^i}\right)\left(\frac{\partial K^i}{\partial\tau^i}-\frac{\partial K^j}{\partial\tau^i}\right)\\ &\quad+m_K\frac{\partial a_K^i}{\partial K^i}\left(\left.\frac{\partial^2 K^i}{\partial\tau^i\partial m_K}\right|_\circ-\left.\frac{\partial^2 K^j}{\partial\tau^i\partial m_K}\right|_\circ\right).\end{aligned} \tag{3.E.6}$$

Note that in the symmetric equilibrium (3.22)-(3.25) can be used to transform (3.E.1)-(3.E.4). Substituting the results afterwards into (3.E.5), (3.E.6) and all together in (3.65) we get

$$\begin{aligned}\left.\frac{d\tau}{dm_K}\right|_{m_S^i=0} &= -\frac{1}{D}\left[\frac{1}{\tau}(\alpha+\theta_L)\left.\frac{\partial w^i}{\partial m_K}\right|_{m_S^i=0}\overline{L}+\frac{1}{\tau}\beta\,V'(y)\left.\frac{\partial y^i}{\partial m_K}\right|_{m_S^i=0}\right.\\ &\quad\left.+\beta\,V'(y)\,\tau\left[\frac{\partial a_K^i}{\partial K^i}\left(\frac{\partial K^i}{\partial\tau^i}-\frac{\partial K^j}{\partial\tau^i}\right)-\frac{\partial a_P^i}{\partial w^i}\left(\frac{\partial w^i}{\partial\tau^i}-\frac{\partial w^j}{\partial\tau^i}\right)\right]\pi_t^{ab}\right],\end{aligned} \tag{3.E.7}$$

$$\begin{aligned}\left.\frac{d\tau}{dm_K}\right|_{m_P^i=0} &= -\frac{1}{D}\left[\frac{1}{\tau}(\alpha+\theta_L)\left.\frac{\partial w^i}{\partial m_K}\right|_{m_S^i=0}\overline{L}+\frac{1}{\tau}\beta\,V'(y)\left.\frac{\partial y^i}{\partial m_K}\right|_{m_P^i=0}\right.\\ &\quad\left.+\beta\,V'(y)\,\tau\left(\frac{\partial a_K^i}{\partial K^i}-\frac{\partial a_S^i}{\partial K^i}\right)\left(\frac{\partial K^i}{\partial\tau^i}-\frac{\partial K^j}{\partial\tau^i}\right)\pi_t^{ab}\right].\end{aligned} \tag{3.E.8}$$

Noting equation (3.49), the terms in (3.84) and (3.85) follow immediately.

References

Aidt, T. and U. Hwang (2008), 'On the Internalization of Cross-National Externalities through Political Markets: The Case of Labour Standards', *Journal of Institutional and Theoretical Economics* 164(3), 509-533.

Anand, B. and R. Sansing (2000), 'The Weighting Game: Formula Apportionment as an Instrument of Public Policy', *National Tax Journal* 53(2), 183-199.

Bardhan, P. and D. Mookherjee (2000), 'Capture and Governance at Local and National Levels', *American Economic Review* 90(2), 135-139.

Baron, D. (1994), 'Electoral Competition with Informed and Uninformed Voters', *American Political Science Review* 88(1), 33-47.

Becker, G. (1983), 'A Theory of Competition among Pressure Groups for Political Influence', *Quarterly Journal of Economics* 98(3), 371-400.

Bergemann, D. and J. Välimäki (2003), 'Dynamic Common Agency', *Journal of Economic Theory* 111(1), 23-48.

Bernheim, B. and M. Whinston (1986a), 'Menu Auctions, Resource Allocation, and Economic Influence', *Quarterly Journal of Economics* 101(1), 1-31.

Bernheim, B. and M. Whinston (1986b), 'Common Agency', *Econometrica* 54(4), 923-942.

Besley, T. (2006), 'Principled Agents? The Political Economy of Good Government', Oxford University Press, Oxford.

Besley, T. (2007), 'The New Political Economy', *The Economic Journal* 117(524), 570-587.

Besley, T. and S. Coate (2001), 'Lobbying and Welfare in a Representative Democracy' *Review of Economic Studies* 68(1), 67-82.

Besley, T. and S. Coate (2003), 'Centralized versus Decentralized Provision of Local Public Goods: A Political Economy Approach', *Journal of Public Economics* 87(12), 2611-2637.

Besley, T. and T. Persson (2008), 'Economic Approaches to Political Institutions', in: S. Durlauf and L. Blume (eds.), *New Palgrave Dictionary of Economics*, Palgrave Macmillan, London.

Besley, T. and M. Smart (2007), 'Fiscal Restraints and Voter Welfare', *Journal of Public Economics* 91(3-4), 755-773.

Borck, R. (2003), 'Tax Competition and the Choice of Tax Structure in a Majority Voting Model', *Journal of Urban Economics* 54(1), 173-180.

Bordignon, M., L. Colombo and U. Galmarini (2008), 'Fiscal Federalism and Lobbying', *Journal of Public Economics* 92(12), 2288-2301.

Brennan, G. and J. Buchanan (1980), 'The Power to Tax: Analytical Foundations of a Fiscal Constitution', Cambridge University Press, Cambridge, UK.

Brou, D. and M. Ruta (2006), 'Special Interest and the Gains from Political Integration', *Economics & Politics* 18(2), 191-218.

Brusco, S., L. Colombo and U. Galmarini (2011), 'Local Governments Tax Autonomy, Lobbying, and Welfare', *working paper*.

Chirinko, R. and D. Wilson (2010), 'Can Lower Tax Rates be Bought? Business Rent-Seeking and Tax Competition among U.S. States', *National Tax Journal* 63(4), 967-994.

Cai, H. and D. Treisman (2005), 'Does Competition for Capital Discipline Governments? Decentralization, Globalization, and Public Policy', *American Economic Review* 95(3), 817-830.

Clausing, K. (2003), 'Tax Motivated Transfer Pricing and US Intrafirm Trade Prices', *Journal of Public Economics* 87(9-10), 2207-2223.

Commission of the European Communities (2001), 'Company Taxation in the Internal Market', Commission Staff Working Paper, COM(2001) 582 final, Brussels.

Commission of the European Communities (2011), 'Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB)', SEC(2011) 315/316, Brussels.

Conconi, P. (2003), 'Green Lobbies and Transboundary Pollution in Large Open Economies', *Journal of International Economics* 59(2), 399-422.

DePater, J. and G. Myers (1994), 'Strategic Capital Tax Competition: A Pecuniary Externality and a Corrective Device', *Journal of Urban Economics* 36(1), 66-78.

Devereux, M., B. Lockwood and M. Redoano (2008), 'Do Countries Compete over Corporate Tax Rates?', *Journal of Public Economics* 92(5-6), 1210-1235.

Dixit, A. (1986), 'Comparative Statics for Oligopoly', *International Economic Review* 27(1), 107-122.

Dixit, A. (1996), 'Special-Interest Lobbying and Endogenous Commodity Taxation', *Eastern Economic Journal* 22(4), 375-388.

Dixit, A., G. Grossman and E. Helpman (1997), 'Common Agency and Coordination: General Theory and Application to Government Policy Making', *Journal of Political Economy* 105(4), 752-769.

Edwards, J. and M. Keen (1996), 'Tax Competition and Leviathan', *European Economic Review* 40(1), 113-134.

Eggert, W. (2001), 'Capital Tax Competition with Socially Wasteful Government Consumption', *European Journal of Political Economy* 17(3), 517-529.

Eggert, W. and P. Sørensen (2008), 'The Effects of Tax Competition when Politicians Create Rents to Buy Political Support', *Journal of Public Economics* 92(5-6), 1142-1163.

Eichner, T. and M. Runkel (2008), 'Why the European Union Should Adopt Formula Apportionment with a Sales Factor', *Scandinavian Journal of Economics* 110(3), 567–589.

Eichner, T. and M. Runkel (2009), 'Corporate Income Taxation of Multinationals and Unemployment', *Regional Science and Urban Economics* 39(5), 610–620.

Esteller-Moré, A., U. Galmarini and L. Rizzo (2012), 'Vertical Tax Competition and Consumption Externalities in a Federation with Lobbying', *Journal of Public Economics* 96(3-4), 295-305.

Federation of Tax Administrators (2012), 'State Apportionment of Corporate Income', http://www.taxadmin.org/fta/rate/apport.pdf.

Feenstra, R. (2004), 'Advanced International Trade: Theory and Evidence', Princeton University Press, Princeton, New Jersey.

Felli, L. and A. Merlo (2006), 'Endogenous Lobbying', *Journal of the European Economic Association* 4(1), 180-215.

Frey, B. and R. Eichenberger (1996), 'To Harmonize or to Compete? That's not the Question', *Journal of Public Economics* 60(3), 335-349.

Fuest, C. (2008), 'The European Commission's Proposal for a Common Consolidated Corporate Tax Base', *Oxford Review of Economic Policy* 24(4), 720–739.

Fuest, C. and B. Huber (2001), 'Tax Competition and Tax Coordination in a Median Voter Model', *Public Choice* 107(1-2), 97-113.

Fuest, C., B. Huber and J. Mintz (2005), 'Capital Mobility and Tax Competition', *Foundations and Trends in Microeconomics* 1(1), 1-62.

Gerard, M. and F. Ruiz (2009), 'Corporate Taxation and the Impact of Governance, Political and Economic Factors', *CESifo Working Paper Series* No. 2904.

Gordon, R. (1983), 'An Optimal Taxation Approach to Fiscal Federalism', *Quarterly Journal of Economics* 98(4), 567-586.

Gordon, R. and J. Wilson (1986), 'An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment', *Econometrica* 54(6), 1357-1373.

Grazzini, L. and T. van Ypersele (2003), 'Fiscal Coordination and Political Competition', *Journal of Public Economic Theory* 5(2), 305-325.

Gresik, T. (2001), 'The Taxing Task of Taxing Transnationals', *Journal of Economic Literature* 39(3), 800-838.

Griffith, R., J. Hines and P. Sørensen (2010), 'International Capital Taxation', in: J. Mirrlees, S. Adam, T. Besley, R. Blundell, S. Bond, R. Chote, M. Gammie, P. Johnson, G. Myles and J. Poterba (eds.), *Dimensions of Tax Design: the Mirrlees Review*, Oxford University Press, Oxford.

Grossman, G. and E. Helpman (1994), 'Protection for Sale', *American Economic Review* 84(4), 833-850.

Grossman, G. and E. Helpman (1995), 'Trade Wars and Trade Talks', *Journal of Political Economy* 103(4), 675-708.

Grossman, G. and E. Helpman (1996), 'Electoral Competition and Special Interest Politics', *Review of Economic Studies* 63(2), 265-286.

Grossman, G. and E. Helpman (2001), 'Special Interest Politics', MIT Press, Cambridge, Massachusetts.

Grossman, G. and E. Helpman (2002), 'Interest Groups and Trade Policy', Princeton University Press, Princeton, New Jersey.

Guriev, S., E. Yakovlev and E. Zhuravskaya (2010), 'Interest Group Politics in a Federation', *Journal of Public Economics* 94(10), 730-748.

Hatfield, J. and G. Padró i Miquel (2012), 'A Political Economy Theory of Partial Decentralization', *Journal of the European Economic Association*, 10(3), 605-633.

Haufler, A. (1997), 'Factor Taxation, Income Distribution and Capital Market Integration', *Scandinavian Journal of Economics* 99(3), 425-446.

Haufler, A. (2001), 'Taxation in a Global Economy', Cambridge University Press, Cambridge, UK.

Haufler, A., A. Klemm and G. Schjelderup (2008), 'Redistributive Taxation, Multinational Enterprises, and Economic Integration', *European Journal of Political Economy* 24(1), 249-255.

Haufler, A. and G. Schjelderup (2000), 'Corporate Tax Systems and Cross Country Profit Shifting', *Oxford Economic Papers* 52(2), 306-325.

Hill, M., G. Kelly, G. Lockhart and R. van Ness (2011), 'Determinants and Effects of Corporate Lobbying', *working paper*, University of Mississippi.

Hindriks, J. and B. Lockwood (2009), 'Decentralization and Electoral Accountability: Incentives, Separation and Voter Welfare', *European Journal of Political Economy* 25(3), 385-397.

Hines, J. (1996), 'Altered States: Taxes and the Location of Foreign Direct Investment in America', *American Economic Review* 86(5), 1076-1094.

Hines, J. (1999), 'Lessons from Behavioral Responses to International Taxation', *National Tax Journal* 52(2), 305-322.

Hoyt, W. (1991), 'Property Taxation, Nash Equilibrium, and Market Power', *Journal of Urban Economics* 30(1), 123-131.

Huizinga, H. and L. Laeven (2008), 'International Profit-Shifting within Multinationals: A Multi-Country Perspective', *Journal of Public Economics* 92(5-6), 1164-1182.

Huizinga, H. and S. Nielsen (1997), 'Capital Income and Profit Taxation with Foreign Ownership of Firms', *Journal of International Economics* 42(1-2), 149-165.

Ihori, T. and C. Yang (2009), 'Interregional Tax Competition and Interregional Political Competition: The Optimal Provision of Public Goods Under Representative Democracy', *Journal of Urban Economics* 66(3), 210-217.

Janeba, E. and G. Schjelderup (2009), 'The Welfare Effects of Tax Competition Reconsidered: Politicians and Political Institutions', *The Economic Journal* 119(539), 1143-1161.

Janeba, E. and J. Wilson (2011), 'Optimal Fiscal Federalism in the Presence of Tax Competition', *Journal of Public Economics* 95(11-12), 1302-1311.

Kant, C. (1988), 'Endogenous Transfer Pricing and the Effects of Uncertain Regulation', *Journal of International Economics* 24(1-2), 147-157.

Kessler, A., C. Lülfesmann and G. Myers (2002), 'Redistribution, Fiscal Competition, and the Politics of Economic Integration', *Review of Economic Studies* 69(4), 899-923.

Kessler, A., C. Lülfesmann and G. Myers (2003), 'Economic versus Political Symmetry and the Welfare Concern with Market Integration and Tax Competition', *Journal of Public Economics* 87(5-6), 847-865.

Kolmar, M. and A. Wagener (2007), 'Tax Competition with Formula Apportionment: The Interaction Between Tax Base and Sharing Mechanism', *CESifo Woring Paper Series* No. 2097.

Lai, Y. (2008), 'Auctions or Grandfathering: The Political Economy of Tradeable Emission Permits', *Public Choice* 136(1-2), 181-200.

Lai, Y. (2010), 'The Political Economy of Capital Market Integration and Tax Competition', *European Journal of Political Economy* 26(4), 475-487.

Laussel, D. (2006), 'Special Interest Politics and Endogenous Lobby Formation', *Topics in Theoretical Economics* 6(1), 1-14.

Lockwood, B. (2002), 'Distributive Politics and the Costs of Centralization', *Review of Economic Studies* 69(2), 313-337.

Lockwood, B. (2006), 'Fiscal Decentralization: A Political Economy Perspective', in: E. Ahmad and G. Brosio (eds.), *The Handbook of Fiscal Federalism*, Edward Elgar.

Lockwood, B. and M. Makris (2006), 'Tax Incidence, Majority Voting and Capital Market Integration', *Journal of Public Economics* 90(6-7), 1007-1025.

Lorz, O. (1998), 'Capital Mobility, Tax Competition, and Lobbying for Redistributive Capital Taxation', *European Journal of Political Economy* 14(2), 265-279.

Marceau, N. and M. Smart (2003), 'Corporate Lobbying and Commitment Failure in Capital Taxation', *American Economic Review* 93(1), 241-251.

Masters, M. and G. Keim (1985), 'Determinants of PAC Participation among Large Corporations', *The Journal of Politics* 47(4), 1158-1173.

Mazza, I. and F. van Winden (2002), 'Does Centralization Increase the Size of Government? The Effects of Separation of Powers and Lobbying', *International Tax and Public Finance* 9(4), 379-389.

Mazza, I. and F. van Winden (2008), 'An Endogenous Policy Model of Hierarchical Government', *European Economic Review* 52(1), 133-149.

McLure,C. (1980), 'The State Corporate Income Tax: Lambs in Wolves Clothing?', in: Aaron, H. and M. Boskin (eds.), *The Economics of Taxation*, The Brookings Institution, Washington D.C.

Mieszkowski, P. and G. Zodrow (1985), 'The Incidence of a Partial State Corporate Income Tax', *National Tax Journal* 38(4), 489–496.

Mitra, D. (1999), 'Endogenous Lobby Formation and Endogenous Protection: A Long-Run Model of Trade Policy Determination', *American Economic Review* 89(5), 1116-1134.

Nicodème, G. (2007), 'Corporate Tax Competition and Coordination in the European Union: What Do We Know? Where Do We Stand?', in: G. Gregoriou and C. Read (eds.), *International Taxation Handbook: Policy, Practice, Standards, and Regulation*, CIMA, Oxford.

Nielsen, S., P. Raimondos-Møeller and G. Schjelderup (2010), 'Company Taxation and Tax spillovers: Separate Accounting Versus Formula Apportionment', *European Economic Review* 54(1), 121-132.

Oates, W. (1972), 'Fiscal Federalism', Harcourt Brace Jovanovich, New York.

Oates, W. (1999), 'An Essay on Fiscal Federalism', *Journal of Economic Literature* 37(3), 1120-1149.

Oates, W. (2005), 'Toward A Second-Generation Theory of Fiscal Federalism', *International Tax and Public Finance* 12(4), 349-373.

Olson, M. (1965), 'The Logic of Collective Action', Harvard University Press, Cambridge, MA.

Peralta, S. (2007), 'Political Support for Tax Decentralization', *Journal of Public Economic Theory* 9(6), 1013-1030.

Persson, T. (1998), 'Economic Policy and Special Interest Politics', *The Economic Journal* 108(447), 310-327.

Persson, T. and G. Tabellini (1992), 'The Politics of 1992: Fiscal Policy and European Integration', *Review of Economic Studies* 59(4), 689–701.

Persson, T. and G. Tabellini (1994), 'Does Centralization Increase the Size of Government?', *European Economic Review* 38(3-4), 765–773.

Persson, T. and G. Tabellini (2000a), 'Political Economics – Explaining Economic Policy', MIT Press, Cambridge, Massachusetts.

Persson, T., G. Roland and G. Tabellini (2000b), 'Comparative Politics and Public Finance', *Journal of Political Economy* 108(6), 1121-1161.

Pethig, R. and A. Wagener (2007), 'Profit Tax Competition and Formula Apportionment', *International Tax and Public Finance* 14(6), 631–655.

Pinto, S. (2007), 'Corporate Profit Tax, Capital Mobility, and Formula Apportionment', *Journal of Urban Economics* 62(1), 76-102.

Prat, A. and A. Rustichini (2003), 'Games Played Through Agents', *Econometrica* 71(4), 989-1026.

Rama, M. and G. Tabellini (1998), 'Lobbying by Capital and Labor over Trade and Labor Market Policies', *European Economic Review* 42(7), 1295-1316.

Rauscher, M. (1998), 'Leviathan and Competition among Jurisdictions: The Case of Benefit Taxation', *Journal of Urban Economics* 44(1), 59-67.

Redoano, M. (2010), 'Does Centralization Affect the Number and Size of Lobbies?', *Journal of Public Ecnomic Theory* 12(3), 407-435.

Richter, B., K. Samphantharak and J. Timmons (2009), 'Lobbying and Taxes', *American Journal of Political Science* 53(4), 893-909.

Riedel, N. and M. Runkel (2007), 'Company Tax Reform with a Water's Edge', *Journal of Public Economics* 91(7-8), 1533-1554.

Runkel, M. and G. Schjelderup (2011), 'The Choice of Apportionment Factors under Formula Apportionment', *International Economic Review* 52(3), 913-934.

Ruta, M. (2010), 'Lobbying and (De)Centralization', *Public Choice* 144(1-2), 275-291.

Sato, M. (2003), 'Tax Competition, Rent-Seeking and Fiscal Decentralization', *European Economic Review* 47(1), 19-40.

Seabright, P. (1996), 'Accountability and Decentralisation in Government: An Incomplete Contracts Model', *European Economic Review* 40(1), 61-89.

Segal, I. (1999), 'Contracting with Externalities', *Quarterly Journal of Economics* 114(2), 337-388.

Snyder, J. (1990), 'Campaign Contributions as Investments: The U.S. House of Representatives, 1980-1986', *Journal of Political Economy* 98(6), 1195-1227.

Spiller, P. and S. Liao (2008), 'Buy, Lobbying or Sue: Interest Group's Participation in Policy Making - A Selective Survey', in: Brousseau, E. and J.-M. Glachant (eds.), *New Institutional Economics: A Guidebook*, Cambridge University Press.

Tommasi, M. and F. Weinschelbaum (2007), 'Centralization vs. Decentralization: A Principal-Agent Analysis', *Journal of Public Economic Theory* 9(2), 369–389.

Van Winden, F. (2003), 'Interest Group Behaviour and Influence', in: C. Rowley and F. Schneider (eds.), *Encyclopedia of Public Choice*, Volume 1, Kluwer Academic Publishers, Boston.

Wagner, W. and S. Eijffinger (2008), 'Efficiency of Capital Taxation in an Open Economy: Tax Competition versus Tax Exportation', *International Tax and Public Finance* 15(6), 673-646.

Weiner, J. (2005), 'Formulary Apportionment and Group Taxation in the European Union: Insights from the United States and Canada', *European Comission Taxation Papers* No.8, Brussels.

Weingast, B. (2009), 'Second Generation Fiscal Federalism: The Implications of Fiscal Incentives', *Journal of Urban Economics* 65(3), 279-293.

Wellisch, D. (2000), 'Theory of Public Finance in a Federal State', Cambridge University Press, Cambridge, UK.

Wellisch, D. (2004), 'Taxation under Formula Apportionment - Tax Competition, Tax Incidence, and the Choice of Apportionment Factors', *Finanzarchiv* 60(1), 24-41.

Wildasin, D. (1988), 'Nash Equilibria in Models of Fiscal Competition', *Journal of Public Economics* 35(2), 229-240.

Wildasin, D. (1989), 'Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy', *Journal of Urban Economics* 25(2), 193-212.

Wildasin, D. (2010), 'State Corporation Income Taxation: An Economic Perspective on Nexus', *National Tax Journal* 63(4), 903-924.

Wilson, J. (1986), 'A Theory of Interregional Tax Competition', *Journal of Urban Economics* 19(3), 296-315.

Wilson, J. (1987), 'Trade, Capital Mobility, and Tax Competition', *Journal of Political Economy* 95(4), 835-856.

Wilson, J. (1999), 'Theories of Tax Competition', *National Tax Journal* 52(2), 269-304.

Wilson, J. (2005), 'Welfare-Improving Competition for Mobile Capital', *Journal of Urban Economics* 57(1), 1-18.

Wilson, J. and D. Wildasin (2004), 'Capital Tax Competition: Bane or Boon', *Journal of Public Economics* 88(6), 1065-1091.

Zodrow, G. (2010), 'Capital Mobility and Tax Competition', *National Tax Journal* 63(4), 865-901.

Zodrow, G. and P. Mieszkowski (1986), 'Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods', *Journal of Urban Economics* 19(3), 356-370.