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Are Capital Taxes Racing to the Bottom in the European Union?

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Abstract

This paper tests the central predictions of the theoretical tax competition literature for capital tax rates for a panel of European Union countries, notably a race to the bottom in capital tax rates. One measure of capital mobility is found to exhibit a downward pressure on capital taxes while another measure shows a positive correlation. Empirical tests imply that the latter positive relationship may be caused by neglecting to control for the agglomeration forces linked with capital mobility. If this is indeed the case, the results lend strong empirical support to the hypothesis of a downward pressure on capital tax rates in absolute terms and relative to labor taxes, but add to this that agglomeration forces mitigate, and might even outweigh the race to the bottom effect of increasing capital mobility.

ARE CAPITAL TAXES RACING TO THE BOTTOM IN THE EUROPEAN UNION?

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Abstract This paper tests the central predictions of the theoretical tax competition literature for capital tax rates for a panel of European Union countries, notably a race to the bottom in capital tax rates. One measure of capital mobility is found to exhibit a downward pressure on capital taxes while another measure shows a positive correlation. Empirical tests imply that the latter positive relationship may be caused by neglecting to control for the agglomeration forces linked with capital mobility. If this is indeed the case, the results lend strong empirical support to the hypothesis of a downward pressure on capital tax rates in absolute terms and relative to labor taxes, but add to this that agglomeration forces mitigate, and might even outweigh the race to the bottom effect of increasing capital mobility.

Keywords: Tax competition; Capital taxation, European financial integration, Capital mobility

JEL Classification: H2; F2; F36

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NON-TECHNICAL SUMMARY

Capital has become increasingly mobile within the European Union in the last few decades. Capital controls are lifted, and the Single Market allows businesses approved in one member country to set up shop in other member countries without acquiring a new license. In addition to intra-EU foreign direct investment, the Single Market significantly facilitates cross border portfolio investment. The introduction of the single currency has, moreover, eliminated inter-EU currency risk and facilitated cross-country comparisons of prices of financial products. All these changes have reduced barriers to flows of both financial and real capital in the European Union. It is not uncommon to hear that increasing capital mobility creates a milieu in which governments will engage in a competitive race to the bottom in everything from environmental standards and product quality to social security. Belonging in this 'race to the bottom' line of reasoning is the argument that increasing mobility of capital will result in a downward pressure on taxation, particularly on capital, and an increase in the relative tax burden on less mobile factors such as labor. These concerns have been particularly voiced in a European Union context, where internal liberalization of capital flows is, perhaps, farther reaching than in any other regionally integrating constellation of countries. But what is often disregarded in the debate on the consequences of liberalization – be it regarding European integration, or globalization in general - is that theories of bottom-racing behaviors are just that: theories among other theories, based on a subjective choice of modeling setup and a subjective choice of simplifying assumption. Indeed, it is possible to arrive at different conclusions with small changes in underlying assumptions or modeling framework.

The theoretical literature on capital tax competition allows for cases where capital mobility causes an increase or a divergence in capital taxation rather than a race to the bottom, as soon as asymmetries, political economy considerations, or simply strategic interaction due to size of the competing countries are allowed for. In particular, allowing for increasing returns and agglomeration rent to arise when capital mobility increases may reverse tax competition forces entirely.

Whether one theory should be chosen over other theories modeling the same phenomenon should dependent on whether the theory is supported by the facts, or whether it has predictive power, rather than whether the theory suits a certain political agenda. So the question is, what has happened to capital taxation in European Union countries during the years in which capital mobility has increased? There has not been firm evidence so far that tax competition has lead to a downward pressure on capital taxation in EU countries. Some studies even find a popular measure of capital mobility, Quinn's 14-point index of financial liberalization, to be positively correlated with capital taxation, opposite to the race to the bottom theory. But the evidence is at best uncertain, and the empirical literature is fragmented and thin. No empirical studies of EU countries alone have been carried out previously, and moreover, predictions allowing for asymmetries and agglomeration forces have not been tested empirically, even for the more heterogenous panels of OECD countries, which have previously been studied.

This paradox – lack of consistent empirical support for a theory that has gained political influence and a certain recognition – is addressed in this paper by testing five hypotheses derived from the theoretical literature for a panel of European Union countries. The main challenge in conducting such an analysis, and the most likely reason for the scarce empirical literature on this subject, is

that capital mobility is not directly observable; it is a phenomenon, influenced by numerous other variables, for which only its effects on other measurable variables may be observable. Before an empirical analysis of the link between capital mobility and taxation may begin, extensive effort therefore needs to be directed into identifying appropriate and credible methods for assessing the degree of capital mobility through its effects on other variables. Two such measures, which are appropriate for a panel regression analysis, are identified in this paper: Quinn's 14-point index mentioned above and covered interest parity differentials. Measuring capital mobility is not the only measurement problem, however. Measuring the tax burden on capital and labor is not straightforward due to the degree of detail and idiosyncrasy of national tax laws and how statistics on taxes are constructed. The paper discusses different options and selects two tax burden measures suitable for panel regression analysis, namely corporate tax revenues in percent of GDP, and ex post implicit tax rates.

The empirical analysis shows that the choice of measure of capital mobility matters for whether tax competition is found to take place in the European Union. The results are that capital tax competition does seem to have put a downward pressure on capital tax rates and shifted the tax burden from capital toward labor in EU member states during the 1980s and 1990s, but that agglomeration economies seem to have counteracted this downward pressure. The finding that agglomeration economies may reverse tax competition pressures on capital tax rates is a novel result in the empirical literature, and may provide an explanation for the counter-intuitive results of a list of previous attempts at identifying tax competition pressures empirically. More research efforts need to be directed into identifying the effects of agglomeration forces on capital taxation, given the strong implications the existence of such forces would have for the correct formulation of tax harmonization policy measures in the European Union.

1. Introduction

A review of the theoretical literature on capital tax competition[1] shows that under restrictive assumptions, increasing capital mobility within the European Union is predicted to result in a race to the bottom in capital tax rates. But when the restrictive assumptions are relaxed, the predicted consequences of increasing capital mobility for capital taxation in the European Union become more nuanced. As an example, different types of cross-country asymmetries, such as size of the country as well as degree of clustering of economic activity, may play a non-negligible role in determining that country's choice of tax rate in equilibrium. In particular, clustering of economic activity may reverse the effect of capital mobility on the tax rate and result in a "race to the top" in capital taxation. The review of the theoretical literature hence shows that a race to the bottom is not the only logical consequence of increasing capital mobility, and that this prediction depends on a set of restrictive assumptions underlying the basic tax competition model. In lack of a more detailed and precise theoretical framework for analysis, the question of how capital mobility affects capital taxation in the European Union should therefore be an empirical one.

Turning to the empirical evidence, it has not been established, beyond anecdotal evidence, that capital tax competition and race to the bottom in capital tax rates is taking place in the European Union. This is in spite of the fact that financial liberalization has been taking place for many years, and in spite of the fact that capital mobility has reached high levels. A number of studies of OECD countries look for empirical evidence of tax competition pressures, but do not find consistent evidence of such pressures, and some even find evidence supporting the hypothesis of a race to the top. In spite of the intense political debate on this topic in the European Union, no studies use panels consisting of only European Union countries. Moreover, existing studies only test for the central prediction that capital mobility results in a downward pressure on relative and absolute capital taxation. Thus, no studies test allow for the wider range of hypotheses, which can be derived the theoretical literature. There are no empirical tests of the asymmetry hypothesis, of the consequences of concentration of economic activity for tax competition, etc.

The aim of this paper is to bridge this gap in the literature, by searching for empirical evidence of the presence of capital tax competition pressures in a panel of European Union countries. More specifically, five testable hypotheses derived from the theoretical literature on tax competition identified in Krogstrup (2002) are tested empirically for a panel of EU countries.

The structure of the paper is the following. Section 2 presents five testable hypotheses derived from the theoretical literature on tax competition. Section 3 looks at the previous empirical literature on capital taxation and capital mobility. Section 4 derives a methodology for testing for the presence of tax competition pressures in European Union countries. A basic specification for testing the five hypotheses for a panel of EU countries is set up. Section 5 deals with the problems of measuring capital mobility and tax burdens on capital. Three measures of capital mobility are chosen due to data availability and relative preciseness, namely Quinn's 14 point index of financial liberalization (also referred to as Quinn14), FDI stocks in percent of GDP and absolute covered interest parity differentials (referred to as the CIP). Only two measures of the absolute tax burden on capital are picked out for the same reasons, namely corporate tax revenues relative to GDP and the implicit capital tax rate. When the relative tax burden on capital is

[1] See Krogstrup (2002)

analyzed, the corporate tax revenues relative total tax revenues, and the implicit capital tax rate relative to the corresponding implicit tax rate on labor are used. The results of the empirical analysis are presented in Section 6. The final section concludes.

2. Predictions of the theoretical literature on tax competition

Krogstrup (2002) presents the theoretical literature on capital tax competition in a unifying framework, and derives 5 testable hypotheses concerning the effect of increasing capital mobility on capital taxation from this literature. The central predictions concerning capital taxation in the European Union derived from the tax competition literature are:

H1: The higher the capital mobility, the lower the provision of public goods.

H2: The higher the capital mobility, the lower the tax revenues from and tax burden on capital taxed at the source.

These predictions are, however, based on a set of rather restrictive assumptions about the economies in which tax competition takes place. The assumptions include the simplification that the regions between which tax competition takes place are identical; that capital is taxed only at source; that there are no other sources of tax revenues than capital taxation; that the government choosing the tax rate does this with the only aim of maximizing welfare for its citizens; that changes in capital mobility does not bring about political change; and that there are region-level decreasing returns to capital (and hence no agglomeration forces in play). Relaxing these restrictions allows for the predictions of the tax competition literature to change.

When residence taxation of capital is enforceable, capital income taxation at the source is predicted to be zero under perfect capital mobility. However, since there is no real measure of whether residence taxation of capital is enforceable, and since residence taxation is usually argued to not be enforceable in the European Union, this hypothesis is not empirically testable and will not be considered any further here. When assuming that also labor income can be taxed, increasing capital mobility will result in a partial or full switch of the tax burden from capital to labor income. The hypothesis concerning capital taxation in the European Union derived from models allowing taxation of imperfectly mobile labor is therefore:

H3: The higher the degree of capital mobility, the higher the tax revenues from and tax burden on labor income relative to that of capital income.

Relaxing the assumption that countries are small gives each of the competing countries market power to affect the world after-tax rate of return to capital when setting the capital tax rate. This does not change the conclusion that the tax rate is too low and that public goods are under-provided in equilibrium, however, but it does mitigate the under-provision result so that the equilibrium Pareto-dominates the small-country equilibrium. Hence, the first two hypothesis of the tax competition literature are not affected by the assumption concerning the size of the countries.

When the assumption of symmetry of the competing countries is relaxed, and differences in the size of capital endowments or population are allowed for, the elasticity of capital to the tax rate is perceived to be higher by smaller countries. The larger country will therefore set a higher tax rate relative to the smaller country, although still too low to be efficient, and the smaller country will be better off than the larger one. In extreme cases, the small country may be even better off than under coordination. Asymmetric models have no clear answer to how asymmetry affects public good provision compared to the symmetric case. The fourth hypothesis concerning capital taxation in the European Union derived from the tax competition literature is therefore:

H4: The larger the country, the smaller the downward pressure of capital mobility on the tax rate

When assuming that the government is motivated partly, or fully, by self-interest, the inefficiency result may be reversed, so that the coordination result is inefficient and tax competition enhances efficiency. But the predictions for the tax rate on capital remain the same as for the basic model where government is assumed benevolent.

Allowing for democratic elections, it is shown that increasing capital mobility moves the political equilibrium toward the left side of the political spectrum, thus counterbalancing the downward pressure on tax rates. However, the move to the left does not outweigh the tax competition pressure and the net effect of increasing capital mobility on capital income taxes is still found to be negative. Hence, allowing for democratic elections mitigates the sup-optimality result but does not eliminate it and the qualitative predictions are the same as those of the basic tax competition literature.

When agglomeration rents are allowed for, the conclusions change since attracting industry to one location creates agglomeration rents which can then be taxed without capital fleeing, in spite of capital being perfectly free to move. Agglomeration rents make capital a quasi-fixed factor, and thus create a margin between the return to capital of the agglomeration and other locations, within which a positive tax rate can be set without reaching the limit where capital flees to another location.

H5: The more concentrated production is in the country, the smaller the downward pressure of capital mobility on the tax rate

The next Section evaluated the previous empirical literature on whether capital tax competition is taking place in the European Union.

3 The Literature

A necessary condition for tax competition to be taking place in the European Union is that the behavior of European investors is such that investment decisions are sensitive to national capital taxation. In turn, there are two sides to tax sensitivity of capital flows; investors must be both willing and able to react to tax differentials between countries, i.e. capital must be technically mobile across borders and taxes have to be considered significant determinants in investment decisions. The degree of capital mobility alone is therefore not enough to determine whether this necessary condition is fulfilled. A strain of the empirical literature on tax competition has the aim

of establishing the sensitivity of different types of capital flows to the tax rate, with the larger part investigating the sensitively of foreign direct investment to tax rates, and a smaller part looking into the effect of tax rates on cross border flows of bank deposits. There does not seem to be any studies on the empirical effect of taxes on the placement of portfolio investment. Another strain of the empirical literature is comprised of a few studies aiming to establish whether tax setting behavior of governments is affected by the tax rates of other countries by estimating reaction functions. Finally, a part of the empirical literature searches directly for correlations between measures of capital mobility and tax burdens on capital using regression techniques, in order to test the tax competition hypothesis. These three parts of the empirical literature on capital mobility and tax rates are discussed in turn.

Empirical Studies of the Sensitivity of Capital Flows to Tax Rates

The larger part of studies of the tax sensitivity of FDI looks at inward and outward US FDI[2,3]. Many early studies fail to link taxes and FDI flows[4]. More recently, time series regressions as well as cross sectional studies of FDI into and out of the US have found a positive sensitivity of FDI to variations in host country tax rates in particular, while the impact of variations in tax rates in the country of origin have been less clear. An example of a time series analysis of aggregate inward FDI is Slemrod (1990), who finds a significantly negative tax elasticity of US inward FDI. By distinguishing between country of origin he finds significant differences between the tax elasticity of FDI from different countries of origin. Grubert and Mutti (1991), Hines and Rice (1994), and more recently Altshuler, Grubert and Newlon (1998) carry out cross sectional analyses of outward US FDI and host country tax rates. All three studies find that tax rates significantly influence FDI flows. The latter study, moreover, carry out the same cross sectional analysis for two different years and finds that the elasticity of US country specific outward FDI to the host country tax rate has been increasing from 1984 to 1992. This finding supports the hypothesis that capital mobility has been increasing in that period. Hines (1999) provides a comprehensive list of studies of FDI based on US data.

Moving beyond studies of US data, only very few contributions to the literature exist and no studies of tax effects on FDI purely based on data for EU countries seem to be carried out. Devereux and Freeman (1995) investigate the tax sensitivity of the allocation of FDI between seven OECD countries (Germany, Italy, France, the Netherlands, Great Britain, Japan, the US) in the late 1980s and find that the allocation is significantly determined by the tax wedge while a tax effect on the choice between domestic and foreign investment is not found, supporting the results of the studies based solely on US data. Bènassy-Quéré, Fontagné and Lahréche-Révil (2000) study the effect of nominal corporate tax rates on inward FDI in 11 OECD countries and find the tax effect to be significant. Finally, Gropp and Kostial (2000) go a step further. Not only do they seek to establish the effect of taxes on FDI, they in turn estimate the effect of FDI flows on

[2] One reason for this is the superior quality of US data on FDI.

[3] Most studies of tax effects on FDI location use the micro-approach to measuring the tax burden on capital, in that the pre- and after tax cost of capital is calculated using national tax codes.

[4] This is pointed out by Morisset and Pirnia (2000), and may, among other reasons, be due to omitted variables bias since the tax burden on capital often will be correlated with the public provision of other advantages to business, such as education and infrastructure. See Hines (1999) for a more thorough discussion of reasons why early studies have not found significant relationships and reasons why taxes might not be very important in location decisions of firms.

corporate tax revenues in order to simulate the effect of corporate income tax harmonization in Europe on FDI flows and corporate tax revenues. They find that taxes matter not only for FDI inflows, but also for FDI outflows in contrast to the previous literature. Moreover, they find a positive relationship between FDI inflows and corporate tax revenues, all else equal[5].

The central conclusion of the empirical literature on the tax sensitivity of foreign direct investment is that tax rates affect the choice of location of FDI. However, the empirical support for the proposition that tax policy of the home country of an investor should affect this investor's choice between foreign and domestic location of investment is rather week. This implies that only tax rates directly affecting foreign investors can be effectively used to attract investment while tax rates only affecting domestic investors do not seem to affect incentives to keep investment at home. These findings offer a potential explanation for the popularity of tax holiday schemes targeted to foreign investors in general, and may explain Ireland's recent successes in attracting FDI.

A small number of studies look into the effect of interest taxation on the location of bank and non-bank deposits. Grilli (1992) investigates the influence of capital controls, withholding taxes and bank secrecy laws on the international flows of deposits for 10 major OECD countries from 1972 to 1987. He finds that inter-bank deposits only respond to withholding taxes on dividend income in the country of placement (i.e. not to the tax which is applied directly to deposits, but the taxation of alternative investment) while non-bank deposits respond to the withholding tax on deposits in the country of placement. A more recent study by Huizinga and Nicodéme (2001), also based on data for OECD countries, finds that international deposits are sensitive to domestic interest tax rates, but not to withholding taxes in the country of placement abroad, contrary to the estimated tax sensitivity of foreign direct investment. In sum, there is some, although vague, evidence of tax sensitivity of the choice of where to place international bank deposits.

Although none of the studies reviewed above look exclusively at EU countries, it seems safe to conclude that tax policy of EU countries can be expected to affect the placement of deposits and the location of FDI across EU countries in addition to the size of corporate tax revenues in EU countries. Tax policy is therefore a potential tool for attracting capital to the country. However, the above studies do not reveal anything about whether European policy makers have actually used this tool, in turn triggering tax competition. They merely imply that the incentives to do so are there.

Empirical Estimations of International Tax Reaction Functions

Two studies, which both are being carried out as this is being written, look at whether national tax setting behavior is influenced by the tax rates of other countries, and hence whether countries engage in tax competition, by estimating tax reaction functions between countries. These studies are inspired by the recent empirical literature on policy reaction functions, which until now has been limited to estimating tax reaction functions for legal jurisdictions within a country, and not

[5] In effect, Kropp and Kostial (2000) find a positive relationship between FDI and the profit tax base from which the effect of FDI on tax revenues can be derived. They thus only consider the tax base effect and does not take into account the potential tax competition effect on the tax rate.

between countries[6]. Devereux et al. (2001) estimate the reaction functions of 10 OECD countries' tax rates on capital, using three different measures of capital tax rates, namely the statutory tax rate, a measure of the average effective tax rate and the cost of capital[7]. They find, preliminarily, that governments do, indeed, react positively to changes in the average international capital tax rate when the statutory and average effective tax rate on capital is concerned, but they are not found to react to international changes in the cost of capital. Besley et al. (2001) estimate reaction functions for tax revenues in percent of GDP for five overall tax categories, by modeling tax ratios as a function of the tax rates of the other countries of the sample, in addition to several control variables. For a sample of OECD countries, they preliminarily find that tax ratios do react to changes in the average of international tax rates, and more so for taxes on tax bases which are considered mobile (e.g capital).

The two studies hence imply that governments do indeed react to other governments' changes in tax rates. But it is still not possible to conclude that a spiral of strategic interactions in tax rates has led to a significant downward pressure on tax burdens on capital in EU countries.

Studies of Correlation of Capital Mobility and the Capital Tax Burden

A relatively recent empirical literature takes its starting point in the political science literature on the effects of globalization on political institutions, and notably, on fiscal variables. Among other endeavors, this literature takes the next step to look for ex post evidence of whether incentives to engage in tax competition have been reacted on, and in turn, whether the tax burden on capital has decreased in response to increases in capital mobility. These studies look for correlations between measures of the degree of capital mobility and ex post measures of the tax burden on mobile capital, using panel regression techniques. They therefore face the obvious difficulty of looking for correlations between two variables of which neither can be directly observed. Moreover, empirically implementable ways of measuring tax burdens and the degree of capital mobility are not abundant. The methods that do exist at best have high degrees of white noise, at worst may also be considerably biased or imprecise. Section 5 gives a more into depth discussion of how to measure the degree of capital mobility and the tax burden on capital.

Several studies, including the one conducted later in this Chapter, use the correlation approach to test for the presence of tax competition in spite of the above-mentioned shortcomings, in lack of a better alternative to testing for tax competition pressures on tax rates. The results of these studies are summarized in Table 0-1. None of the previous studies find support for the predictions of the theoretical tax competition literature. The effect of capital mobility on capital taxation as well as on expenditures is consistently found to be either insignificant or positive, leaving no support to the central hypothesis of the theoretical tax competition literature.

Garrett (1995) tests for the effect of increasing capital mobility on government spending, deficits and capital taxation. In a panel regression for OECD countries, he finds the effect of capital mobility on capital taxation to be insignificant while the effect on government spending and the government deficit to be significantly negative. Hence, rather than placing a downward pressure

[6] See Brueckner (2001) for an overview of this literature.
[7] The ten countries are G7 countries plus Italy, Spain and Australia.

on tax rates which in turn would result in lower public spending, capital mobility is found to exert a direct downward pressure on spending.

Quinn (1997) regresses several measures of the corporate tax burden on an index of financial liberalization, Quinn's 14-point index (also referred to as Quinn14 in the following), and finds that contrary to the tax competition hypotheses, the corporate tax burden is significantly positively related to financial liberalization. Similarly, Rodrik (1997) includes a dummy for capital account restrictions in his regression of capital taxation, which shows the same as the rest of the literature: less capital account restrictions are found to be associated with higher capital tax rates.

In Swank (1998a), the author estimates the effect of two measures of capital mobility, namely covered interest parity differentials and the Quinn14 measure of capital mobility[8], on measures of effective tax rates on labor, capital and consumption in a panel regression for OECD countries. He finds no evidence to support the tax competition hypotheses that tax rates on capital have declined in response to higher capital mobility, nor does he find that the relative tax burden has shifted toward the less mobile labor income and consumption. He does, however, find the Quinn14 measure of capital mobility to be significantly positively associated with capital taxation, contrary to the race to the bottom theory.

Hallerberg and Basinger (1998) investigate the effect of capital liberalization on changes in statutory tax rates across OECD countries, and find that capital liberalization is insignificant in explaining such changes.

Finally, the most recent study in this line of research, Garrett and Mitchell (2001), confirms previous results. Garrett and Mitchell regress effective tax rates on capital alone and relative to consumption and labor effective tax rates on three different measures of capital mobility: FDI flows in percent of GDP, covered interest parity differentials and Quinn14[8]. They find that capital taxes are not systematically lower when financial integration is higher, and moreover, do not find a systematic relationship between capital mobility and the tax burden of capital relative to those of labor and consumption. They do find a significantly positive relationship between FDI flows and the effective rate of capital taxation, and government spending to be negatively related to the Quinn14 measure of capital mobility.

[8] See Section 5 for an explanation of these measures.

Table 0-1: Summary of the literature on regression analysis of capital mobility and tax burdens.

Study	Dependent Variable	Capital Mobility Measure	Sample	Significant Effects
Garrett (1995)	-Capital taxation -Government Spending % GDP	-Index of number of capital controls	OECD Countries, 1967-1990	Effect of capital mobility on government spending: -1.22
Quinn (1997)	-Corporate Tax Revenues % Personal Tax Revenues -Corporate Tax Revenues % GDP -Corporate Tax Revenues % Total Tax Revenues	-Quinn14[/b]	OECD Countries, 1974-1989	Effect of capital mobility on corporate tax in % of personal tax: 0.443 Effect of capital mobility on corporate tax in % of GDP: 0.003
Swank (1998a)	-Implicit Tax Rates on Capital, Labor and Consumption	-Total Capital Flows -FDI Flows % GDP -Quinn14[/b] -CIP[/a]	OECD Countries, 1966-1993	Effect of Quinn14 on the implicit capital tax rate: 0.830
Hallerberg and Bassinger (1998)	-Statutory Corporate Tax Rate	-Index for number of capital controls	OECD Countries, 1986-1990	No significant effect
Garrett and Mitchell (2001)	-Government Spending % GDP -Implicit tax rate on Capital -Ratio of Implicit Tax Rates on Capital and Labor	-FDI Flows % GDP -Quinn14[/b] -CIP[/a]	OECD Countries, 1967 (1961 for spending) – 1992	-Effect of Quinn14 on Spending: -0.095 -Effect of FDI on Implicit Capital Tax: 0.419

/a: Covered Interest Parity Differentials
/b: Quinn's 14 point index of financial liberalization

In brief, studies looking for correlations between measures of capital mobility and measures of the tax burden on capital and spending have not found any evidence in support of the central hypotheses derived from the theoretical tax competition literature. In contrast, several studies find significantly positive correlations between capital mobility on the one hand, and capital tax burdens on the other hand. Some support for a downward pressure on government spending from increasing capital mobility has been found, however.

What the Literature Does Not Account For

The empirical literature on the sensitivity of cross border capital flows to tax rates finds that capital is indeed sensitive to national capital taxation in OECD countries. This means that there is scope for using national tax policy to attract capital to the country, or in other words, there is a potential for tax competition to take place. Moreover, estimation of tax reaction functions shows that national taxes do respond to taxes of neighboring countries, implying that strategic interaction in tax rates is prone to take place. There should hence be a negative relationship between capital mobility and capital taxation. However, studies looking for direct correlations between measures of capital mobility and the tax burden on capital do not find this to be the case in OECD countries. On the contrary, there seems to be slight evidence that capital taxation has increased with the degree of capital mobility. At the same time, there does seem to be support for

the partial prediction of the tax competition literature that capital mobility puts a downward pressure on government spending.

There are many potential explanations of these results. One could be that tax competition does not take place or has not yet started. Or alternatively, that the predictions of the economic geography literature that higher capital mobility leads to higher degree of clustering of economic activity, with higher economic rents to tax lump sum. Or yet, that political economy forces are in play, limiting the scope of or reversing capital tax competition. But the lack of significant support for tax competition hypotheses might also stem from problems with the design of the previous empirical literature. Seven such potential problems are identified below in order to provide remedies in the empirical investigation of the next section.

1. **Imprecise or poor measures of capital mobility.** The measures of capital mobility used in the literature may not adequately be capturing the degree of capital mobility. The next section gives a more detailed discussion of and justification for the choice of measures of capital mobility, but has not been able to identify a new and better approach.

2. **The tax base effect.** As will be discussed in the next section concerning measures of tax burdens, some of the significantly positive parameter estimates might be capturing a tax base effect rather than a tax burden effect. If the measure of capital taxation, such as corporate tax revenues in percent of GDP, does not take into account changes in the capital income tax base on which the capital tax is applied, and the capital income tax base is positively correlated with financial liberalization, a positive relationship between the tax burden measure and the capital mobility measure should be expected. This point is not valid as explanation for the significantly positive parameter estimates found by Swank (1998a) and Garrett and Mitchell (2001), as these studies have used measures of corporate tax burdens, which do take into account the tax base. The issue of taking into account the tax base is discussed in more detail in the next Section.

3. **Overall trend in tax revenues**. The overall tax level, as well as the degree of capital mobility, has increased for reasons unrelated to tax competition during the investigated period. If capital taxation has been adjusted along with other tax categories to the post-war growth of the public sector in Europe, and the overall tax level is not included as control variable in the regressions, this might lead to an omitted variables bias[9]. The overall trend in total tax revenues is controlled for in the robustness checks of the empirical analysis of the next section.

4. **Omission of agglomeration and asymmetric size and income effects**. None of the previous studies have controlled for the effect of asymmetries in size and agglomeration economies on the effect of capital mobility on the tax rate. If, for example, agglomeration economies are important determinants of the pressure of capital mobility on tax rates, not taking this variable into account will lead to omitted variables bias, since increasing capital mobility leads to increasing agglomeration, according to a simple model presented in Krogstrup (2002). Similar arguments can be made for the omission of asymmetries in economic size. Moreover, the positive sign may simply be a story of countries, when they get richer, liberalize and start taxing

[9] However, this potential omitted variables bias would not be able to explain the finding of positive correlations between capital mobility and the corporate tax relative to the personal income tax found in the study of Quinn (1997).

more (Wagner's law). If this is the reason for the positive correlations, then the omission of income per capita might lead to an omitted variables bias.

5. **Unit roots and spurious correlations**. Another issue which is not addressed in the above mentioned studies is that of unit roots. Several of the variables used in the regressions may have unit roots, implying that there is a potential risk of spurious correlations, although the risk of spurious regressions due to nonstationary data is lower in panel data than in traditional time series analysis[10]. A discussion of which variables might be non-stationary, helped by formal tests for unit roots, is given in the following section, and variables which are likely to have a unit root are first differenced.

6. **Heterogeneity of the panels**. The panels studied in the previous literature may have been too heterogeneous, by using various OECD countries and including observations from the structurally very different 1970s. The sample of countries or the time period may have to be narrowed down to attain more homogeneity. This is done in the analysis later in this paper by limiting the panel to EU countries and excluding the 1970s from the sample. Moreover, sensitivity analyses to the included countries in the panel are carried out, and prove to be important in showing the lack of robustness of some results.

7. **Endogeneity**. There is a potential source of endogeneity in these types of regressions. The dependent variables are fiscal variables and hence may have an effect on economic activity, and in turn, on some of the explanatory variables. This is clearly the case for growth and inflation, but fiscal policy may also influence capital flows and interest rates, and hence potentially the measures of capital mobility which are often based on these variables. The parameter estimates of the capital mobility indices may therefore be biased. Lagging the explanatory variables by one year or using instrumental variables may substantially reduce this potential risk of endogeneity bias of the parameter estimates[11]. Since instruments for capital mobility, which are not prone to exactly the same source of endogeneity, are hard to find, the option of lagging the explanatory variables is used in the empirical analysis of this study.

Finally, it is very interesting to observe that while capital tax competition and the potential adverse effects on taxation in European Union countries is an argument which has been used frequently in the public debate over the future of fiscal policy in the European Union, no purely European empirical panel regression studies of these issues have been carried out. Moreover, the empirical studies of OECD country panels are limited to testing the central prediction of the tax competition literature that increasing capital mobility should result in lower taxes on capital. There are no studies conducting comprehensive tests of other important predictions derived from the theoretical literature on tax competition. The next part of this paper aims to fill these gaps, by providing a panel regression analysis of five tax competition hypotheses, for a panel of EU countries, and taking into account the seven points outlined above concerning the lack of results of the previous literature. Point five to seven are taken into account in the empirical methodology

[10] See Baltagi (2002)'s chapter on non-stationary panel data.
[11] Of the above mentioned studies, only Swank (1998a,b) clearly states that the explanatory variables are lagged in the regression of corporate implicit tax rates, while it is less obvious whether Quinn (1997) uses lagged or contemporaneous values of the explanatory variables.

and procedures used, while the first four points are looked at in the robustness analysis of the regression results or included directly in the hypotheses to be tested.

4. Methodology

The Basic Specification

Empirical tests of the five tax competition hypotheses require a basic specification of a regression equation for different types of tax rates and tax ratios as well as for public spending. Theoretical tax competition models do not provide a fully-fledged structural framework from which an estimating equation can be derived. Instead, inspiration is found in the empirical literature on fiscal effects of globalization reviewed above. The following basic specification is proposed:

$$\textbf{(0-1)} \qquad \Delta BUDGET_{it} = \alpha + \beta \cdot \begin{bmatrix} GR_{i,t-1} \\ INFL_{i,t-1} \\ \Delta OPEN_{i,t-1} \\ \Delta PART_{i,t-1} \\ \Delta LEFT_{i,t} \\ \Delta UN_{i,t-1} \\ MAAS_{i,t-1} \end{bmatrix} + \gamma \cdot \Delta\left[\Omega_{i,t-1}\right] + \upsilon_i + \varepsilon_{it}$$

Where the dependent variable, *BUDGET*, is primary expenditures in percent of GDP when hypothesis one is tested. For hypotheses two, four and five, the dependent variable is a measure of the tax burden on capital. Hypothesis three is tested using a ratio of the tax burden on capital in percent of either the total tax burden or the tax burden on labor. Different ways of measuring the tax burdens are discussed in the section on data below. Table 1 summarizes the different hypothesis specific dependent variables used.

In line with the bulk of the empirical literature carrying out regressions of tax and/or expenditure ratios, inflation (*INFL*) and real growth (*GR*) are included to capture the cyclicality of the budget and inflation induced changes in tax revenues due to changes in the nominal tax brackets in which income is taxed. Moreover, current inflation also proxies for money growth and hence also controls for monetary financing of the budget. Current growth is expected to be negatively related to expenditures and tax revenues to GDP[12]. The expected sign of inflation in the expenditure regression is positive while that of the tax regressions does not lend itself to a priori identification. Demographic changes are controlled for by including the participation rate (*PART*)[13], defined as the labor force divided by the population between 15 and 65 years old. The greater the value of *PART*, the more participation and the less burden on social security. Hence,

[12] It can also be argued that according to Wagner's Law, growth should lead to preferences for larger government and hence to higher taxes and expenditures in percent of GDP. But this is a longer-term argument as opposed to the above, and will not be taken into account here.

[13] The participation rate is included in a similar regression in Garreth and Mitchell (2001) and found statistically significant. Alternatively, or additionally, the ratio of over-65 year olds to the total population (*OLD*), which is found statistically significant in Swank (1998) could be included.

the participation rate is expected to be negatively related to tax as well as spending measures. Openness of the country to trade is controlled for by including the imports and exports to GDP ratio (*OPEN*)[14]. According to the arguments and empirical findings of Cameron (1997) and Rodrik (1999), among others, overall taxes and spending are expected to be positively related to the degree of openness of the country, while there is no a priori expectation for capital taxes or tax ratios per se[15]. In order to control for the political influence on capital tax burdens, which Person and Tabellini (1992) argue may be correlated with the degree of capital mobility (see Krogstrup (2002)), a dummy for partisanship is included, taking the value one when the government in power is defined as being to the left (*LEFT*)[16]. A leftwing government is a priori expected to prefer higher overall taxes, higher taxes on capital and higher spending all else equal, thus implying that the a priori sign of *LEFT* is positive in regressions of expenditures and taxes, as well as the tax mix regressions. The unemployment ratio (*UN*) is included to capture the direct influence of unemployment on the personal income and social security payments, which is expected to affect taxes negatively and government spending positively. The effect of unemployment on capital taxes relative to other taxes is a priori ambiguous. MAAS is a dummy for the 'Maastricht years' and takes the value 1 from 1993 and onward. Since the Maastricht Treaty imposes an upper limit to the budget deficit, the expected sign is negative in the expenditures equation and positive in tax regressions, while not signed a priori in the tax mix regressions[17].

Ω is a vector of variables which, as *BUDGET*, are specific to the particular hypothesis tested. For hypotheses one, two and three concerning the effects of increased capital mobility on fiscal variables, the vector will simply consist of a measure of capital mobility. When hypothesis four on the implications of differences in country size for the outcome of the tax competition game is tested, the Ω vector in addition includes capital mobility interacted with a measure of country size. When hypothesis five on the implications of the degree of agglomeration for capital income taxation is tested, a measure of capital alone and in interaction with a measure of degree of agglomeration are added to the Ω vector. Different ways of measuring the degree of capital mobility, country size and degree of agglomeration are discussed in the section on data below. The hypothesis specific dependent and explanatory variables are summarized in Table 0-2.

[14] Garrett and Mitchell (2001) and Swank (2001) find it statistically in their regression of the effective capital tax rate while Hallerberg and Basinger do not.

[15] Cameron (19972) argues that positive relationship between government size and openness is due to higher rates industrial concentration in open countries, and hence higher union power and, in turn, higher demand for government services and spending. Rodrik (1999) alternatively argues that the positive relationship is due a greater need for social insurance in open countries, which are characterized by higher economic risks and fluctuations of an open country.

[16] The construction of the index LEFT is explained in Data Appendix. Using LEFT is in line with Garrett and Mitchell (2001), who control for number of portfolios held by left wing parties as well by christian democratic parties, and Swank (1998), who controls for number of portfolios held by leftist parties. Swank also controls for the election cycle by including a dummy taking the value one in years of parliamentary elections. Since there is no reason to expect measures of capital mobility to be correlated with such a dummy, excluding it does not lead to an omitted variables bias and an election year dummy is left out. It is, however, controlled for in the robustness check.

[17] Dummies for whether the exemption or the credit system is used as double taxation relief system is not included in the analysis in spite of this variable being identified as having an effect on the location decision of investment. The reason for this exclusion is that this dummy would provide no time variation and would hence be correlated with the country fixed effects of the regression. Moreover, carrying out the regressions for either exemption countries or credit countries separate does not change the results substantially (results of these regressions are not shown but can be obtained from the author).

Finally, υ_i is a country specific error term (can be fixed or random) while ε_{it} is the country and time specific error term. See appendix for the precise definition of the variables used in the regressions.

As pointed out in the review of the empirical literature, endogeneity is a potential problem in the above specification. To avoid endogeneity bias, all explanatory variables are included with a lag. There is also a risk of finding spurious correlations since unit roots in the levels of several of the explanatory variables as well as the dependent variables are likely[18]. The country specific data series are tested for stationarity and results of the tests (see unit root test results and descriptive statistics in Data Appendix) support this suspicion, although it should be kept in mind that the short time series make the strength of the test very low[19]. All variables except growth and inflation are likely to exhibit unit roots. Hence, growth and inflation are included in levels while the rest of the variables are first differenced in the basic specification. Including growth and inflation in first differences is carried out as a robustness check and commented below[20].

5. Data Sources and Measures

Most data is taken from OECD revenue statistics and OECD Economic Outlook. There are a few exceptions, some of them mentioned below and the rest are listed in Data Appendix. Two types of data, namely tax burdens on capital and labor income and the degree of capital mobility, are not directly observable and therefore have to be measured. How to measure these two variables is discussed in some detail in the next two subsections. Moreover, the degree of agglomeration and size of a country needed for testing hypotheses four and five are also not straightforward and hence given some consideration below.

Measures of Tax Burdens

Not all capital is taxed at the source, and hence, not all capital taxes are necessarily squeezed by increasing capital mobility. It is important to first identify the types of capital taxation which are prone to tax competition, in order to target measures of the tax burden on capital toward these types of tax competition. An brief overview of capital taxation in the European Union is given below, after which, possible measures of the tax burden on capital are discussed.

Are all capital taxes prone to tax competition?

Many different types of capital income taxation coexist in European Union countries. Whether the tax is levied on capital income of individuals or companies, whether the income is interest, dividend or retained earnings, among other factors determine whether the tax is levied at the source of the income or at the residence of the investor, whether capital income taxed abroad is

[18] Even if some variables exhibit unit roots, the risk of finding spurious correlations is lower in a panel, due to the added information in the cross section dimension. See Baltagi (2002).

[19] The risk of type II errors is very high and the test cannot confirm but only be used to support suspicion of unit roots in the data. If the unit root tests were the only criteria on which the choice of whether to carry out the regressions in levels or first differences were based, more attention should be diverted to carrying out panel unit root tests. However, since this is not the case, it is not done here.

[20] The equation could alternatively be estimated entirely in levels including the lagged explanatory variable, but when the lagged dependent variable is included in a fixed effects panel regression, this introduces a bias due to the correlation of the lagged dependent with the fixed effects. Due to this potential bias and the potential spurious regression results due to unstationary time series, the levels specification is not pursued any further.

tax-exempt at home or whether a credit is provided, as so on. Theoretical models of tax competition typically assume a specific type of capital taxation and look at how tax competition may or may not arise as a response to increased capital mobility. It is usually found that only source based capital income taxation is prone to tax competition, while enforceable residence based capital income taxes are not. Residence taxation of capital income is, however, often argued not to be enforceable due to lack of international information exchange on capital income. While the lack of information exchange does not lead to tax competition, it does imply that residence taxation is prone to tax avoidance[21]. It is therefore important to identify the types of capital taxation resembling the source type tax and those resembling residence type taxes. With this in mind, corporation tax and personal capital income tax, are discussed in turn.

Corporate income from international investments can originate from both direct and portfolio investments[22]. Income from these two types of investment is generally treated identically for tax purposes, but a distinction is made between interest income and dividend income. Corporate foreign equity investment income taxation broadly follows the source principle for taxation, in that the country hosting the investment levies taxes on the profits of activities in the host country. In order to avoid double taxation of foreign source income in the home country, corporations are either exempted from taxes on foreign source income or benefit from a limited tax credit in their country of residence. The tax credit is usually limited to a maximum of the residence country tax obligation, which the gross of source tax foreign income generates. Whether the exemption system or the credit system is used makes a difference to a firm's decisions of where to locate investment. To see this, note that if foreign source income is tax exempt, then the foreign tax rate is the final tax rate applied to income from the foreign investment. If a limited tax credit of the size of the foreign tax is applied to foreign source income, and the foreign tax rate is lower than the residence tax rate, the domestic tax will be the final tax rate applied to the foreign source income, and the tax will resemble a residence tax even though some of the tax revenue is paid at source. Conversely, if the foreign tax is higher than the domestic tax under the limited credit system, the taxation of foreign source income resembles a source tax. Residence taxes are only paid when profits (i.e. dividends) are repatriated under the credit system, which hence also may resemble the source tax system until repatriation takes place. Since about half of the European Union countries apply the exemption system to foreign source income of corporations[23], and since the credit countries only apply the limited credit system, the taxation of corporate foreign source investment income in the European Union may be viewed as closely resembling sourced based taxation. Corporate taxation is hence prone to source based tax competition as laid out by the theoretical tax competition literature reviewed below.

The taxation of foreign source interest income differs from that of equity investment income in that all OECD countries have adopted a limited tax credit system[24]. Hence, taxation of foreign interest income should resemble that of a residence based system. Haufler (2001), however, argues that since the country of residence have difficulties in monitoring the foreign source

[21] See Soerensen (2001) for a discussion of the implications for capital taxation in the European Union.
[22] See European Commission (2001) for a definition of FDI vs. portfolio investment.
[23] Exemption countries in the European Union are Austria, Denmark, Finland, France, Germany and The Netherlands.
[24] Moreover, interest paid are most often deductible from the profit tax base, which means that parent companies have an incentive to use debt financing of subsidiaries compared to equity finance. This tax-induced non-neutrality of choice of financing has recently been dealt with in several member states. See Joumard (2001) for a survey.

capital income of their residents, residents easily evade domestic taxes on foreign source income, and since most countries levy zero withholding tax on interest income, taxes on foreign source interest income may to a large extent be entirely evaded in the European Union[25].

Other than affecting firms' investment decisions and therefore the location of assets, taxation may also trigger international relocation of profits by multinational corporations. There are several ways that multinational corporations can shift their tax burden to lower-tax countries without changing the location of their assets: relocation of cost (relocating production cost in high-tax countries), transfer pricing techniques, and thin capitalization (debt financing instead of equity financing of a subsidiary due to interest expenses that the subsidiary pays to the company being deductible from taxable income).

Turning to taxation of capital income of individuals, the domestic tax rate applied to individuals' capital income is either the personal income tax rate, or - which is more and more often the case - a flat rate on individuals' global capital income[26]. A limited tax credit system also applies to the taxation of individuals' interest income from abroad which is taxed at source, and the taxation of individuals' interest income hence resembles closely the residence system, which is not prone to tax competition pressures, but is likely to be prone to tax avoidance: since interest income is generally not subject to withholding taxes, individuals may avoid taxes on interest income from abroad all together[27].

In order to relieve double taxation of net of corporate tax dividend income of individuals, some countries have imputation systems in which the shareholder pays the difference between the income tax of the dividend and the corporate tax already paid. Some countries exempt dividends from income taxation entirely, while other countries have no provisions for avoiding double taxation. However, countries with imputation-type systems do not provide credits for foreign source dividend income, such that foreign source dividends are always subject to double taxation.

In conclusion, corporate capital income taxation behaves like source taxation and is therefore particularly prone to the types of tax competition presented in the theoretical literature review below[28]. In contrast, taxation of individuals' capital income follows more closely the residence principle and is therefore not as likely as corporate taxation to be under the tax competition pressure modeled in the basic tax competition literature. However, tax revenues from individual's capital income may have been declining with the increased capital mobility as well, as it has become easier to invest abroad, hence making it less likely that information about the proceeds from these investments reach the residence tax authorities. It has thus become easier to avoid

[25] This conclusion is inspired by Haufler (2001). Soerensen (2001) makes the same conclusion but does not extend it to company interest taxation.
[26] Several countries have recently switched to a dual income tax system, in which labor income is taxed at a progressive rate while income from investments (i.e. interest, dividends and capital gains) is taxed at a flat rate which is usually lower than that applied to labor income, and sometimes zero. See Joumard (2001).
[27] To counter the presumed widespread tax avoidance on foreign interest income in EU countries, the European Commission proposed a combined plan for information exchange and minimum withholding taxes on interest income in the EU. EU finance ministers accepted a revised plan in 2000, with an emphasis on information exchange among EU member states in the longer term being the solution, and contingent on specific third countries accepting participation. See Joumard (2001).
[28] To the extent, of course, that the particular corporate tax base is mobile. Some corporate profits might not be. An example of immobile corporate activity is natural resource extraction activity.

taxes on individuals' capital income. Measures of the tax burden on capital for the present purposes should thus be targeted as far as possible on corporate income taxation. As the discussion below will show, this is not always possible, and broader measures of the tax burden on capital will often have to be used.

Constructing a measure of the tax burden

Four categories of measures of the absolute tax burden on capital and the tax burden on capital relative to labor are discussed below: tax revenues in percent of GDP or total taxes, statutory capital tax rates, effective tax rates and implicit tax rates. Two criteria are used in choosing which measures of tax burdens to use: first, whether data exists/is accessible, and second, whether the measure contains ex post evidence of tax competition. Whether the measure reflects the tax incentives which corporations or capital would respond to is less important in the present contexts, since the response of capital to tax rates is not what is being investigated. Measures of marginal tax rates are therefore not discussed. The choices of measures of tax burdens for the present study are summarized in Table 0-2.

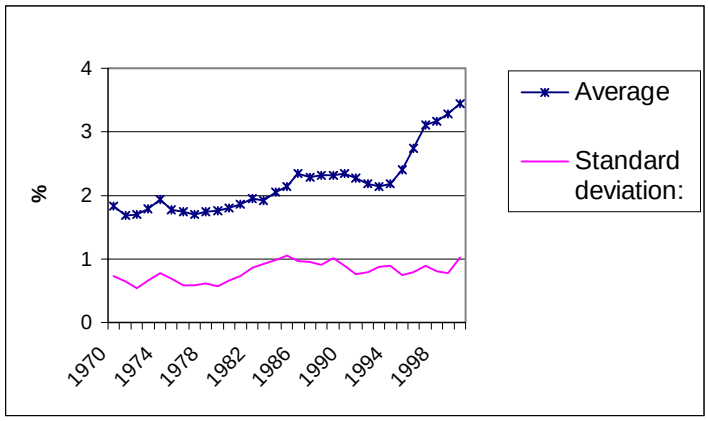
Tax revenues in percent of GDP

In the basic tax competition model, tax revenues and the tax rate on capital both decline as a consequence of tax competition when capital mobility increases. Capital tax revenues in percent of GDP should hence be suitable as the dependent variable in a panel regression testing for the presence of tax competition pressures. The main obstacle to measuring capital income tax revenues, however, is that taxes derived from capital are not directly reported in aggregate internationally comparable statistics. Tax revenues are usually split up in the three overall categories of indirect taxes, personal income taxes and corporate (or business) taxes, and capital income can fit into either of the two latter categories. Moreover, since personal income taxes also include taxes on income from unincorporated business and labor income as well as interest, dividend and capital gains from invested savings, there is no straightforward way of separating personal income taxes derived from capital income from that derived from other sources of income (attempts at doing so are made, however, see below).

One way of avoiding the problem of identifying capital tax revenues is to focus only on corporate income tax revenues. This would be justified by the above conclusion that corporate income taxation follows the source principle, as opposed to personal capital income. If corporate income is the part of capital income which is most mobile internationally, and if tax competition pressures are not found for this part of capital income taxation, then it is not likely to be found for other types of capital income taxation either[29]. Data on corporate tax revenues are easily available, and moreover, tax revenues in percent of GDP are predicted by the tax competition model to decline in the face of tax competition pressures, implying that tax revenues in percent of GDP should reflect the presence of tax competition, all else equal. Corporate tax revenues in percent of GDP will therefore be used as one of two dependent variables when testing hypotheses 2, 4 and 5. Corporate tax revenues in percent of total tax revenues will be used as one of two dependent variables when testing hypothesis 3.

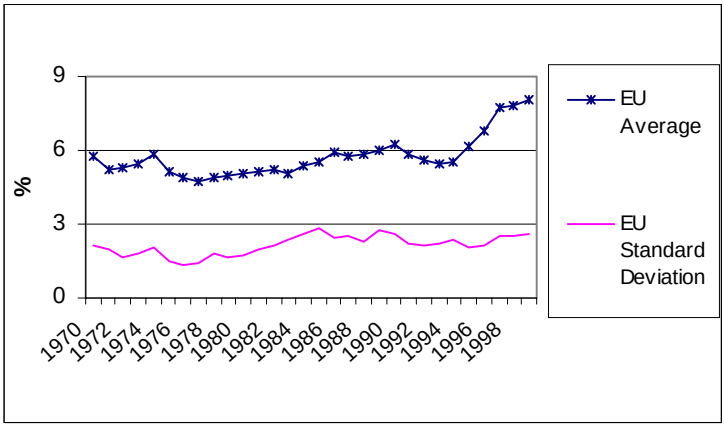
[29] Devereux et al (2002) use this argument in justifying only looking at measures of the corporate tax burden in the UK when looking for descriptive evidence of tax competition pressures in the UK.

Figure 0-1: EU average and standard deviation of corporate tax revenues in percent of GDP, 1970-2000. (Source: See Data Appendix)



The EU average and standard deviation of corporate tax revenues in percent of GDP are plotted in Figure 0-1. The plot shows that there has been an upward trend in average EU corporate income tax revenues since the mid 1970s, contradicting the central predictions of a race to the bottom in capital taxation. Clearly, the positive trend in corporate tax revenues partly reflects the positive trend in overall tax collections and the size of the public sector which has taken place in the post war era, but this cannot be the whole story. The growth of the public sector halted in the mid 1990s in EU countries[30], while from the mid 1990s, the positive trend in corporate tax revenues became even stronger. Capital tax revenues in percent of total tax revenues are plotted in Figure 0-2 and show a similar picture. Corporate tax revenues have been a rather steady fraction of total tax revenues, between 5 and 6 percent, until the mid 1990s, after which the fraction increased to 8 percent in 2000.

Figure 0-2: EU average and standard deviation of corporate income taxes in percent of total tax revenues, 1970 – 2000 (Source: See Data Appendix)



The recent increases in corporate tax revenues may stem from increases in the corporate tax base. This eventuality draws the attention to two potential problems with the use of corporate tax

[30] According to OECD data on primary spending in percent of GDP for EU countries.

revenues in percent of GDP as a measure of the tax burden on capital. First, the statistical definition of the corporate tax base may change at a certain point in time. Alternatively, incentives to register capital income in a certain category may change, in turn shifting tax revenues from the corporate to the personal income category, without changes in the economic definition of tax rates or bases taking place. Second, the corporate sector may simply grow or decrease as a proportion of the economy over time, leading to changes in corporate tax revenues unrelated to tax policies. Growth in the corporate tax base is very likely to account for the increase in corporate taxes to GDP and to total tax revenues of the late 1990s. A measure of the tax burden is therefore more precise if it takes into account changes in the corporate tax base.

Statutory tax rates

The statutory tax rate per definition takes into account the tax base. But the statutory tax rate has a similar and equally problematic drawback: The definition of the capital tax base to which the statutory rate is applied may differ significantly across countries, and does not correspond to the economic tax base. Examples of such cross-country differences include differences in the provisions for double taxation relief[31], tax holidays and provisions for writing off depreciated capital. All of these are important in measuring the tax burden on capital, but would not show up in any statutory tax rate. Statutory tax rates on capital are therefore not used as dependent variable in any of the empirical tests for tax competition of Section 6.

As alternatives, the empirical public finance literature has come up with several approaches to how to measure the average country tax burden on a particular tax base. Following the terminology used in Devereux et al. (2001), there are two types of measures of average tax burdens: effective tax rates and implicit tax rates. Effective average tax rates are measures of tax rates which are based directly on the legal-formal tax framework of the country in question[32]. Implicit tax rates, on the other hand, are derived from aggregate statistics on tax revenues and national accounts. Both approaches are discussed in turn below.

Effective Tax Rates

A methodology for calculating the marginal effective tax rate on capital has been proposed by King and Fullerton (1984), who suggest calculating the cost of capital on a hypothetical investment project for a given cost, horizon, country of origin, and other parameters, only letting the tax structure differ across the countries that are compared. The marginal effective tax rate is measured as the difference between the cost of capital gross of tax payments and net of tax payments. An average effective tax rates along the same lines is proposed by Devereux and Griffith (1998), who calculate the effective average tax rate as the difference between the net of tax and gross of tax cost of capital of the net present value of a hypothetical investment project. The advantage of effective tax rate measures is that they are rather precise and directly comparable across countries for the given underlying assumptions concerning the hypothetical investment project. The drawback is that the effective tax rate tends to vary substantially with these underlying assumptions, such that seemingly small changes in the assumptions concerning,

[31] Double taxation is a problem when the classical capital tax system is used, following which corporate dividend payments are taxed as corporate profits and individuals receiving the dividend payments are taxed on this income as well. There as almost as many systems for relieving this source of double taxation as there are countries in the European Union. See Joumard (2001) for an overview.

[32] Effective average tax rates often refer to the macro-approach to measuring average tax burdens described above. I have chosen to use Devereux's definition, however, since it is more logical.

for example, the type of financing, may change the conclusion about the relative size of capital taxation across countries dramatically. The effect of changes in the underlying assumption concerning the hypothetical investment project on the derived effective tax rate is clearly pointed out and shown empirically for EU countries in Hugounenq et al. (1999). One way to get around this problem would be to calculate the effective tax rates for a continuum of different underlying investment projects and taking the average as the overall effective tax rate. This is, however, out of the scope of the present study. Moreover, since effective tax rates more than reflecting ex post potential tax competition pressures, reflect the fiscal incentive structure for the underlying hypothetical investment project, and is hence less suited as tax burden measure in an empirical investigation of ex post effects of tax competition. Effective tax rates will hence not be used here as a measure of the average tax burden on capital.

Implicit Tax Rates

As opposed to the effective tax rate approach, the methodology used to calculate implicit tax rates takes its starting point in available aggregated data on tax revenues and taxable income, and is hence in essence an ex post measure of tax burdens. The seminal paper proposing a methodology along these lines is that of Mendoza, Razin and Tsar (1994). Mendoza et al. (1994) outline a methodology for how to classify different categories of tax revenues and income from OECD revenue statistics and national accounts into three tax categories, namely labor income, consumption and capital income. Capital income tax revenues are defined as a residual when all tax revenues from labor income and consumption have been identified, which makes this measure of the tax burden on capital somewhat broad and imprecise. Carey and Tchilinguirian (2000) propose refinements to the Mendoza et al. capital and labor income tax burden measures and as such are more appropriate, but still suffer from being broad and imprecise[33]. The main problem with the use of the implicit tax rate on capital as proposed by Carey and Tchilinguirian (2000) in empirical studies of tax competition is that it includes capital tax base categories which are not viewed as being mobile tax bases, such as property and inheritance taxation. Moreover, it includes capital tax bases, which are not formally taxed at the source, such as savings taxation. But it does have the advantage of taking into account changes in the tax base, as well as providing a relatively large sample for a large number of countries. Carey and Tchilinguirian (2000) provide data for almost all the EU countries from 1980 to 1997. The Carey and Tchilinguirian (2000) implicit tax rate on capital is chosen as the second dependent variable when testing hypotheses 2, 4 and 5. The implicit capital tax rate divided by the implicit labor income tax rate is used as dependent variable when testing hypothesis 3. The EU average and standard deviation of both are plotted in Figure 0-3 and Figure 0-4, and tell a very different story compared to that of corporate tax revenues. The implicit capital tax rate has shown an overall negative trend throughout the last two decades, lending support to the tax competition predictions. Only in the late 1980s and early 1990s and again in the last part of the 1990s did the implicit capital tax increase. Moreover, in line with the prediction of the tax competition models, the EU average implicit capital income tax rate has clearly decreased over the last 2 decades compared to the implicit tax rate on labor.

[33] Carey and Tchilinguirian (2000) point out a number of problems with, among other factors, the treatment of social security contributions, (one such problem was that they were included twice in the numerator of labor income taxation), employers' pension contributions, the division of self employed income between capital and labor income, etc.

Figure 0-3 EU average and standard deviation of implicit capital income taxes, 1980 - 1997 (Source: See Data Appendix)

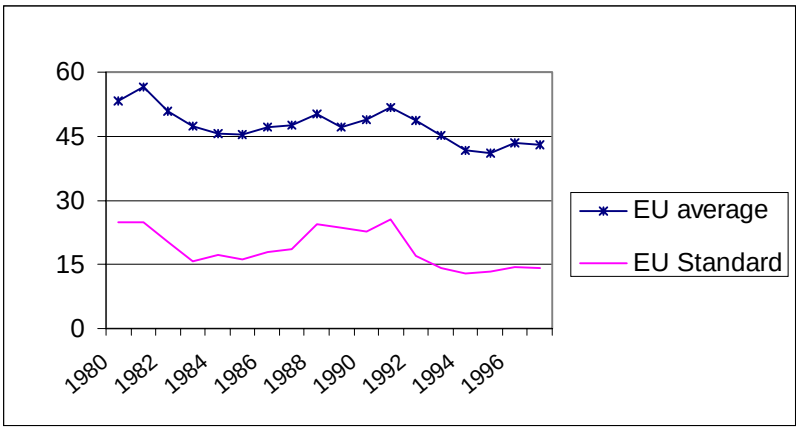
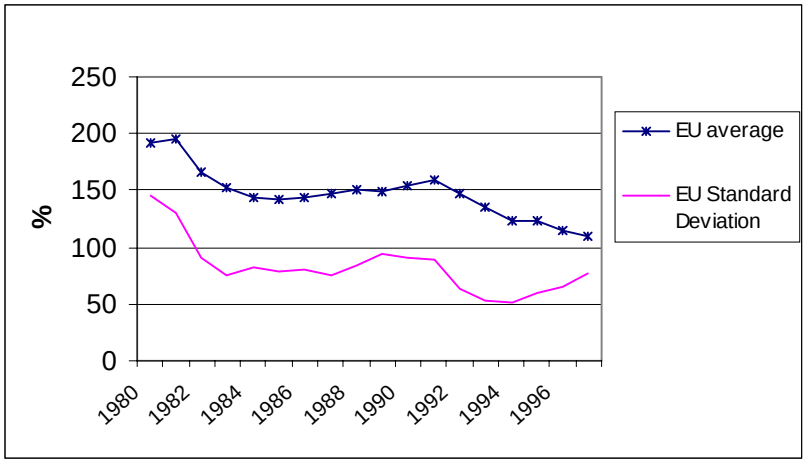


Figure 0-4: EU average and standard deviation of implicit capital income tax rates in percent of implicit labor income tax rates, 1980 – 1997 (Source: See Data Appendix)



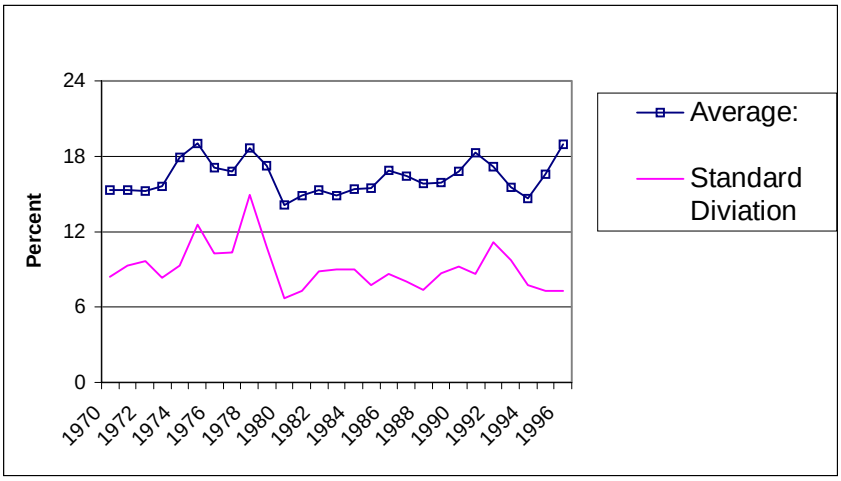
Due to the given problems in using the implicit capital tax rate in studies of tax competition pressures, Devereux et al. (2002) propose alternatively to calculate an implicit corporate tax rate[34]. Corporate profits are considered belonging to the more mobile of capital incomes, and moreover, using the implicit corporate income tax is consistent with the fact that corporation tax is the only capital income tax which is formally and consistently levied at source in EU countries. However, available data on operating surpluses for the corporate sector, which are used as measures of the economic tax base in calculating implicit corporate tax rates, are very limited and for several countries not available at all[35]. Moreover, as pointed out in Devereux et al (2002), the

[34] Devereux et al (2001) acknowledge that other capital taxes, which are not included in the corporate income tax, may be prone to capital income tax competition pressures. They argue, however, that tax competition is most likely to be found in corporate income taxes due to the tax structure of corporate income, and if not found there, is not likely to prevail in other forms of capital taxation either.

[35] Data on gross operating surplus of the corporate sector are provided by Eurostat, but only till 1997 after which the series are no longer are produced. Moreover, no data on gross operating surpluses are available for Austria, Greece and Ireland at all. The gross operating surplus is equal to the net operating surplus plus consumption of fixed capital

operating surplus is net of interest paid and received, while paid interest are not taxed and received interests are. Correcting for this flaw is cumbersome and would have to be done on a country-by-country basis. For these reasons, the implicit corporate tax rate is not used as dependent variable in the regressions. However, for illustrative purposes and in order to use it in robustness tests, the corporate implicit tax rate using the gross operating surplus is calculated for the 9 of the EU countries for which data is available. A plot of the EU average and standard deviation of the implicit corporate tax rate is provided in Figure 0-5[36]. No discernable trend is present in this average, thus implying that the increase in average EU corporate tax revenues over the same time period mostly stems from an increase in the tax base. As for corporate tax revenues in percent of GDP and total taxes, an increase in the last part of the 1990s is also present, but less pronounced, implying that the increase in corporate tax revenues of the late 1990s is due in part - but not fully - to increases in the tax base.

Figure 0-5: EU average and EU standard deviation implicit corporate tax rate, 1970-1996 (Calculated s corporate tax revenues in percent of gross operating surplus. Source: OECD)



Main points concerning tax burden measures

The above overview of different measures of the tax burden on capital reveals that depending on which data is chosen, descriptive statistics on tax burdens may tell many different stories about the effect of capital mobility on tax rates. Corporate tax revenues in percent of GDP and in percent of total taxes have increased significantly in recent years, contrary to the predictions of the theoretical tax competition literature. The corporate implicit tax rate has remained stable during the same time period, implying that the recent relative increases in corporate tax revenues are due to increases in the corporate tax base. Moreover, the implicit tax rate on capital has mostly decreased over the last two decades, lending support to the central prediction of the tax

(OECD national accounts definition). Data on net operating surpluses for the corporate sector are provided by OECD national accounts and the samples are even smaller than those of the gross operating surplus. Another problem with using the net operating surplus is that the way to adjust for consumption of fixed capital is very different across countries, making the series from some countries very volatile while the series of other countries are very stable, further discrediting the use of this measure for a cross country investigation.

[36] Devereux et al (2002 forthcoming) calculate a correction for interest payments and receipts for the UK.

competition literature. For reasons of data availability, for the sake of comparison and due to their attributes as ex post tax burden measures, two of the three above mentioned measures will be used as dependent variable in turn, in testing hypotheses 2, 4 and 5: the implicit capital income tax rate calculated using the Carey and Tchilinguirian (2000) method and corporate tax revenues in percent of GDP. Hypothesis 3 will be tested using corporate tax revenues in percent of total tax revenues and the implicit tax rate on capital in percent of the implicit tax rate on labor as dependent variables for the same reasons. Hypothesis 1 is tested using primary expenditures in percent of GDP as dependent variable. The choices of hypothesis specific dependent variables are summarized in Table 0-2.

Measures of Capital Mobility

Just as there is no perfect, but several imperfect, measures of the tax burden on capital, there is no straightforward measure of the degree of capital mobility, but there is a battery of suggested proxies. Approaches to constructing empirical measures of capital mobility can be split into 4 different categories: The legal/formal approach; the volume approach; the price approach; and the macro approach. Each type of measure, what it has to say about the degree of capital mobility in the European Union over the past few decades and whether the measure is appropriate to use in the panel regression analysis is discussed in this section. The choices of measures for the empirical analysis are summarized in Table 0-2.

The legal/formal approach

The degree to which capital flows freely across national borders is influenced, if not entirely determined by, the legal framework governing financial transactions between residents and non-residents of a country. National financial regulation can therefore be coded into an index of the restrictions to the free movement of capital. The simplest way to create an index of capital mobility based on the legal/formal framework is to create a dummy taking the value one if some type of restriction of cross border financial transactions is in state in the respective country, and zero otherwise. Alesina et al (1994), among other studies[37], construct four dummies on the basis of information from the Annual Report on Exchange Restrictions of the IMF, each dummy taking the value of one if there are restrictions in one of the four following areas of financial cross border transactions: the existence of multiple exchange rates, restrictions on current account transactions, restrictions on capital account transactions and requirements of surrender of export proceeds. The four dummies can be used separately, or as a weighted average, as measures of capital mobility.

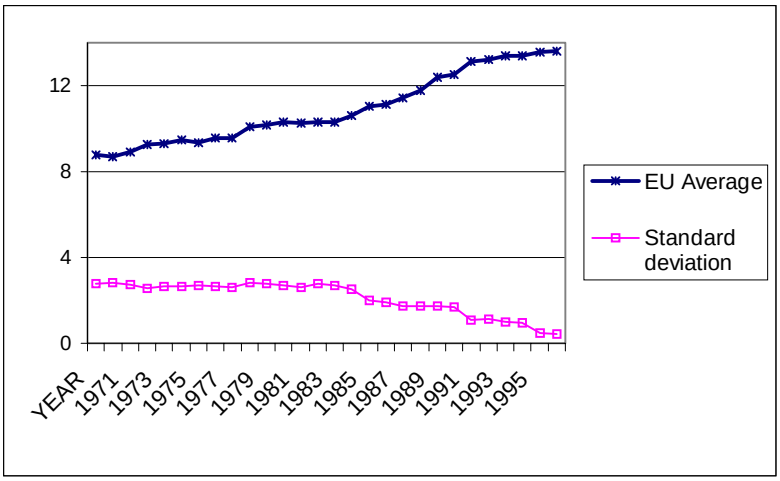
Quinn (1997) proposes a more sophisticated measure of capital mobility based on the legal/formal framework governing international capital transactions, also based on information on financial regulation from the above mentioned IMF publication. Quinn's 14 point index is constructed using a scoring system to translate restrictions on not only outward but also inward capital account transactions, outward and inward current account transactions, and finally, the existence of agreements limiting the future use of capital controls, into a quantitative measure ranging from 0 (financially closed) to 14 (financially open). Quinn proposes using the first difference of the 14-point index as a measure of financial liberalization. Figure 0-6 shows the

[37] A non-exhaustive list of studies using discrete legal measure of capital mobility is Grilli and Milesi-Ferretti (1995), Rose (1994), Epstein and Schor (1992), and Garrett (1995).

mean and standard deviation of Quinn's 14-point index for EU14[38]. The trend is clear: financial liberalization in the EU has increased and the dispersion in the degree of liberalization has narrowed - much confirming the usual perception of how capital mobility has evolved in the last few decades. The individual country series (not shown) increase during almost the entire period for all 14 countries, conforming to the general perception of increased capital mobility in the European Union during the last three decades. Quinn's 14-point index will be used as one of three measures of capital mobility in the empirical analysis.

Perhaps the most important drawback of the legal/formal approach to measuring capital mobility is its discrete nature, since the sheer presence of restrictions does not necessarily convey any information about the magnitude of the actual impact of the restriction on capital flows. For example, mechanisms for enforcement of the legal restrictions may prove of key importance to the effect of the restrictions. Moreover, non-legal restrictions of cross border capital flows such as transaction costs and institutional barriers, may also significantly influence the degree of capital mobility, and are not taken into account in the legal approach[39].

Figure 0-6: EU average and standard deviation of Quinn's 14 point index, 1970 – 1998 (Source: See Data Appendix[38])



The volume approach

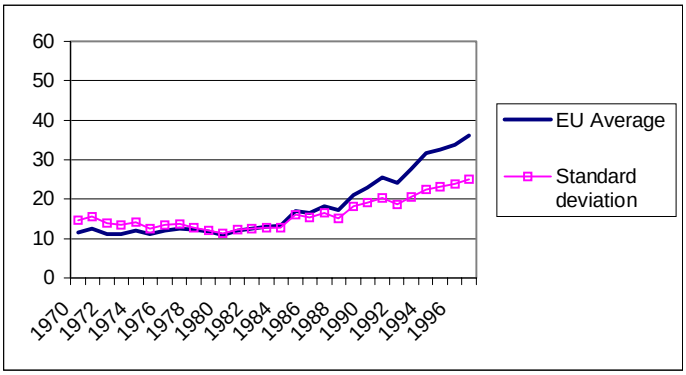
Another measure of the degree of capital mobility widely used in the literature is the volume of gross cross border stocks or flows of either portfolio capital, foreign direct investment flows or both, and rests on the assumption that increases in the mobility of capital results in increasing flows of cross border investment.

[38] I am very grateful to Dennis Quinn for kindly providing data on Quinn's 14 point index for EU countries in electronic form.

[39] See Grilli and Milesi-Ferretti (1995) for a more thorough discussion of drawbacks of the simple dummy approach.

Both stocks and flows of cross border investment have been used in the literature as measures of capital mobility[40]. Which of the two measures is the conceptually more consistent one to use as a proxy for capital mobility depends on whether a certain degree of capital mobility corresponds to an equilibrium level of gross stock or gross flow of foreign investment. Arguably, if two countries with different returns to investment and zero capital mobility between them open up to capital flows, capital would flow until the returns to capital were equalized, after which there would be no more incentive for capital flows. Hence, a certain stock of foreign investment would correspond to a certain degree of capital mobility in equilibrium, which implies that stocks would be the more correct measure of the degree of capital mobility. The same conclusion is arrived at when using portfolio theory arguments, as Adam et al. (2001) do[41]. Adjustment to a new degree of capital mobility may, however, be sluggish, in which case it could be argued that flows are better short-term indicators of changes in capital mobility. Following Obstfeld and Taylor (2001) and Adam et al. (2001), stocks have been preferred to flows for the present treatment of capital mobility. New estimates of stocks of FDI and portfolio equity investment positions carried out by Lane and Milesi-Ferretti (2001) and data on portfolio debt assets and liabilities from IFS International Investment Position data has been used to construct 3 measures of capital mobility: the sum of inward and outward FDI stocks; the sum of inward and outward portfolio equity investment stocks; and finally the sum of inward and outward portfolio debt investment stocks, all three in percent of GDP. The EU average and standard deviations of the three measures are plotted in Figure 0-7, Figure 0-8 and Figure 0-9. Only for the first were data available for all EU countries[42], and hence, the samples used to calculate the averages are not the same for the three measures. For this reason, only the FDI stock in percent of GDP is used as a measure of capital mobility in the empirical analysis.

Figure 0-7: EU average and standard deviation of sum of inward and outward stock of FDI in percent of GDP, 1970 – 1997. (Source: See Data Appendix)



[40] Obstfeld and Taylor (2001) look at cross border stocks of FDI and portfolio investment as an indicator of capital mobility, while Garreth and Mitchell (2001) and Swank (1998) use FDI and portfolio capital flows.
[41] Portfolio theory implies that investors diversify optimally and hold a portfolio on the efficient frontier. Hence, comparing the actual portfolio with the optimal, or benchmark, portfolio, should give an indication of the degree of financial integration.
[42] Data for neither of the portfolio measures were available for Greece and Ireland. Moreover, data on stock of inward and outward debt portfolio investment were not available for Portugal and Spain.

Figure 0-8: EU average and standard deviation of sum of inward and outward portfolio equity investment stock, 1970 - 1997. (Source: See Data Appendix)

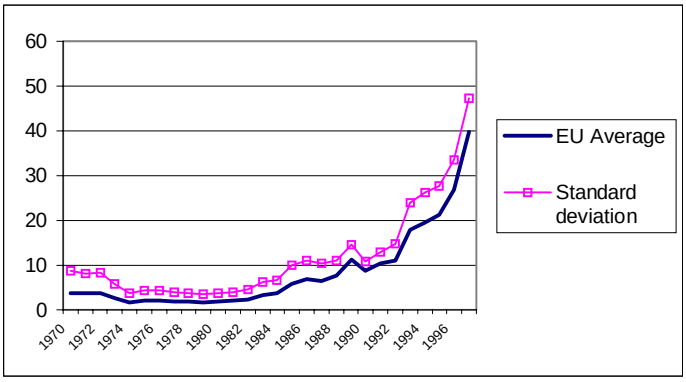
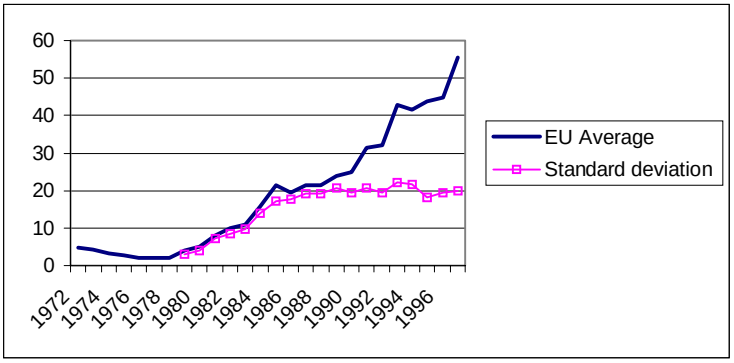


Figure 0-9: EU average and standard deviation of sum of inward and outward portfolio debt investment stocks, 1970 - 1997. (Source: See Data Appendix)



The three volume measures show the same pattern. Stocks of cross border investment have been increasing since the late 1970s-early 1980s, conforming to the usual perception that capital mobility has been increasing for the last couple of decades. The standard deviation of EU foreign direct and portfolio investment stocks increased during the period as well, except for portfolio debt stocks for which the standard error stabilized during the 1990s. An increase in the dispersion implies a divergence in the degree of capital mobility around the increasing trend, which is somewhat counter to the usual perception and gives an indication of the uncertainty of using this measure as a measure of the degree of capital mobility. Cross border capital flows may to a higher degree be driven by increases in wealth than by capital mobility per se, and to control for this effect, stocks should be divided by net wealth rather than GDP. However, data on net wealth is not available. There are several other drawbacks to using this approach to measuring capital mobility. As mentioned above, the volume approach to measuring capital mobility rests on the assumption that increases in the mobility of capital results in actual cross border capital flows. This assumption is a weak point of this approach, as investment decisions do not necessarily respond to increases in the mobility of capital if there are no price incentives to respond to, and capital may flow across borders if price differentials become high enough, even when the cost of

the cross border transaction has not changed. At the same time, it is very possible that increases in capital mobility result in changes in asset prices rather than offsetting capital flows.

The price approach

Covered Interest Parity differentials (CIP)
As mentioned in the paragraph on the dummy approach to measuring capital mobility, using dummies for the existence of capital restrictions does not sufficiently describe the degree of capital mobility. Moreover, increased capital mobility may tend to equalize prizes (i.e. interest rates) rather than producing actual capital flows, as mentioned in the paragraph on the volume approach. A way of getting around both critiques is to look at the price differential directly. Based on the assumption that the higher the price differential net of currency risk between two identical assets of different nationality, the higher restrictions, formal or informal, to capital mobility must be since price-offsetting flows have not been triggered to take advantage of the arbitrage opportunity. In other words, in a regime of perfect capital mobility, some sort of interest parity condition should hold while the lower the degree of capital mobility is, the higher a differential from interest parity should be possible without triggering arbitrage activity.

Adam et al. (2001) give a very thorough overview of different measures of financial market integration based on the divergence from the law of one price. Measures of bond and credit market integration include international comparisons of interest on similar bank deposits (Centeno and Mello (1999), Kleimeier and Sander (2000), among other studies use such measures), international differences in similar banking products, as well as divergence from interest parity of similar financial assets (Lemmen and Eijffinger (1996)) and changes in the degree of M&A activity. Measures based on the law of one price have the same drawbacks and potential pitfalls in common: the products compared have to be very similar in terms of risk and liquidity profile for the differential in price to be an indicator of market segmentation. This drawback poses a substantial constraint on the number of assets, which can be used for the purpose of measuring market integration and capital mobility.

The covered interest parity differential for three months inter-bank deposits is very commonly used for measuring interest parity differentials due to the availability of data as well as the homogeneity of inter-bank deposits across borders. For these reasons, as well as the fact that the measure provides both time and cross-country variation, this measure of capital mobility will also be used here.

Covered interest parity is based on the notion that the return on two identical assets denominated in different currencies should be the same when currency risk is hedged in the forward market, default risk and liquidity characteristics of the two assets are the same and capital is perfectly mobile. The differential from covered interest parity can hence be written:

$$\rho_{t,\delta} = 1 + r_{t,\delta} - (1 + r^{*}{}_{t,\delta}) \cdot \frac{F_{t,\delta}}{S_t} \qquad (0\text{-}2)$$

where ρ is the covered interest parity differential at time t with respect to an asset of a maturity of δ, r is interest on the domestic asset, r^* is the interest on the foreign asset, F is the forward exchange rate at time t for time $t+\delta$ and S is the spot exchange rate at time t, expressed in domestic currency per foreign currency. The differential can consist of differential default risk of the two assets, differential liquidity premiums of the two assets, differential transaction costs or capital controls. It is therefore important to choose assets, which are as similar as possible with respect to default risk and liquidity in order to minimize the measurement error of the two latter components of the differential which amount to capital mobility.

Ideally, interest and exchange rate data observed on the same time of day and the same day should be used to calculate the differential, but collecting such data for a panel of EU countries limits the sample size substantially compared to using monthly averages of the relevant variables. Since the availability of data on monthly averages is better and following Lemmen (1996), monthly averages of data on 3-month inter-bank deposit interest rates, 3-month forward exchange rates and spot rates from Datastream and OECD Main Economic Indicators are used to calculate *CIP*s for 14 European Union countries. In the defense of using monthly averages, note that if interest parity holds for data sampled at the same time in the month, then it should also hold for monthly averages. On the other hand, a value close to zero of the CIP calculated using monthly averages does not necessarily imply that interest parity holds for data collected at the same time in the month, implying that using monthly averages may tend to understate the differentials from interest parity. This potential for understatement should be kept in mind when analyzing the estimates.

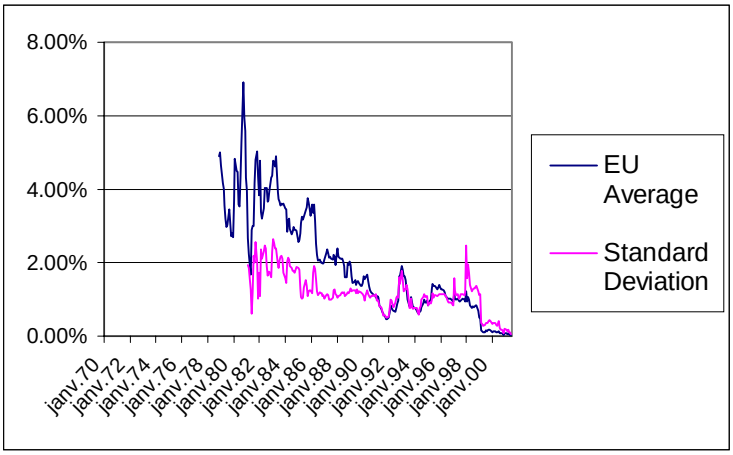
The absolute differentials from covered interest parity *vis-à-vis* Germany will be used as the third measure of capital mobility in the empirical analysis. Using Germany and not a third country (e.g. the US) as base country rests on the hypothesis that Germany had close to free capital movements for the entire period. This hypothesis is supported by the Quinn's 14-point index, which designates Germany as having had close to perfectly financially since 1970, contrary to any other OECD country[43]. Since Germany is the base country, the series is set to zero for Germany for the entire period. Moreover, due to the integrated inter-bank market post January 1999, the series for all EMU member countries are set to zero after this date while the absolute differential remains positive for the UK, Sweden and Denmark. The longest series allowed by availability of both future and spot exchange rates and inter-bank deposit rates is for Spain, starting in 1977. However, the CIP is highly volatile between 1977 and 1990 (going from 11 percent to 2 percent and back to 11 percent in a few years). Since such volatility is unlikely to be due to changes in capital mobility, and more likely to stem from changes in default, systemic or liquidity risk changes, only data from 1990 onward is therefore used for a Spanish measure of capital mobility. The EU average CIP is shown in Figure 0-10. As for the gross investment position measures and Quinn's 14 point index, the average absolute covered interest parity differential exhibits an increasing trend in capital mobility over the past 20 years, but the sequencing of increases in capital mobility implied by the CIP is different from the other two measures. The absolute CIP indicates that a high degree of capital mobility was reached already

[43] Quinn's 14 point index only takes the values 13 or 14 for the entire period for Germany, implying that Germany had very few capital controls from 1970 to 1997. This is contrary to all other OECD countries, which have values between 4 (Portugal) and 12.5 (US, Canada and Switzerland) in 1970, after which the score mostly increases for all OECD countries.

in the early 1980s, while Quinn's 14-point index shows a pattern of increasing capital mobility throughout the period and the investment stock indicators show that capital mobility increased with an increasing rate over the period in question. The dispersion around the European mean absolute interest parity differential also fell during most of the period, except for increasing slightly after 1992, a possible consequence of the 1992 European currency crisis which may have affected perceived systemic risk of the European banking sectors, and in turn default risk and liquidity premiums.

When using the CIP as a measure of the degree of capital mobility in panel regressions of equation (0-1), it is interesting to note that contrary to the results of the unit root tests of all other measures of tax burdens and capital mobility, a unit root is clearly rejected when monthly country series are used, suggesting that the levels of the CIP are stationary (see Data Appendix). This result could be taken to suggest that the levels rather than the first differences of the CIP could be included in the otherwise first differenced regressions. However, since the level and not the change in the CIP is a measure of the degree of capital mobility, and since yearly and not monthly observations of the CIP are used in the regressions and unit root tests of these are inconclusive due to the short time series, the CIP is included in first differences in the basic specification.

Figure 0-10: EU monthly average and standard deviation of absolute covered interest parity differentials (CIP), 1975 - 2001. (Source: See Data Appendix)



An alternative to the short-term covered interest differential would be to calculate covered interest differentials for long-term assets, as a measure of capital mobility of long-term financial assets. However, no convincing methodology seems to have been devised as of yet for calculating such interest differentials[44].

[44] Popper (1993) provides a methodology for calculating long-term interest differentials, but the approach has conceptual problems which make the methodology problematic. Using currency swap rates as well as interest swap rates, she converts the yield of the foreign currency asset into a domestic currency yield and compares, but does not take into account that the same yield may be derived from different coupon/principal profiles of the foreign currency bond, in turn implying differences in risk profiles, which would make the bonds incomparable.

Cross border asset price correlations

Another measure belonging to the category of price measures of capital mobility is cross border equity price correlations. It can be argued that when the mobility of capital is higher, capital should respond more easily to market specific changes in risk and return to equity by seeking other countries with better risk return profiles, all else equal. Hence, equity prices should co-vary across countries. However, using ex-post cross-country equity price correlations as a measure of cross border capital mobility has many potential pitfalls. Among these are that co-variation may be due to common shocks rather than capital flows responding to changes in cross border differences in price or uncertainty driven by country specific events[45]. Similar problems are present for ex-post cross-country bond price correlations as a measure of capital mobility, and cross-country asset price correlations will therefore not be added to the battery of capital mobility indicators employed here. To avoid correlations being driven by common shocks rather than by market integration, ex-ante returns to equity can be estimated using a asset-pricing model specification. Several authors have attempted this approach, notably Hardouvelis, Malliaropoulis and Priestly (1999), who apply this methodology to European countries. Although a very promising approach to measuring capital mobility, applying this sophisticated methodology is out of the scope of this study.

The macro approach

The macro approach to measuring the degree of capital mobility includes two measures: within-country savings-investment correlations and cross-country consumption correlations.

Savings investment correlations are used as a measure of capital mobility since the less savings and investment are correlated within a country, the more access that country must have to international financial markets to smooth investment, and the higher should be the degree of capital mobility. Feldstein and Horioka (1980), and more recently Hussein (1998) and Lehner (1998) use the approach. Consumption correlations across countries are used as a measure of capital mobility because the higher degree of correlation of consumption across countries, the more access consumers of each country must have to international financial markets to smooth consumption and share risk, and the higher is the degree of capital mobility. Sorensen and Yosha (1997) and Adam et al. (2001) are examples of an application of this approach to EU countries. Important critiques of the two measures of capital mobility have been put forth. One such critique is that savings and investment as well as cross-country consumption can be correlated due to common shocks rather than a lack of financial integration - the same problem with the use of cross-country asset price correlations as a measure of financial integration[46]. Moreover, the measures are usually calculated as a single correlation coefficient for a country or for a group of countries. Thus, these measures do not produce a time and country dependent index of capital mobility, which would be needed in a panel regression. Macro-based measures of the degree of capital mobility will therefore not be used here.

[45] Obstfeld and Taylor (2001) look at equity price correlations to evaluate changes in the degree of international capital mobility over the last century. They show that changes in correlations do not correspond closely with the consensus u-shape perception of the degree of capital mobility over the last century. Rather, correlations are likely to stem from common shocks (which was clearly the case in the 1920s and 1930s) rather than globalization *per se*.

[46] See Lemmen (1998) for a discussion of problems with the two macro approaches to measuring capital mobility.

Main points concerning measures of capital mobility

Four approaches to constructing a measure of the degree of capital mobility have been presented. First, the legal/formal approach, which identifies whether restrictions to the cross border movement of capital are formally in state. Second, the volume approach which take the volume of cross border capital transactions as a measure of the degree of capital mobility. Third, the price approach, which is based on the notion that capital will move to equate prices across borders if it is free to do so, and hence uses cross border asset price disparities or correlations as an indicator or the degree of capital mobility. And finally, the macro approach based on the assumption that free access to international capital markets should result in consumption smoothing and the detachment of investment and savings within countries. Three measures, one from each of the first three approaches, will be used as measures of the degree of capital mobility in the panel regression analysis of the next section due to their characteristics of providing both time and cross-country variation as well as their relative appropriateness as measures of capital mobility: Quinn's 14 point index of financial openness (also referred to as Quinn14), FDI stock in percent of GDP (also referred to as FDI) and absolute covered interest parity differentials (also referred to as CIP). Table 0-2 summarizes which measures are used in the different tests of the next section.

Each of the measures identified above have significant drawbacks, however, and extensive research into devising new measures of capital mobility and financial integration is warranted. The ongoing Adam et al. (2002) study of indicators of financial integration in the European Union is a step in this direction. Their series of indicators are not available as this is being written, however.

Measuring Country Size and the Degree of Agglomeration

Testing the hypothesis concerning the effect of economic size of a country on the tax competition equilibrium calls for a measure of economic size.

Bocuvetski (1988) looks at differences in population size when investigating the theoretical implications of asymmetries in the size of countries engaged in tax competition, implying that population size could be used as a measure of country size for testing the asymmetry hypothesis. However, Bucovetski assumes that all citizens are identical and hold the same amount of savings to invest, and hence that differences in population size result in a proportional difference in the endowment of investable savings and fixed factors of the countries. According to the model, the endowment of capital as well as immobile labor[47] rather than population size is what affects the elasticity of the marginal product of capital and hence the optimal tax rate. Since composite measures of factor endowment are not available, GDP relative to total EU GDP will be used as a proxy[48]. Figure 0-11 and Figure 0-12 show scatter plots of average size and implicit tax rates and corporate tax revenues in percent of GDP respectively. The plots show that a clear relationship between size and capital taxation is not evident.

[47] The endowment of immobile labor matters in that it changes the marginal productively to capital in the basic tax competition model. Hence, to be strict, it is the endowment of labor scaled with its productivity which matters, but these are details that will not be further developed here.

[48] What matters for the equilibrium tax rate in asymmetric models is relative and not absolute size. If real GDP increases in all competing countries in the same year, this should not matter for the equilibrium tax rate. Hence, the ratio of total EU GDP produced in the given country is used.

Figure 0-11: Country size and implicit capital tax rate, averages over 1980-1997. (Source: See Data Appendix)

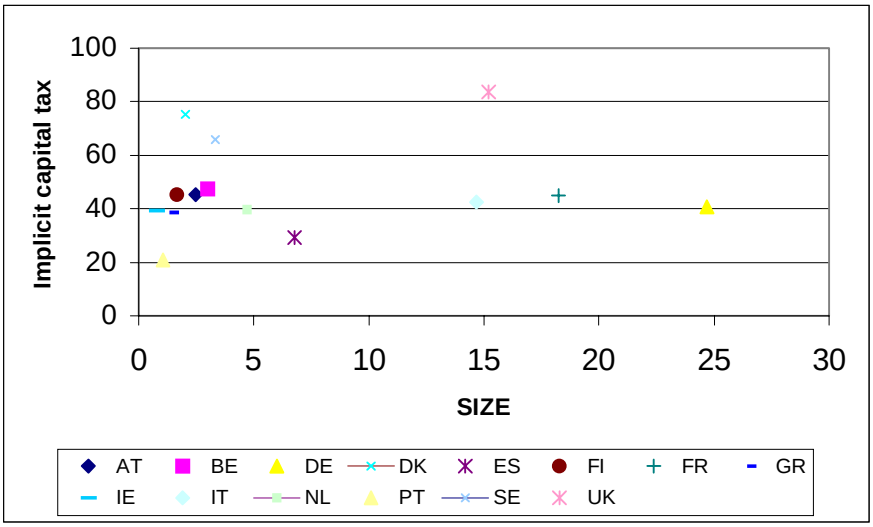
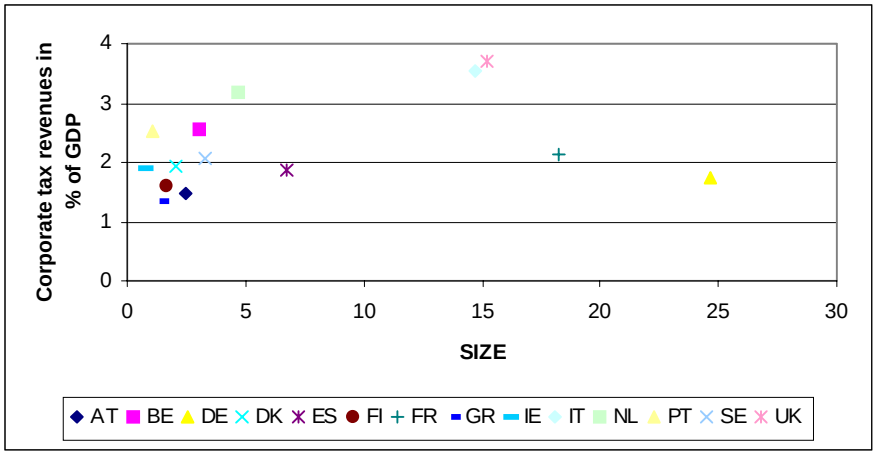


Figure 0-12: Country size and corporate tax revenues in percent of GDP, averages over 1980-1997. (Source: See Data Appendix)



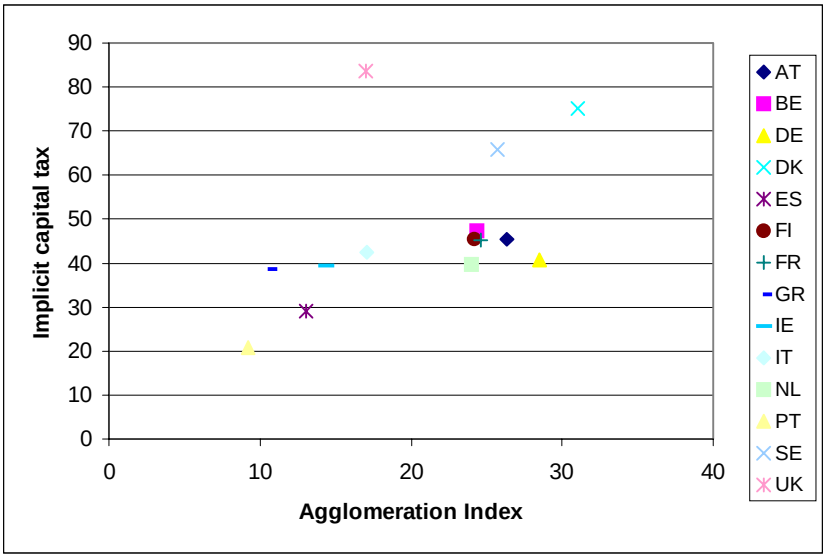
When testing the central predictions of the economic geography literature for tax competition, a measure of agglomeration is needed. In identifying the kind of agglomeration in question in the agglomeration models of tax competition, an important conceptual problem becomes evident. Since the present study is country based, a measure of agglomeration on country scale, including aggregate production, is needed, whereas the empirical literature on agglomeration economies only provides industry or sub-region specific measures of agglomeration economies[49].

[49] These measures include the Balassa index and the derived locational Gini-coefficient, see for example Mary Amiti (1999): "Specialization Patterns in Europe" Weltwirthshaftlishes Archiv 1999, vol 135(4)

Agglomeration economies are therefore measured here as real gross domestic product per capita[50]. GDP per capita is measured in millions of dollars in fixed 1995 prices per capita.

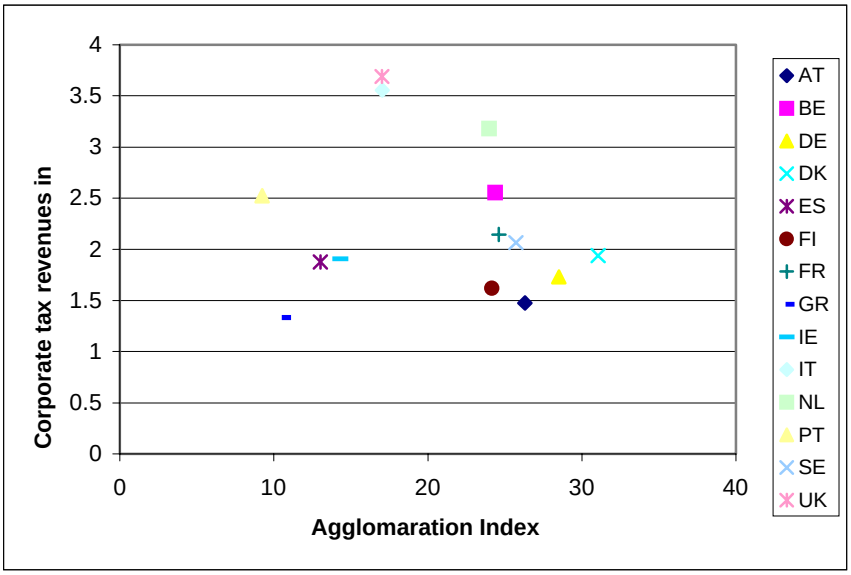
Figure 0-13 shows the average agglomeration index for each country plotted against the average implicit tax rate on capital for the period 1980 to 1997. The positive relationship is clear, with only the observation for the UK breaking the trend: the more economic activity per capita, the higher the implicit tax rate on capital, lending support to the new economic geography predictions for capital mobility and capital income taxation. This positive link between agglomeration and capital income taxation becomes less clear when corporate tax revenues in percent of GDP is used. Figure 0-14 shows that here, the relationship is rather bell-shaped, and might be due to the fact that more economic activity means higher GDP, such that the numerator of the tax measure goes up as well as the denominator, when agglomeration increases. This should be kept in mind when the empirical analysis is carried out, and hypothesis 5 is therefore only tested using the implicit tax rate.

Figure 0-13: Agglomeration and implicit capital tax rate, averages over 1980-1997. (Source: See Data Appendix)



[50] Alternatively, manufacturing value added per capita could be used, but since it does only include one aspect of production, the gross domestic product has been adopted.

Figure 0-14: Agglomeration and corporate tax revenues in percent of GDP, averages over 1980-1997. (Source: See Data Appendix)



Summary of Data Sources and Measures

Most of the data for the econometric analysis of the five hypotheses comes from OECD Revenue Statistics and OECD Economic Outlook, with some exceptions. Precise sources and definitions are given in Data Appendix. Data on capital mobility, tax burdens, asymmetries and agglomeration are not directly available. This section has discussed and identified measures of these variables to be used in the empirical analysis.

The method proposed by Carey and Tchilinguirian (2000) is adopted for calculating implicit tax rates on labor and capital. Moreover, simple corporate tax revenues in percept of GDP as well as in percent of total tax revenues will be used as well. Several measures of capital mobility are identified, and three measures are adopted in this study. Asymmetries in country size are proxied by the fraction of EU real gross domestic product produced in the country in question. Finally, the potential for agglomeration economies is measured by real gross domestic product per capita. Table 0-2 summarizes the choices and definitions of the variables used for testing each of the five hypotheses in the panel regression analysis.

Table 0-2. Overview of hypotheses to be tested and the hypothesis specific dependent and explanatory variables used in the panel regression analysis.

	Hypothesis	Dependent(s) variable(s)	Hypotheses specific explanatory variable(s)
H1	The higher the capital mobility, the lower the primary government expenditures	Primary expenditures in percent of GDP.	• Quinn14 • FDI stocks • CIP
H2	The higher the capital mobility, the lower the tax revenues from and tax burden of capital income taxed at the source	Tax burden on capital measured by the implicit capital tax rate and corporate tax revenues in percent of GDP	• Quinn14 • FDI stocks • CIP
H3	The higher the degree of capital mobility, the higher the tax rate on labor relative to that of capital income	Tax burden on capital relative to the tax burden on labor measured by the implicit capital tax rate in percent of the implicit tax rate on labor, and corporate tax revenues in percent of total tax revenues	• Quinn14 • FDI stocks • CIP
H4	The larger the country, the smaller the downward pressure of capital mobility on the capital tax rate	Tax burden on capital measured by the implicit capital tax rate and corporate tax revenues in percent of GDP	• Quinn14 • FDI stocks • CIP Alone and interaction with the percentage of EU real GDP produced in the country.
H5	The more production is clustered in a country, the lower the effect of capital mobility on the tax rate	Tax burden on capital measured by the implicit capital tax rate	• Quinn14 • FDI stocks • CIP Alone and interaction with GDP per capita.

6. Results of the Empirical Analysis

Estimation Procedure

Table 0-3 shows the results of the regressions of the basic specification for each of the dependent variables, which will be used for testing the five hypotheses, excluding hypothesis specific explanatory variables. Even though there is data for some variables and some countries back to 1970 for the regressions using corporate tax revenues as dependent variables, the sample range has been restricted to exclude data from the 1970s. The reason is that the standard errors of the parameter estimates of the control variables fall significantly when the 1970s are not included, as can be seen when comparing with the results of the regressions including all available observations, shown in Table 0-15 in Appendix[51]. The sample thus runs from 1980 to 1999.

[51] When carrying out Chow tests of a structural break between 1980 and 1990, no structural breaks are accepted by the data, however. When carrying out Chow predictive tests for the same structural break, these are not accepted.

The regressions are estimated using FGLS, allowing for cross-country contemporaneous correlation of the error terms as well cross sectional heteroskedasticity. The Hausman tests for fixed effects against the alternative of random effects are all accepted, implying that the fixed effects model is the more appropriate of the two one-way error components models. Moreover, the test for the country fixed effects jointly being equal to zero rejects the null in all regressions on a 5 percent significance level, with the exception of the regression of corporate tax revenues in percent of total revenues[52]. The fixed effects one-way error components specification is therefore kept. Concerning the goodness of fit of the regressions, an F-test of the slope coefficients being jointly equal to zero is rejected in all five regressions[53].

All parameter estimates of explanatory variables are either insignificant or significant with the expected sign in the five regressions shown in Table 0-3, with two exceptions. The dummy for partisanship, *LEFT*, is significantly positive in the regressions on corporate tax revenues relative to GDP and total tax revenues (B and C), contrary to the usual perception of left wing expenditure policy[54], and contrary to the conclusions of Persson and Tabellini (1992). But the native sign may also be the previously mentioned tax base effect. A left-wing government may enact policies which potentially lower the corporate tax base effect. Moreover, *PART* enters significantly positively in the implicit tax rate regressions, opposite to expectation. An interesting result for the control variables is the parameter estimates for the Maastricht Treaty dummy, which come out strongly significant and with the expected sign in the primary expenditure regressions as well as the two regressions of corporate tax revenues. This implies that the Maastricht budget restrictions have had a significant impact on fiscal policy in EU member states, and indicates moreover that corporate taxation has taken more of the adjustment toward balancing budgets than other types of taxation.

Results

The *CIP* has been multiplied by minus one in the following, so that an increase in the *-CIP* implies an increase in capital mobility in line with the *FDI* and the Quinn14 measures of capital mobility.

Test of Hypothesis 1: The effect of capital mobility on primary spending

The hypothesis that higher capital mobility results in lower primary spending in EU countries is tested by regressing primary expenditures in percent of GDP on the three measures of capital mobility identified in Section 5 in addition to the 7 control variables. The regression results are shown in Table 0-4.

[52] For which the hypothesis of zero fixed effects has a significance probability of 9 percent.

[53] The R2 of the regressions are also reported in Table 0-3, but are not meaningful when FGLS estimation is used, and are therefore not commented on.

[54] This is not due to the variable capturing an election year effect since including a dummy taking the value one in years of parliamentary elections does not change the sign or significance of LEFT, nor is it itself significant.

Table 0-3: The basic regressions excluding hypothesis specific explanatory variables, specification tests

Dependent Variable	A. Primary expenditures in % of GDP			B. Corporate tax revenues in percent of GDP			C. Corporate tax revenues in percent of total tax revenues		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
GR_{-1}	-0.083	-2.416	0.017	0.025	3.300	0.001	0.068	3.761	0.000
$INFL_{-1}$	0.0248	1.256	0.211	0.007	2.301	0.022	0.007	0.835	0.405
$\Delta OPEN_{-1}$	0.0208	3.110	0.002	-0.003	-3.046	0.003	-0.006	-1.833	0.068
$\Delta PART_{-1}$	0.0347	0.453	0.651	-0.002	-0.137	0.891	-0.043	-1.003	0.317
LEFT	-0.064	-0.546	0.586	-0.116	-3.469	0.001	-0.296	-3.863	0.000
ΔUN_{-1}	-0.086	-1.302	0.194	-0.039	-2.921	0.004	-0.102	-3.006	0.003
$MAAS_{-1}$	-1.384	-5.615	0.000	0.272	8.797	0.000	0.666	9.159	0.000
No. Obs	235			242			242		
Hausmann	4.059		0.77	8.18		0.317	7.810		0.35
Wald (fixed effects=0)	6.140		0.00	2.07		0.014	1.554		0.09
F-test (all slopes=0)	7.900		0.00	21.681		0.00	27.120		0.00
DW statistic	2.176			1.906			1.833		
R2	0.113			0.172			0.189		

Table 0-3 continued: The basic regressions excluding hypothesis specific explanatory variables, specification tests

Dependent Variable	D. Implicit capital tax rate			E. Implicit tax rate on capital relative to implicit tax rate on labor		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
GR_{-1}	-0.036	-0.236	0.814	0.004	1.051	0.295
$INFL_{-1}$	-0.048	-0.875	0.383	-0.012	-6.288	0.000
$\Delta OPEN_{-1}$	0.054	1.908	0.058	0.004	2.817	0.005
$\Delta PART_{-1}$	1.237	3.905	0.000	0.017	2.019	0.045
LEFT	0.045	0.088	0.930	0.004	0.237	0.813
ΔUN_{-1}	-2.239	-8.717	0.000	-0.069	-8.868	0.000
$MAAS_{-1}$	0.566	1.269	0.206	0.003	0.177	0.860
No. Obs	211			211		
Hausmann	7.203		0.48	9.650		0.21
Wald (fixed effects=0)	3.306		0.00	3.713		0.00
F-test (all slopes=0)	30.026		0.00	41.661		0.00
DW statistic	1.985			1.810		
R2	0.240			0.290		

Table 0-4: The impact of capital mobility on primary expenditures in percent of GDP

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.012	0.184	0.854	-0.035	-1.253	0.212	-0.282	-2.888	0.005
GR_{-1}	-0.094	-2.556	0.011	-0.082	-2.384	0.018	-0.091	-2.046	0.043
$INFL_{-1}$	0.028	1.340	0.182	0.025	1.247	0.214	0.131	4.076	0.000
$\Delta OPEN_{-1}$	0.021	3.080	0.002	0.021	3.167	0.002	-0.035	-3.644	0.000
$\Delta PART_{-1}$	0.035	0.443	0.658	0.016	0.205	0.838	0.322	3.494	0.001
LEFT	-0.061	-0.533	0.595	-0.051	-0.441	0.660	-0.520	-3.063	0.003
ΔUN_{-1}	-0.107	-1.550	0.123	-0.085	-1.292	0.198	0.008	0.105	0.917
$MAAS_{-1}$	-1.354	-5.394	0.000	-1.368	-5.575	0.000	-0.791	-4.462	0.000
No. Obs	235			235			132		
DW statistic	2.179			2.171			1.484		
R2	0.112			0.112			0.304		

Of the three measures of capital mobility, only the *-CIP* measure of capital mobility significantly explains some of the variation in primary expenditures in EU countries, supporting hypothesis one[55]. A narrowing of the absolute covered interest parity differential of 1 percentage point is estimated to reduce primary expenditures in percent of GDP by 0.28 percentage points. Since the EU average *CIP* narrowed by about 4 percentage points from the early 1980s till the late 1990s, this would imply that on the average, primary expenditures in percent of GDP in EU countries were reduced by a little more than 1 percentage point during that time period due to increased capital mobility, a rather modest effect.

However, the parameter estimate of the *-CIP* is not robust to changes in the sample countries as well as to including short-term interest rates and election year effects in the regression (see Table 0-16 and Table 0-17 in Appendix)[56]. Moreover, the introduction of the *-CIP* in the regression turns the parameter estimates of *PART* and *LEFT* significant, but with the wrong signs. Moreover, there are signs of positive autocorrelation in the regressing using *–CIP* as a measure of capital mobility, and this observation together with the above mentioned lack of robustness of the parameter estimate to the explanatory variables included in the regression implies that more work could be done on the specification of the regression of primary expenditures[57]. All of these

[55] Including FDI flows instead of FDI stocks (not shown) does not render the FDI variable significant, and this is the case in all other regressions in which the FDI variable is insignificant. The relatively poor performance in terms of explanatory power of this measure is hence not due to the choice of stocks vs. flows.

[56] The robustness to short-term interest rates is checked since the *-CIP* measure is correlated with short-term interest rates with a correlation coefficient of 0.25. Table 0-17 shows that short-term interest rates are significantly correlated with primary spending, and it is therefore likely that the significantly negative parameter estimate of the *-CIP* captures some of the variation in primary expenditures which is due correlation with interest rates. Notice, also, that the election year effects are significant, but the expected election cycle of increasing expenditures leading up to the election and a reduction of expenditures after the election is not supported by the data.

[57] Whether the DW statistic of the -CIP regression of 1.484 is significantly different from 2 cannot be established due to lack of available tabled significance levels for the characteristics of panel used in this study. Bhargava, A., L. Franzini and W. Narendranathan (1982) supply significance levels for the panel- specific DW statistic, but only for a

observations imply that the parameter estimate of the *-CIP* in the primary expenditures regression is rather uncertain. There is hence no robust support of the hypothesis that primary expenditures are lower when capital mobility increases in EU countries.

Test of Hypothesis 2: The effect of capital mobility on capital taxation

Hypothesis two stating that higher capital mobility results in less taxation of capital in EU countries, is tested by regressing corporate tax revenues in percent of GDP and the implicit capital tax rate on the three measures of capital mobility identified in Section 5. The outcomes of the six resulting regressions are shown in Table 0-5 and Table 0-6 below.

Table 0-5: The impact of capital mobility on the corporate tax revenues in percent of GDP

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.049	2.692	0.008	-0.010	-1.777	0.077	-0.101	-2.889	0.005
GR_{-1}	0.025	3.332	0.001	0.026	3.491	0.001	0.028	2.020	0.046
$INFL_{-1}$	0.007	2.159	0.032	0.007	2.171	0.031	0.002	0.236	0.814
$\Delta OPEN_{-1}$	-0.003	-2.858	0.005	-0.003	-2.817	0.005	-0.016	-5.038	0.000
$\Delta PART_{-1}$	-0.004	-0.223	0.824	-0.006	-0.364	0.716	-0.027	-0.966	0.336
LEFT	-0.119	-3.659	0.000	-0.113	-3.469	0.001	-0.148	-3.502	0.001
ΔUN_{-1}	-0.037	-2.728	0.007	-0.037	-2.817	0.005	-0.003	-0.109	0.913
$MAAS_{-1}$	0.275	8.406	0.000	0.284	9.072	0.000	0.192	3.556	0.001
No. Obs	242			242			133		
DW statistic	1.900			1.910			2.139		
R2	0.178			0.175			0.266		

Table 0-6: The impact of capital mobility on the implicit tax rate on capital

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-0.140	-0.514	0.608	0.055	0.595	0.553	-1.677	-3.748	0.000
GR_{-1}	-0.022	-0.147	0.883	-0.032	-0.211	0.833	0.179	1.101	0.273
$INFL_{-1}$	-0.050	-0.881	0.379	-0.047	-0.859	0.392	-0.037	-0.363	0.718
$\Delta OPEN_{-1}$	0.055	1.893	0.060	0.053	1.887	0.061	-0.155	-3.044	0.003
$\Delta PART_{-1}$	1.243	3.916	0.000	1.223	3.854	0.000	0.938	2.388	0.019
LEFT	0.051	0.099	0.921	0.044	0.086	0.931	-0.846	-2.026	0.045
ΔUN_{-1}	-2.234	-8.579	0.000	-2.236	-8.705	0.000	-1.783	-5.942	0.000
$MAAS_{-1}$	0.555	1.176	0.241	0.537	1.198	0.233	0.559	0.819	0.415
No. Obs	211			211			130		
DW statistic	1.984			1.985			0.290		
R2	0.241			0.240			2.146		

limited number of combinations of time dimension, cross sections and number explanatory variables. The low value does, however, indicate that there might be problems of negative autocorrelation.

Quinn's 14-point index:
When Quinn14 is used as indicator of the degree of capital mobility in the regression of corporate tax revenues in percent of GDP, the significantly positive parameter estimate implies that increasing financial liberalization leads to increasing corporate tax revenues, opposite to the predictions of the tax competition literature and in line with the results of previous empirical literature on tax competition for OECD countries reviewed in Section 3. The estimated effect of a one-point increase in Quinn's 14-point index is a 0.049 percentage points increase in corporate tax revenues in percent of GDP. Given that the EU average increase in Quinn's 14-point index from 1980 to 1997 was 3.4 points, this implies a 0.167 percentage point increase in corporate tax revenues to GDP resulting from an increase in Quinn's 14-point index. Given that the EU average corporate tax revenues in percent of GDP fluctuated between one and four percentage points during the sample period, this effect is not unimportant, corresponding to a relative increase in corporate tax revenues in percent of GDP of 9.3 percent[58]. The significantly positive correlation between Quinn's 14 point index and corporate tax revenues in percent of GDP is robust to changes in the countries included in the panel (Table 0-19), the inclusion of additional explanatory variables (Table 0-21) and to the inclusion of growth and inflation in first differences (Table 0-23).

Quinn's 14-point index is, however, not significant in the regression of the implicit tax rate on capital.

The positive correlation of Quinn14 and corporate tax revenues in percent of GDP could be understood as support for the political economy hypothesis that higher capital mobility leads to the electorate moving further toward the left in order to counteract tax competition, and in turn leading to higher taxes. But since the dummy for left wing governments does not show a statistically significant preference of left wing government for higher capital taxation (rather the contrary), and since the CIP measure of capital mobility does not support this take on the results, this line of reasoning is not pursued any further.

Getting back to the list of potential reasons for the positive correlations found in the previous empirical literature, a few of these reasons may apply here. First, Quinn's 14 point index may be a poor measure of the degree of actual capital mobility, due to it's formal/legal approach (see the section on measures of capital mobility). But this does not explain the robustly significant nature of the index. Regarding point two on the list, finding a significantly positive parameter estimate in the corporate tax to GDP regression, while the result is insignificant in the implicit capital tax rate regression, might imply that the positive correlation is a tax base effect. Unfortunately, it has not been possible to identify a convincing measure of the corporate tax base to test this presumption. Moreover, since using the *CIP* does not show the same pattern, a tax base effect is not likely to be the explanation. Rather, the reason should be inherent to the Quinn14 measure and not the tax measure[59]. Following point 3, Quinn's 14-point index could be suspected to be

[58] Relative to the corporate tax revenues in percent of GDP in 1980
[59] In an attempt to check whether such a tax base effect is likely to be the root of the positive correlation, the implicit corporate tax rate is used as dependent variable in spite of the substantial problems related to this measure. This measure of the tax burden on corporations is discussed in Section 5. It is not used as a primary measure of the tax burden due to lack of data and because the operating surplus is an – at best - imperfect measure of the corporate tax base. The results of these regressions are shown in Table 0-28. The significantly positive parameter estimate

correlated with the upward trend in overall tax revenues during the sample period, in which case the measure would be capturing an overall trend of growth in tax revenues instead of the effect of capital mobility on corporate tax revenues. Testing this hypothesis by including overall tax revenues in percent of GDP in the regression (Table 0-25), rejects this hypothesis[60].

Finally, it is interesting that when agglomeration effects are taken into account in testing hypothesis 5 below, the parameter estimates for Quinn14 becomes significantly negative. Moreover, Quinn14 is correlated with the index of agglomeration with a correlation coefficient of 0.57. Hence, the positive value of the parameter estimate of Quinn14 might therefore be suspected to capture an omitted variables bias due to not taking into account the asymmetric responses of core and peripheral countries. Another potential source of omitted variables bias listed in Section 3 was that when countries get richer, they might liberalize and increase their taxes, such that income level is what is driving both variables. If this source of omitted variables bias is the cause of the positive correlation, including income per capita in the regression should change the parameter estimate of Quinn14. As can be seen in Table 0-27, this is not the case. The best candidate for an explanation of the positive correlation between Quinn14 and corporate tax revenues in percent of GDP therefore remains the omission of agglomeration effects from the estimating equation.

FDI:
When the *FDI* measure of capital mobility is used as indicator of capital mobility in the regression of corporate tax revenues in percent of GDP, the parameter estimate is found to be significantly negative, thus supporting hypothesis two[61]. But the parameter estimate of the *FDI* measure in the corporate tax revenues to GDP regression does not pass any of the robustness tests shown in Table 0-19 to Table 0-28, and can therefore not be taken as a solid support for the tax competition hypothesis. Moreover, the *FDI* measure is not significant in the implicit capital tax rate regression. The *FDI* measure of capital mobility in general fares very poorly in all regressions, and is therefore not given much attention in the remainder of the Chapter.

CIP:
When the -*CIP* index is included in the regression of corporate tax revenues in percent of GDP, the correlation between dependent and the -*CIP* is significantly negative, lending support to hypothesis 2. The estimated effect of a one-percentage point narrowing of the absolute interest parity differential is to lower corporate tax revenues in percent of GDP by 0.101 percentage points. Since EU average *CIP* narrowed by about 4 percentage points from the early 1980s to the late 1990s (see Figure 0-10), this implies an impact of capital mobility of an average EU corporate tax revenues in percent of GDP of -0.403 percentage points, all else equal. In relative

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indicates that the positive correlation found does not provide support for the hypothesis of a above might not be a result of a tax base effect, although given the problems with the tax base measure of the implicit corporate tax rate, this might still be the problem.

[60] Moreover, splitting up the sample into exemption countries and limited credit countries (see the paragraph on capital taxation in the EU), did not qualitatively change the results.

[61] A one percentage point increase in inward and outward FDI stocks in percent of GDP is found to results in 0.01 percentage point lower corporate tax revenues in percent of GDP. Since the FDI measure increased by about 20 percentage points from the early 1980s to the late 1990s, this means that corporate tax revenues in percent of GDP should have fallen by 0.2 percentage points during this period due to increased capital mobility; a rather modest effect.

terms, this estimate corresponds to a 22.5 percent fall in corporate tax revenues in percent of GDP between the early 1980s and the late 1990s[62]. The negative parameter estimate for the -CIP in the corporate tax revenues to GDP regression is robust to changes in the countries included in the sample (Table 0-19), to the inclusion of other explanatory variables (Table 0-21 and Table 0-25), as well as to the inclusion of growth and inflation in first differences (Table 0-23).

In the regression of the implicit capital tax rate, the parameter estimate of the *-CIP* also comes out significantly negative, lending further support to hypothesis 2. More specifically, a one-percentage point narrowing of the absolute interest parity differential is found to result in a 1.677 percentage point fall in the implicit capital tax rate. This implies a 6.7 percentage point fall in the EU average implicit capital tax rate from 1980 to 1997, corresponding to a 12.6 percent relative fall in the EU average implicit capital tax rate since 1980. The negative parameter estimate for the *-CIP* in the implicit capital tax regression is robust to changes in the countries included in the sample (Table 0-19), to the inclusion of other explanatory variables (Table 0-21 and Table 0-25), as well as to the inclusion of growth and inflation in first differences (Table 0-23)

Test of Hypothesis 3: The effect of capital mobility on capital taxation relative to taxation of other factors

The hypothesis that increased capital mobility shifts the tax burden from mobile capital toward the less mobile factors such as labor is tested regressing, respectively, corporate tax revenues in percent of total tax revenues and the implicit capital tax rate in percent of the implicit labor tax rate on the three measures of capital mobility. The regression results are shown in Table 0-7 and Table 0-8.

Table 0-7: The impact of capital mobility on the corporate tax revenues in percent of total tax revenues

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.155	3.449	0.001	-0.021	-1.875	0.062	-0.258	-3.267	0.001
GR_{-1}	0.023	2.161	0.032	0.023	2.219	0.028	0.026	1.389	0.168
$INFL_{-1}$	0.003	0.197	0.844	0.006	0.493	0.623	-0.072	-2.182	0.031
$\Delta OPEN_{-1}$	-0.005	-1.479	0.141	-0.004	-1.234	0.219	-0.025	-3.483	0.001
$\Delta PART_{-1}$	-0.004	-0.097	0.923	-0.001	-0.032	0.974	-0.003	-0.046	0.964
LEFT	-0.267	-3.541	0.001	-0.258	-3.395	0.001	-0.279	-2.861	0.005
ΔUN_{-1}	-0.168	-6.060	0.000	-0.167	-5.983	0.000	-0.083	-1.730	0.086
$MAAS_{-1}$	0.603	9.250	0.000	0.620	9.202	0.000	0.383	3.730	0.000
No. Obs	242			242			133		
DW statistic	1.795			1.820			2.068		
R2	0.178			0.177			0.283		

[62] Calculated as the predicted average change in corporate tax revenues from 1980 to 1997 divided by the 1980 value of corporate tax revenues in percent of GDP.

Table 0-8: The impact of capital mobility on the implicit tax rate on capital relative to the implicit labor tax rate

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.013	1.557	0.121	0.003	1.466	0.144	-0.045	-3.710	0.000
GR_{-1}	-0.011	-4.498	0.000	-0.012	-4.765	0.000	-0.008	-2.558	0.012
$INFL_{-1}$	-0.010	-3.099	0.002	-0.010	-3.034	0.003	-0.005	-1.142	0.256
$\Delta OPEN_{-1}$	0.002	1.444	0.151	0.002	1.423	0.156	-0.003	-1.864	0.065
$\Delta PART_{-1}$	0.022	2.939	0.004	0.023	3.024	0.003	0.036	3.802	0.000
LEFT	0.009	0.564	0.574	0.006	0.388	0.699	-0.044	-2.610	0.010
ΔUN_{-1}	-0.092	-13.67	0.000	-0.092	-13.506	0.000	-0.069	-8.476	0.000
$MAAS_{-1}$	0.042	3.197	0.002	0.037	2.760	0.006	0.003	0.231	0.818
No. Obs	211			211			130		
DW statistic	1.843			1.841			2.229		
R2	0.297			0.297			0.360		

Quinn's 14-point index:

Changes in Quinn's 14-point index significantly positively explain changes in corporate tax revenues in percent of total tax revenues. A one-point increase in Quin14 is found to result in a 0.155 percentage point increase in corporate to total tax revenues. Since the EU average of Quinn14 increased by 3.4 points between the early 1980s and the late 1990s, the parameter estimate implies that corporate tax revenues in percent of total tax revenues increased with 0.527 percentage points due to increased capital mobility during that period. This corresponds to a 10 percent relative increase in corporate tax revenues to total tax revenues between 1980 and 1997[63].

The result is robust to changes in the sample of countries (Table 0-29), the inclusion of other variables (Table 0-31) and the inclusion of growth and inflation in first differences (Table 0-33), suggesting that recent increases in capital mobility have not resulted in shifts of the tax burden from capital to other factors, but rather that the contrary has taken place.

Again, the reasons for this result may include a tax base effect, i.e. that the capital tax base is positively correlated with increases in capital mobility, as suggested in point 2 in the section reviewing the literature above. Moreover, the story of Quinn14 potentially capturing asymmetric tax competition or agglomeration effects cannot be ruled out and seems to be supported by the outcomes of the tests of hypothesis 5 below. On the other hand, point 3 concerning the trend in total tax revenues obviously does not apply.

Quinn's 14-point index is not significant in the regression of the implicit capital tax rate relative to the implicit tax rate on labor (Table 0-8)

[63] This number comes from dividing the average estimated change due to capital mobility over the period from the early 1980s to the late 1990s with the EU average value of corporate tax revenues in percent of total tax revenues in 1980: 5.04 percent.

FDI
When using *FDI* as indicator of capital mobility, this measure is found to be significantly negative in the regression of corporate tax revenues to total tax revenues, supporting hypothesis 3[64]. But the parameter estimate is not robust to changes in the sample countries[65]. Moreover, the *FDI* index is not significant in the regression of the implicit capital tax rate in percent of the implicit labor tax rate.

CIP:
When the -*CIP* measure is used, the parameter estimate is found to be significantly negative in the regression of corporate tax revenues in percent of total tax revenues, thus supporting hypothesis 4. The parameter estimate of -0.258 implies that the EU average narrowing of the *CIP* between 1980 and 1997 of about 4 percentage points resulted in an EU average fall in corporate to total tax revenues of one percentage point, or a 20 percent decrease in corporate tax revenues to total tax revenues over that period. The parameter estimate is robust to changes in countries included in the sample (Table 0-38) and to the changes in the control variables (Table 0-40 and Table 0-42).

The -*CIP* is also significantly negative in the regression of the implicit capital tax rate in percent of the implicit labor tax rate. A one-percentage point narrowing of the absolute covered interest parity differential is estimated to result in a 0.045 percentage point fall in the capital in percent of labor implicit tax rate. Given the EU average narrowing of the CIP of about 4 percentage points between the early 1980s and late 1990s, this implies an EU average fall in the capital to labor implicit tax rate of 18 percentage points due to increased capital mobility over that period, corresponding to a 9.5 percent fall in the fall in the capital to labor implicit tax rate since the early 1980s[66]. This parameter estimate is also robust to changes in the sample countries and control variables (Table 0-39, Table 0-41 and Table 0-43).

Test of Hypothesis 4: The effect of asymmetry on the impact of capital mobility on capital taxation
Whether the effect of capital mobility on tax rates depends on country size, as suggested by the asymmetric tax competition literature, is tested by regressing the two measures of capital taxation on the three measures of capital mobility alone and in interaction with the measure of economic size of the country (referred to as *SIZE* in the following). The results of the regressions are reported in Table 0-9 and Table 0-10. The interaction term is only significant and with the right sign in the regressions using Quinn's 14-point index as measure of capital mobility. However, the parameter estimates of the interaction terms in these regressions are not robust to changes in the sample countries (Table 0-38 and Table 0-39).

[64] A one-percentage point increase in FDI is estimated to result in a -0.021 percentage point fall in corporate tax revenues to total revenues. The FDI measure increased by about 20 percentage points from the early 1980s to the late 1990s, implying that corporate tax revenues in percent of total tax revenues should have fallen by 0.42 percentage points during this period due to increased capital mobility
[65] Table 0-29 shows that taking out either Germany, the Netherlands, Sweden or Spain renders the parameter estimate insignificant
[66] Calculated as the predicted change in the ratio due to increased capital mobility, divided by the EU average implicit capital tax to implicit labor tax of 1980. Since the ratio as been falling, the corresponding number for 1997 would be higher, at 16.5 percent.

Table 0-9: The impact of capital mobility and country size on the corporate tax revenues in percent of GDP

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta icap_{-1}$	0.034	1.672	0.096	-0.014	-2.361	0.019	-0.138	-2.470	0.015
$\Delta(Icap*SIZE)_{-1}$	0.003	1.777	0.077	0.001	1.570	0.118	0.471	0.988	0.326
GR_{-1}	0.026	3.346	0.001	0.027	3.673	0.000	0.025	1.846	0.068
$INFL_{-1}$	0.006	1.770	0.078	0.006	2.042	0.042	0.006	0.642	0.522
$\Delta OPEN_{-1}$	-0.003	-2.800	0.006	-0.003	-2.783	0.006	-0.016	-4.944	0.000
$\Delta PART_{-1}$	-0.009	-0.468	0.640	-0.012	-0.672	0.502	-0.025	-0.881	0.380
LEFT	-0.114	-3.507	0.001	-0.111	-3.439	0.001	-0.150	-3.638	0.000
ΔUN_{-1}	-0.036	-2.672	0.008	-0.034	-2.643	0.009	-0.011	-0.419	0.676
$MAAS_{-1}$	0.268	8.383	0.000	0.281	8.992	0.000	0.194	3.653	0.000
No. Obs	242			242			132		
DW statistic	1.977			1.893			2.101		
R2	0.182			0.175			0.258		

Table 0-10: The impact of capital mobility and country size on the implicit capital tax rate.

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta icap_{-1}$	-0.649	-2.091	0.038	0.178	1.654	0.100	-1.539	-1.882	0.063
$\Delta(Icap*SIZE)_{-1}$	0.095	3.726	0.000	-0.025	-2.279	0.024	-0.871	-0.142	0.888
GR_{-1}	-0.003	-0.021	0.983	-0.021	-0.141	0.888	0.189	1.127	0.262
$INFL_{-1}$	-0.062	-1.210	0.228	-0.056	-1.034	0.303	-0.021	-0.185	0.854
$\Delta OPEN_{-1}$	0.059	2.273	0.024	0.054	1.907	0.058	-0.151	-2.694	0.008
$\Delta PART_{-1}$	0.979	2.890	0.004	1.327	4.188	0.000	0.916	2.332	0.022
LEFT	0.377	0.708	0.480	0.003	0.007	0.995	-0.844	-1.852	0.067
ΔUN_{-1}	-2.242	-8.824	0.000	-2.215	-8.671	0.000	-1.830	-5.360	0.000
$MAAS_{-1}$	0.571	1.273	0.205	0.711	1.581	0.116	0.623	0.900	0.370
No. Obs	211			211			129		
DW statistic	1.977			1.975			2.148		
R2	0.248			0.238			0.289		

A potential reason for the lack of conclusive results in the regressions using *FDI* and *CIP* is that the variation in the *SIZE* variable is low. The interaction term between *SIZE* and the measure of capital mobility is hence rather correlated with the capital mobility index itself. This is particularly a problem in the regressions using *CIP* and *FDI*, where the correlation coefficient of the capital mobility index and the interaction term is over 0.6, and where the standard errors of the other variables increase when the interaction term is included. In the Quinn14 regression, the

corresponding correlation coefficient is only 0.15. Longer time series would be needed to correct this problem, which unfortunately, only time will provide.

The regression of the implicit capital tax rate on the Quinn14 measure of capital mobility, for which multicollinarity does not seem to be a problem and for which tax base effects are less, show that the parameter estimates are as expected and significant. In conclusion, there is some evidence of a size asymmetry effect on capital tax rates. However, the evidence is not robust to changes in the sample countries.

Test of Hypothesis 5: The effect of capital mobility and agglomeration economies on capital taxation

Hypothesis five, stating that the higher the scope for agglomeration economies in the country, the less the country will be pressured by tax competition, is tested for the implicit capital tax rate by including an interaction term between the capital mobility measures and the measure of economic activity in addition to the capital mobility measure. Only the implicit tax rate measure is used since if economic activity is clustering in a country and there are economies of scale, GDP may be increasing even faster than the tax rate and tax revenues, making tax revenues in percent of GDP an unsuited measure. The results of the test regression for the implicit capital tax rate are shown in Table 0-11.

Table 0-11: The impact of capital mobility and agglomeration economies on the implicit tax rate on capital

Capital Mobility Index	Quinn 14			FDI Stock			-CIP		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-1.846	-3.958	0.000	-0.048	-0.148	0.882	-0.069	-0.046	0.963
$\Delta(Icap*AGGLOM)_{-1}$	0.090	3.951	0.000	0.005	0.341	0.734	-7.200	-0.921	0.359
GR_{-1}	-0.090	-0.638	0.524	-0.042	-0.268	0.789	0.222	1.599	0.113
$INFL_{-1}$	-0.038	-0.653	0.514	-0.047	-0.865	0.388	0.018	0.160	0.873
$\Delta OPEN_{-1}$	0.053	1.804	0.073	0.053	1.880	0.062	-0.148	-2.390	0.019
$\Delta PART_{-1}$	1.403	4.573	0.000	1.273	3.696	0.000	0.842	2.477	0.015
LEFT	-0.126	-0.253	0.800	0.051	0.100	0.921	-0.797	-1.886	0.062
ΔUN_{-1}	-2.081	-8.147	0.000	-2.226	-8.574	0.000	-1.836	-5.960	0.000
$MAAS_{-1}$	0.413	0.875	0.383	0.513	1.119	0.265	0.679	0.976	0.332
No. Obs	211			211			129		
DW statistic	1.964			1.987			2.179		
R2	0.243			0.240			0.293		

In the regressions including Quinn's 14-point index and the agglomeration interaction term, the parameter estimate of Quinn14 turn negative and significant, while the parameter estimate of the interaction term are significantly positive, as predicted by hypothesis 5. The parameter estimate is robust to changes in the sample countries and to changes in the included control variables (see Table 0-45 and Table 0-46). These observations imply that the significantly positive parameter estimates of Quinn14 in the previous regressions may be due to an omitted variables bias, in that Quinn's 14-point index may be capturing agglomeration effects.

The interaction term between the agglomeration index and the capital mobility index is not significant when the *CIP* and the *FDI* stock are used. Moreover, when including the interaction term, most of the parameter estimates of the capital mobility indices change sign, size and substantially change their significance, implying that the included interaction term is rather collinear with the capital mobility term. Calculating the correlation coefficients between the interaction term and the capital mobility index for the three indices shows that this is in fact the case: The correlation coefficient for the CIP and the corresponding interaction term is 0.92, while it is 0.94 for the FDI index and 0.58 when Quinn14 is used. The agglomeration index of EU countries does not contain sufficient time variation[67].

In brief, there is evidence that agglomeration economies provide a mitigating effect to pressures of capital mobility on capital income taxation in the European Union. More research is needed in order to solve the multicollinearity problem, however[68].

Conclusions of the empirical analysis

Table 0-12 summarizes the results of the empirical analysis. Results, which are not robust to changes in the sample countries or control variables, are in italics.

Hypothesis 1: Hypothesis one is confirmed when *CIP* is used as a measure of capital mobility, while no significant correlations between the other two measures of capital mobility and primary expenditures were found. But the parameter estimate of the *CIP* is very small and not robust. Hence, the data does not robustly support hypothesis one.

Hypothesis 2: Hypothesis 2 is not straightforward to conclude on, as the Quinn14 measure and the CIP measure give opposite results. In line with the previous literature, the Quinn14 measure is found to be either significantly positively explaining the variation in capital taxation, or to be insignificant. The test of hypothesis 5 gives a possible explanation for the positive correlation between Quinn14 and tax rates: the Quinn14 measure is likely to capture agglomeration effects. If this is the case, then the significantly negative parameter estimate of the CIP measure provides robust evidence in favor of a "race to the bottom" effect of capital mobility if agglomeration effects are disregarded. The implied capital mobility induced fall in tax rates since the early 1980s is a 22.5 percent fall in corporate tax revenues in percent of GDP and a 12.6 percent relative fall in the EU average implicit capital tax.

Hypothesis 3: The results of the test of hypothesis 3 show the same pattern as that of hypothesis 2: If Quinn's 14 point index is used as a measure of the degree of capital mobility, the correlation

[67] Most of the variation in AGGLOM, like in SIZE, derives from the cross-country variation, which is cancelled out by the fixed effects. In order to take advantage of the cross section variation, an alternative approach is attempted, and the sample of countries is split into two sub samples, tentatively called "North" and "South", comprising, respectively, less agglomerated countries and more agglomerated countries. The samples are based on the same criteria as the agglomeration index, and thus, the "South" comprises Greece, Portugal, Spain and Ireland, while the "North" comprises Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands and Sweden. Since Italy and the United Kingdom are in between, they are left out of the groups. However, this test does not either lead to significant expected signs of the parameter estimates.

[68] Including the index of country size or agglomeration directly in the regressions does not change the parameter estimate qualitatively. Only in the regression of the implicit capital tax rate on Quinn14 and the interaction term of Quinn14 and SIZE does the inclusion of SIZE alone increase the standard errors so much that the parameter estimates are no longer significant. But the size and signs remain the same.

between capital mobility and corporate tax revenues in percent of total tax revenues is found to be positive. However, this may be explained by Quinn14 measure capturing agglomeration effects. At the same time, the CIP measure has the predicted sign and is significant. According to the estimate, and if agglomeration effects are disregarded, increasing capital mobility lead to a 20 percent decrease in corporate tax revenues to total tax revenues, and a fall in the capital to labor implicit tax rate of 18 percentage points, corresponding to 9.5 percent of the implicit capital to labor tax ratio since the early 1980s.

Table 0-12. Summary of results of the empirical analysis

Hypothesis and Dependent Variable	*Explanatory Variable*	*Quinn 14*	*FDI*	*-CIP*
H1: *EXPGDP*	*Icap*	0.01	-0.04	*-0.28****
H2: *CORPGDP*	*Icap*	0.05***	-0.01*	-0.10***
H2: *IMPLCAP*	*Icap*	-0.14	0.06	-1.68***
H3: *COPRTOTALTAX*	*Icap*	0.16***	-0.02	-0.26***
H3: *CAPLAB*	*Icap*	0.01	0.003	-0.05***
H4*: CORPGDP*	*Icap*	0.03*	-0.01**	*-0.14***
	SIZE Icap*	0.003*	0.001	0.005
H4*: IMPLCAP*	*Icap*	*-0.65***	0.18	*-1.54**
	SIZE Icap*	*0.10****	-0.03**	-0.009
H5*: IMPLCAP*	*Icap*	-1.85***	-0.05	-0.07
	AGGLOM Icap*	0.09***	0.005	-0.07

Hypothesis 4: Concerning hypothesis 4, there was some support for larger countries to experience a weaker downward pressure of capital mobility on their implicit capital tax rates. However, parameter estimate was not robust to changes in the sample countries, and no clear conclusions can be drawn.

Hypothesis 5: Support for hypothesis 5, that agglomeration rents mitigate tax competition pressures, was found, but due to problems of multicollinearity, more research has to be done to establish this result more robustly. It is, however, very interesting that in the regression for which multicollinarity problems were smallest, namely in the regression using Quinn14, a clear acceptance of the agglomeration hypothesis was found. What is more, this result suggests that the widespread finding of positive correlations between Quinn14 and capital taxation in the previous empirical literature may have been due to omitted variables bias.

7. Conclusions

The use of the concept of a race to the bottom in capital taxation in the European Union is widespread, and this is irrespective of the fact that no robust empirical support for such tax competition effects has been established for the European Union countries. Moreover, there are

contesting theories to the "race to the bottom", and what should be expected as a consequence of increasing capital mobility depends on the characteristics of the EU economies. Whether a race to the bottom in capital tax rates is taking place in the European Union is hence an empirical question.

As the review of the empirical literature of Section 3 has shown, no previous support has been found for a direct downward pressure of capital mobility on tax rates. Several studies have even come to the opposite conclusion that capital mobility, measured by a popular measure of capital mobility, Quinn's 14-point index of financial liberalization, is positively correlated with capital taxation. However, the previous empirical literature does not test the extended predictions of the tax competition literature. Moreover, the empirical literature on tax competition only analyses rather heterogeneous panels of OECD countries, and no studies test the sensitivity of their results to the sample countries included. There are no regression studies only focusing on the potentially more homogenous EU data.

This paper has provided such an investigation by testing the five tax competition hypotheses derived from the theoretical literature for a panel of EU countries. To this effect, three measures of capital mobility and two measures of the tax burden on capital have been derived and a panel regression analysis linking the measures of tax burdens and capital mobility has been carried out.

Several conclusions can be drawn from the empirical analysis. One conclusion, concerning the effects of capital mobility on capital taxation, is that the choice of measure of capital mobility matters more than it should for the results. Using Quinn's 14 point index in general led to results opposite to what is predicted by standard tax competition theory, while using covered interest parity differentials often led to predicted parameter estimates. Parameter estimates for FDI stock measures did not exhibit a pattern and were often not significant or robust. The FDI measure was in advance deemed less appropriate as a measure of capital mobility, but a priori, none of the two former measures are better than the other, which complicates drawing conclusions.

The regressions showed that the omission of agglomeration effects from the capital tax regression may be a potential explanation of the positive correlation between Quinn's 14-point index and capital taxation found here and in the previous literature. When agglomeration effects were included, the parameter estimate of Quinn's 14-point index became significantly negative, as predicted by standard tax competition theory, while the agglomeration term was positive, lending support to the predictions of the new economic geography literature that agglomeration rents are taxable and allow non-distortionary taxation within certain limits. However, the inclusion of the agglomeration term was accompanied by a substantial rise in multicollinearity, making more robust estimates of the agglomeration effect difficult. More research is definitely warranted.

Furthermore, if the parameter estimates of Quinn's 14 point index indeed have suffered from omitted variables bias, then the results of the regressions using covered interest parity differentials as measure of capital mobility lend robust support to the standard tax competition hypotheses, disregarding potential agglomeration effects. Capital taxation in absolute terms and relative to labor taxation were both found to be negatively correlated with capital mobility. More specifically, an estimated 22.5 percent fall in corporate tax revenues in percent of GDP and a 12.6 percent relative fall in the EU average implicit capital tax since the early 1980s were found to be due to increased capital mobility. Moreover, increasing capital mobility was found to lead to a 20

percent decrease in corporate tax revenues in percent of total tax revenues, and a fall in the capital to labor implicit tax rate of 9.5 percent since the early 1980s. However, these conclusions are based on disregarding agglomeration effects, while at the same time basing the choice of capital mobility measure on agglomeration effects being correlated with Quinn's 14 point measure, which is clearly not consistent. More research into the importance of agglomeration effects on capital taxation is needed in order to identify whether these provide a significant counterweight to the estimated downward pressure on capital taxes.

The hypothesis that tax competition leads to under-provision of the public good, and the hypothesis that the size of a country matters for the outcome of the tax competition game were not concluded on for lack of fit of the regressions and data problems.

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Appendix

Data

Table 0-13: Definitions and sources of data used in the panel regression analysis

Variable	Definition and Sources
EXPGDP	Primary expenditures in percent of GDP. Source: OECD Economic Outlook
CORPGDP	Corporate tax revenues in percent of GDP. Source: OECD Economic Outlook
IMPLCAP	Implicit tax rate on capital calculated according to Carey and Thilinguirian 2000 on the basic of OECD revenue statistics. Source: Carey and Thilinguirian 2000
CORPTOTALTAX	Corporate tax revenues in percent of total tax revenues. Source: OECD Economic Outlook
TOTALTAX	Total tax revenues in percent of GDP. Source: OECD Economic Outlook
CAPLAB	The average effective tax rate on capital in percent of the average effective capital income tax. Source: Carey and Thilinguirian 2000.
CIP	Calculated as laid out in Chapter two. The data is from Datastream and OECD Main Economic Indicators.
SIZE	GDP relative to sum of GDP of countries included in the sample (EU13). Source: OECD Economic Outlook
AGGLOM	Real GDP per capita. Source: OECD Economic Outlook
GR	Real growth rate, calculated using data on nominal GDP and the GDP deflator. Source: OECD Economic Outlook
INFL	The yearly percentage change in the consumer price index. Source: OECD Economic Outlook
OPEN	The sum of exports and imports divided by 1.000.000*GDP (all in current local currency). Source: OECD Economic Outlook
UN	Unemployment rate, percent. Source: OECD Economic Outlook
PART	The participation rate, constructed as the labor force in percent of the population between the age of 15 and 65. Data for Portugal are from the Ameco database. Otherwise, the source is OECD Economic Outlook.
MAAS	Dummy for the Maastricht years, taking the value 1 from 1993 onwards.
EYEAR	Dummy taking the value 1 in years of parliamentary elections of the given country, and zero otherwise. Source: Parties and Elections in Europe: http://www.parties-and-elections.de/
LEFT	Dummy for the ideology of the government in power. Construction as explained below. Source: Woldendorp, Keman and Budge (2000)
IR	Short term Interest Rate, percent. Source: OECD Economic Outlook

Descriptive statistics and unit root test statistics for all data series, sample: 1970-2001

Table 0-14: Descriptive statistics and result of unit root tests for individual country specific series

	Descriptive Statistics				Augmented Dicky Fuller Unit Root Tests (with a constant and a trend but no lagged first differences)					
Series	Country	Obs.	Mean	St. Deviation	t-stat levels	Critical Value 5%	Unit root levels	t-stat changes	Critical Value 5%	Unit root first differences
IMPLCAP: Implicit tax rate on capital	Austria	18	45.37	5.37	-7.24	-3.73	Rejected	-6.29	-3.76	Rejected
	Belgium	18	47.42	3.96	-1.11	-3.73	NR	-3.17	-3.76	NR
	Germany	18	40.77	5.88	-2.66	-3.73	NR	-4.17	-3.76	Rejected
	Denmark	9	75.17	14.63	-5.07	-4.35	Rejected	-1.78	-4.58	NR
	Spain	18	29.15	4.39	-1.15	-3.73	NR	-2.20	-3.76	NR
	Finland	18	45.43	19.31	-2.71	-3.73	NR	-3.76	-3.76	Rejected
	France	18	45.12	5.84	-1.07	-3.73	NR	-4.47	-3.76	Rejected
	Greece	9	38.66	6.18	-2.05	-4.35	NR	-1.62	-4.58	NR
	Ireland	18	39.46	21.29	-6.12	-3.73	Rejected	-4.19	-3.76	Rejected
	Italy	18	42.45	7.16	-3.08	-3.73	NR	-3.31	-3.76	NR
	Netherlands	18	39.68	4.42	-3.29	-3.73	NR	-3.43	-3.76	NR
	Portugal	9	20.80	2.83	-4.78	-4.35	Rejected	-2.25	-4.58	NR
	Sweden	18	65.84	13.59	-1.83	-3.73	NR	-3.09	-3.76	NR
	UK	18	83.57	15.09	-2.32	-3.73	NR	-2.79	-3.76	NR
CAPLAB: Implicit tax rate on capital divided by the implicit tax rate on labor	Austria	18	1.26	0.20	-5.03	-3.73	Rejected	-5.71	-3.76	Rejected
	Belgium	18	1.21	0.12	-1.60	-3.73	NR	-2.69	-3.76	NR
	Germany	18	1.18	0.21	-2.50	-3.73	NR	-4.47	-3.76	Rejected
	Denmark	9	1.80	0.40	-4.24	-4.35	NR	-1.82	-4.58	NR
	Spain	18	1.06	0.09	-1.71	-3.73	NR	-2.79	-3.76	NR
	Finland	18	1.18	0.47	-2.76	-3.73	NR	-3.70	-3.76	NR
	France	18	1.19	0.23	-1.04	-3.73	NR	-5.88	-3.76	Rejected
	Greece	9	1.73	0.29	-1.90	-4.35	NR	-1.33	-4.58	NR
	Ireland	18	1.78	1.28	-12.59	-3.73	NR	-5.80	-3.76	Rejected
	Italy	18	1.34	0.13	-2.85	-3.73	NR	-2.58	-3.76	NR
	Netherlands	18	0.96	0.13	-2.93	-3.73	NR	-3.26	-3.76	NR
	Portugal	9	0.93	0.10	-6.51	-4.35	Rejected	-3.73	-4.58	NR
	Sweden	18	1.35	0.24	-1.81	-3.73	NR	-3.41	-3.76	NR
	UK	18	3.71	0.53	-2.17	-3.73	NR	-2.37	-3.76	NR
CORPGDP: Corporate tax revenues in percent of GDP	Austria	31	1.51	0.26	-2.61	-3.57	NR	-6.15	-3.58	Rejected
	Belgium	31	2.70	0.46	-1.27	-3.57	NR	-3.30	-3.58	NR
	Germany	31	1.76	0.30	-2.83	-3.57	NR	-4.81	-3.58	Rejected
	Denmark	31	1.79	0.61	-2.45	-3.57	NR	-3.20	-3.58	NR
	Spain	31	1.77	0.62	-2.15	-3.57	NR	-2.57	-3.58	NR
	Finland	31	1.86	1.10	-0.65	-3.57	NR	-3.62	-3.58	Rejected
	France	31	2.19	0.31	-1.28	-3.57	NR	-4.69	-3.58	Rejected
	Greece	31	1.33	0.90	2.28	-3.57	NR	-2.62	-3.58	NR
	Ireland	31	2.01	0.85	-1.08	-3.57	NR	-4.34	-3.58	Rejected
	Italy	31	2.96	0.90	0.09	-3.57	NR	-4.40	-3.58	Rejected
	Netherlands	31	3.13	0.56	-2.69	-3.57	NR	-4.16	-3.58	Rejected
	Portugal	12	2.91	0.89	-6.13	-3.99	Rejected	-3.48	-4.08	NR
	Sweden	31	2.03	0.66	-1.51	-3.57	NR	-3.79	-3.58	Rejected
	UK	31	3.32	0.82	-2.62	-3.57	NR	-4.39	-3.58	Rejected

NR: Not rejected

Table 0-14 continued: Descriptive statistics and result of unit root tests for individual country specific series

	Descriptive Statistics				Augmented Dicky Fuller Unit Root Tests (with a constant and a trend but no lagged first differences)					
Series	Country	Obs.	Mean	St. Deviation	t-stat levels	Critical Value 5%	Unit root levels	t-stat changes	Critical Value 5%	Unit root first differences
CORPTOTAL-TAX: Corporate tax revenues in percent of total tax revenues	Austria	31	3.75	0.54	-2.47	-3.57	NR	-5.99	-3.58	Rejected
	Belgium	31	6.36	1.09	-1.10	-3.57	NR	-3.33	-3.58	NR
	Germany	31	4.84	0.83	-2.74	-3.57	NR	-4.55	-3.58	Rejected
	Denmark	31	3.83	1.07	-2.52	-3.57	NR	-3.37	-3.58	NR
	Spain	31	6.55	1.36	-1.92	-3.57	NR	-2.74	-3.58	NR
	Finland	31	4.52	2.21	-0.60	-3.57	NR	-3.49	-3.58	NR
	France	31	5.36	0.77	-1.26	-3.57	NR	-5.08	-3.58	Rejected
	Greece	31	4.55	2.15	0.42	-3.57	NR	-3.30	-3.58	NR
	Ireland	31	6.22	2.66	-0.75	-3.57	NR	-4.46	-3.58	Rejected
	Italy	31	8.40	1.45	-0.24	-3.57	NR	-4.81	-3.58	Rejected
	Netherlands	31	7.43	1.32	-2.13	-3.57	NR	-4.03	-3.58	Rejected
	Portugal	12	8.95	2.28	-16.25	-3.99	NR	-8.11	-4.08	Rejected
	Sweden	31	4.18	1.17	-1.54	-3.57	NR	-3.87	-3.58	Rejected
	UK	31	9.26	2.02	-2.94	-3.57	NR	-4.64	-3.58	Rejected
FDI Stock in percent of GDP	Austria	28	7.75	2.69	1.54	-3.59	NR	-4.09	-3.60	Rejected
	Belgium	28	28.20	19.18	0.45	-3.59	NR	-3.07	-3.60	NR
	Germany	28	9.88	2.74	-1.98	-3.59	NR	-3.77	-3.60	Rejected
	Denmark	28	10.42	6.14	0.17	-3.59	NR	-5.03	-3.60	Rejected
	Spain	28	11.92	7.30	-1.62	-3.59	NR	-6.01	-3.60	Rejected
	Finland	28	8.63	8.01	-0.29	-3.59	NR	-7.02	-3.60	Rejected
	France	28	14.04	8.33	-0.11	-3.59	NR	-4.57	-3.60	Rejected
	Greece	28	9.76	4.36	-0.48	-3.59	NR	-2.57	-3.60	NR
	Ireland	28	12.29	4.72	-1.90	-3.59	NR	-4.09	-3.60	Rejected
	Italy	28	7.04	2.18	-1.10	-3.59	NR	-3.99	-3.60	Rejected
	Netherlands	28	60.62	13.94	-1.95	-3.59	NR	-4.94	-3.60	Rejected
	Portugal	26	9.31	6.65	-1.51	-3.61	NR	-3.85	-3.62	Rejected
	Sweden	28	20.40	17.58	-0.42	-3.59	NR	-4.89	-3.60	Rejected
	UK	28	17.90	9.72	1.28	-3.59	NR	-1.23	-3.60	NR
Quinn'14: Quinn's 14 point index of financial liberalization	Austria	28	11.50	1.05	-2.41	-3.59	NR	-3.94	-3.60	Rejected
	Belgium	28	11.07	1.81	-1.88	-3.59	NR	-3.47	-3.60	NR
	Germany	28	13.93	0.18	-3.25	-3.59	NR	-3.90	-3.60	Rejected
	Denmark	28	11.27	2.07	-2.17	-3.59	NR	-4.21	-3.60	Rejected
	Spain	28	8.86	3.20	-2.65	-3.59	NR	-3.43	-3.60	NR
	Finland	28	10.84	1.77	-2.50	-3.59	NR	-4.08	-3.60	Rejected
	France	28	11.41	0.99	-1.77	-3.59	NR	-3.35	-3.60	NR
	Greece	28	7.18	2.63	-2.13	-3.59	NR	-3.58	-3.60	NR
	Ireland	28	10.75	1.88	0.04	-3.59	NR	-4.20	-3.60	Rejected
	Italy	28	11.48	1.54	-1.58	-3.59	NR	-3.18	-3.60	NR
	Netherlands	28	13.21	0.92	-1.21	-3.59	NR	-3.87	-3.60	Rejected
	Portugal	28	7.75	3.60	-1.67	-3.59	NR	-3.59	-3.60	NR
	Sweden	28	11.32	1.15	-2.34	-3.59	NR	-3.47	-3.60	NR
	UK	28	12.23	2.63	-1.40	-3.59	NR	-3.24	-3.60	NR

NR: Not rejected

Table 0-14 continued: Descriptive statistics and result of unit root tests for individual country specific series

	Descriptive Statistics				Augmented Dicky Fuller Unit Root Tests (with a constant and a trend but no lagged first differences)					
Series	Country	Obs.	Mean	St. Deviation	t-stat levels	Critical Value 5%	Unit root levels	t-stat changes	Critical Value 5%	Unit root first differences
CIP, Yearly series Covered Interest Parity differentials	Austria	15	0.00	0.00	-6.79	-3.83	Rejected	-3.33	-3.87	NR
	Belgium	21	0.01	0.01	-0.61	-3.67	NR	-3.05	-3.69	NR
	Germany	32	0.00	0.00						
	Denmark	15	0.01	0.01	-3.68	-3.83	NR	-3.63	-3.87	NR
	Spain	25	0.03	0.02	-4.40	-3.62	Rejected	-5.25	-3.63	Rejected
	Finland	6	0.00	0.00						
	France	19	0.01	0.01	-2.01	-3.71	NR	-3.80	-3.73	Rejected
	Greece	6	0.03	0.03						
	Ireland	12	0.01	0.00	-1.86	-3.99	NR	-2.14	-4.08	NR
	Italy	24	0.03	0.02	-3.43	-3.63	NR	-2.84	-3.65	NR
	Netherlands	17	0.00	0.00	-5.88	-3.79	Rejected	-3.29	-3.83	NR
	Portugal	10	0.02	0.01						
	Sweden	18	0.02	0.01	-3.18	-3.73	NR	-3.28	-3.76	NR
	UK	17	0.02	0.01	-2.24	-3.76	NR	-2.45	-3.79	NR
CIP, Monthly Series. Covered Interest Parity differentials	Austria	169	0.00	0.00	-4.91	-3.44	Rejected	-11.75	-3.44	NR
	Belgium	246	0.01	0.01	-4.61	-3.43	Rejected	-13.02	-3.43	NR
	Germany	378	0.00	0.00						
	Denmark	174	0.01	0.01	-3.45	-3.44	Rejected	-8.96	-3.44	Rejected
	Spain	294	0.03	0.02	-5.54	-3.43	Rejected	-14.49	-3.43	NR
	Finland	55	0.00	0.00	-3.75	-3.50	Rejected	-7.31	-3.50	Rejected
	France	213	0.01	0.01	-4.29	-3.43	Rejected	-11.25	-3.43	NR
	Greece	55	0.02	0.03	-1.86	-3.50	NR	-5.62	-3.50	Rejected
	Ireland	127	0.01	0.01	-3.03	-3.45	NR	-9.28	-3.45	Rejected
	Italy	273	0.03	0.02	-3.78	-3.43	Rejected	-10.92	-3.43	NR
	Netherlands	198	0.00	0.00	-3.66	-3.43	Rejected	-12.45	-3.43	NR
	Portugal	114	0.02	0.01	-4.01	-3.45	Rejected	-9.58	-3.45	Rejected
	Sweden	214	0.02	0.01	-4.81	-3.43	Rejected	-10.24	-3.43	NR
	UK	198	0.02	0.01	-2.16	-3.43	NR	-11.70	-3.43	NR
RB: DS1. Interest payments on public debt in percent of GDP	Austria	30	2.97	1.24	0.68	-3.58	NR	-3.74	-3.59	Rejected
	Belgium	30	7.88	2.91	-0.10	-3.58	NR	-3.18	-3.59	NR
	Germany	30	2.44	0.93	-2.75	-3.58	NR	-3.60	-3.59	Rejected
	Denmark	12	6.51	0.92	0.00	-3.99	NR	-3.70	-4.08	NR
	Spain	32	2.33	1.92	-1.57	-3.57	NR	-3.47	-3.57	NR
	Finland	30	1.90	1.30	-2.54	-3.58	NR	-3.04	-3.59	NR
	France	30	2.30	1.07	-1.69	-3.58	NR	-2.16	-3.59	NR
	Greece	30	5.28	3.60	-1.48	-3.65	NR	-2.90	-3.66	NR
	Ireland	23	6.91	2.04	-1.13	-3.58	NR	-2.09	-3.59	NR
	Italy	30	6.84	3.23	0.29	-3.58	NR	-2.51	-3.59	NR
	Netherlands	30	4.77	1.37	-0.59	-3.58	NR	-2.27	-3.59	NR
	Portugal	32	4.15	2.66	-0.63	-3.57	NR	-3.57	-3.57	Rejected
	Sweden	32	4.76	1.99	-2.06	-3.57	NR	-2.39	-3.57	NR
	UK	32	3.85	0.71	-2.04	-3.57	NR	-3.40	-3.57	NR

Table 0-14 continued: Descriptive statistics and result of unit root tests for individual country specific series

	Descriptive Statistics				Augmented Dicky Fuller Unit Root Tests (with a constant and a trend but no lagged first differences)					
Series	Country	Obs.	Mean	St. Deviation	t-stat levels	Critical Value 5%	Unit root levels	t-stat changes	Critical Value 5%	Unit root first differences
RB: DS2. Interest payments net of growth on public debt in percent of GDP	Austria	3.60	1.31	12	-3.52	-3.59	NR	-5.55	-3.59	Rejected
	Belgium	0.55	1.21	29	-1.78	-3.59	NR	-5.48	-3.59	Rejected
	Germany	2.05	3.11	29	-3.10	-3.59	NR	-5.31	-3.59	Rejected
	Denmark	0.52	1.13	29	-2.38	-3.99	NR	-2.89	-4.08	NR
	Spain	-1.29	1.61	26	-1.91	-3.61	NR	-3.61	-3.62	NR
	Finland	1.38	1.57	11	-3.24	-4.08	NR	-2.18	-4.20	NR
	France	0.16	1.62	23	-1.43	-3.65	NR	-3.94	-3.66	Rejected
	Greece	-2.04	2.05	29	-1.66	-3.65	NR	-3.82	-3.66	Rejected
	Ireland	-1.42	2.98	23	-2.10	-3.59	NR	-4.29	-3.59	Rejected
	Italy	-1.03	4.35	29	-4.48	-3.59	Rejected	-5.93	-3.59	Rejected
	Netherlands	1.48	2.16	29	-1.40	-3.59	NR	-4.67	-3.59	Rejected
	Portugal	-1.54	1.97	31	-2.60	-3.57	NR	-4.85	-3.58	Rejected
	Sweden	1.20	2.11	31	-4.46	-3.57	Rejected	-6.91	-3.58	Rejected
	UK	-1.37	2.41	31	-1.77	-3.57	NR	-4.55	-3.58	Rejected
BY: Public Debt in percent of GDP	Austria	45.87	17.88	32	-0.90	-3.56	NR	-3.62	-3.57	Rejected
	Belgium	100.3	29.33	32	-0.76	-3.56	NR	-1.90	-3.57	NR
	Germany	38.96	14.54	32	-2.33	-3.56	NR	-2.51	-3.57	NR
	Denmark	65.73	10.56	22	-2.38	-3.67	NR	-2.56	-3.67	NR
	Spain	47.94	21.59	26	-1.89	-3.61	NR	-2.03	-3.62	NR
	Finland	42.91	15.86	13	-2.76	-3.92	NR	-3.96	-3.99	NR
	France	45.06	13.32	25	-2.72	-3.62	NR	-1.74	-3.63	NR
	Greece	58.08	37.84	32	0.27	-3.59	NR	-2.72	-3.60	NR
	Ireland	76.85	22.01	28	-1.38	-3.56	NR	-2.17	-3.57	NR
	Italy	83.97	28.48	32	-0.52	-3.56	NR	-1.79	-3.57	NR
	Netherlands	59.37	14.42	32	-0.73	-3.56	NR	-1.70	-3.57	NR
	Portugal	44.29	17.37	32	-0.59	-3.56	NR	-3.89	-3.57	Rejected
	Sweden	51.50	17.12	32	-2.88	-3.56	NR	-2.67	-3.57	NR
	UK	57.78	7.68	32	-2.64	-3.56	NR	-2.65	-3.57	NR

NR: Not rejected

References

1. Volkerink and de Haan (1999): “Political and Institutional Determinants of the Tax Mix: An Empirical Investigation for OECD Countries”, University of Groningen, Research Institute SOM Research Report 99E05
2. Volkerink and de Haan (2000): “Fragmented Government Effects on Fiscal Policy: New Evidence”, Mimeo, University of Groningen
3. Woldendorp, Jaap, Hans Keman and Ian Budge (2000): "Party government in 48 democracies (1945-1998)". December 2000, Kluwer Academic Publishers.

Robustness Tests of the Basic Specification

Table 0-15: The basic regressions including all available observations. Max. sample: 1972-200

Dependent Variable	A. Primary expenditures in % of GDP (b)			B. Corporate tax revenues in percent of GDP (c.)			C. Corporate tax revenues in percent of total tax revenues (c.)		
Explanatory Variable	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value	Para-meter estimate	t-stat	p-value
GR_{-1}	-0.05	-1.44	0.15	0.02	3.84	0.00	0.06	3.86	0.00
$INFL_{-1}$	0.08	4.04	0.00	0.00	-0.96	0.34	-0.02	-2.19	0.03
$\Delta OPEN_{-1}$	0.02	2.61	0.01	0.00	-1.05	0.30	0.00	-0.24	0.81
$\Delta PART_{-1}$	0.01	0.17	0.86	0.02	1.07	0.29	0.01	0.14	0.89
LEFT	-0.32	-2.29	0.02	-0.08	-2.38	0.02	-0.20	-2.52	0.01
ΔUN_{-1}	-0.10	-1.38	0.17	-0.03	-2.54	0.01	-0.08	-2.23	0.03
$MAAS_{-1}$	-1.22	-4.66	0.00	0.26	6.84	0.00	0.65	6.91	0.00
No. Obs	313.00			338.00			338.00		
DW statistic	2.20			2.06			2.02		
R2	0.12			0.14			0.15		

Robustness Tests for Hypothesis 1

Table 0-16: Robustness of the parameter estimates of the capital mobility index in the primary expenditures to GDP regression of dropping countries from the sample

Excluding country:	Quinn 14		FDI Stocks		-CIP	
	Parameter Estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat
AT	0.030	0.449	-0.045	-1.537	-0.370	-3.181
BE	-0.119	-1.519	-0.045	-1.502	-0.273	-2.953
DE	0.003	0.038	-0.020	-0.650	-0.274	-2.803
DK	0.059	0.867	-0.036	-1.226	-0.236	-1.883
FI	0.044	0.608	-0.029	-0.929	-0.282	-2.888
FR	-0.021	-0.281	-0.019	-0.659	-0.243	-2.477
GR	-0.063	-0.970	-0.030	-1.093	-0.282	-2.888
IE	-0.010	-0.144	-0.025	-0.829	-0.297	-2.466
IT	0.095	1.397	-0.021	-0.696	-0.109	-1.035
NL	0.014	0.213	-0.045	-1.145	-0.319	-2.901
SE	0.031	0.423	-0.027	-0.862	-0.406	-3.366
UK	0.010	0.152	-0.040	-1.375	-0.376	-3.418
ES	0.107	1.330	-0.038	-1.257	-0.359	-2.956
PT	-0.050	-0.604	-0.008	-0.235	-0.265	-2.748

Table 0-17: Robustness of the parameter estimates of the capital mobility index in the primary expenditures to GDP regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	Parameter estimate	t-stat	p-value	Parameter estimate	t-stat	p-value	Parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.086	1.186	0.237	-0.039	-1.271	0.205	0.242	1.559	0.122
GR_{-1}	-0.061	-1.591	0.113	-0.062	-1.670	0.096	-0.146	-3.097	0.003
$INFL_{-1}$	0.014	0.677	0.499	0.013	0.619	0.537	0.102	3.344	0.001
$\Delta OPEN_{-1}$	0.021	2.826	0.005	0.020	2.691	0.008	-0.027	-2.589	0.011
$\Delta PART_{-1}$	0.000	-0.004	0.997	-0.005	-0.065	0.949	0.313	3.180	0.002
LEFT	-0.107	-0.984	0.326	-0.101	-0.891	0.374	-0.484	-2.900	0.005
ΔUN_{-1}	-0.028	-0.355	0.723	-0.031	-0.403	0.688	0.099	1.106	0.271
$MAAS_{-1}$	-1.041	-4.866	0.000	-1.056	-5.105	0.000	-0.274	-1.149	0.253
ΔIR_{-1}	0.158	4.455	0.000	0.149	4.279	0.000	0.297	5.233	0.000
$ELEC_{+1}$	-0.062	-0.637	0.525	-0.084	-0.840	0.402	-0.323	-2.463	0.015
ELEC	-0.076	-0.763	0.446	-0.054	-0.541	0.589	-0.268	-1.950	0.054

Table 0-18: Robustness of the parameter estimates of the capital mobility index in the primary expenditures to GDP regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	Parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.058	0.966	0.335	-0.010	-0.382	0.703	-0.258	-3.279	0.001
ΔGR_{-1}	-0.169	-8.675	0.000	-0.167	-8.675	0.000	-0.126	-7.037	0.000
$\Delta INFL_{-1}$	-0.009	-0.391	0.696	-0.016	-0.701	0.484	0.152	3.423	0.001
$\Delta OPEN_{-1}$	0.017	2.221	0.027	0.016	2.215	0.028	-0.034	-4.488	0.000
$\Delta PART_{-1}$	-0.027	-0.484	0.629	-0.022	-0.380	0.704	0.246	2.958	0.004
LEFT	-0.081	-0.693	0.489	-0.058	-0.501	0.617	-0.556	-3.414	0.001
ΔUN_{-1}	-0.035	-0.578	0.564	-0.033	-0.567	0.572	0.195	3.244	0.002
$MAAS_{-1}$	-1.251	-7.029	0.000	-1.278	-7.189	0.000	-0.959	-6.507	0.000

Robustness Tests for Hypothesis 2

Table 0-19: Robustness of the parameter estimates of the capital mobility index in the corporate revenue to GDP regression of dropping countries from the sample

Excluding country:	Quinn 14		FDI Stocks		-CIP	
	Parameter Estimate	t-stat	Parameter estimate	t-stat	Parameter Estimate	t-stat
AT	0.071	3.660	-0.008	-1.362	-0.101	-2.852
BE	0.069	3.346	-0.007	-1.040	-0.126	-3.384
DE	0.068	3.581	-0.008	-1.345	-0.098	-2.814
DK	0.068	3.398	-0.005	-0.822	-0.087	-2.413
FI	0.064	3.269	-0.011	-1.757	-0.101	-2.889
FR	0.075	3.699	-0.005	-0.796	-0.121	-3.180
GR	0.072	3.399	-0.008	-1.306	-0.101	-2.889
IE	0.070	3.382	-0.007	-1.354	-0.093	-2.694
IT	0.071	3.691	-0.010	-1.806	-0.131	-3.232
NL	0.067	3.529	-0.007	-0.874	-0.107	-3.033
SE	0.065	3.413	-0.003	-0.512	-0.064	-1.718
UK	0.043	2.136	-0.011	-1.874	-0.079	-2.147
ES	0.057	2.696	-0.006	-0.990	-0.114	-3.056
PT	0.077	4.130	-0.009	-1.661	-0.010	-2.625

Table 0-20: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax regression of dropping countries from the sample

Excluding country:	Quinn 14		FDI Stocks		-CIP	
	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter Estimate	t-stat
AT	-0.171	-0.625	0.094	1.012	-1.590	-3.374
BE	-0.087	-0.237	0.041	0.404	-1.696	-3.598
DE	-0.138	-0.467	0.066	0.693	-1.580	-3.417
DK	0.384	1.398	0.066	0.694	-1.222	-2.943
FI	-0.430	-1.815	-0.025	-0.287	-1.677	-3.748
FR	-0.278	-0.841	0.095	0.971	-2.162	-4.172
GR	-0.019	-0.066	0.071	0.770	-1.677	-3.748
IE	-0.418	-1.324	0.002	0.017	-1.505	-3.186
IT	-0.274	-0.987	0.101	1.047	-1.440	-2.872
NL	-0.201	-0.718	-0.075	-0.581	-1.559	-3.318
SE	-0.091	-0.316	0.077	0.807	-1.583	-3.053
UK	-0.283	-1.052	0.051	0.534	-1.421	-3.034
ES	-0.268	-0.885	0.084	0.851	-1.699	-3.391
PT	0.244	0.769	0.085	0.858	-1.639	-3.436

Table 0-21: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues in percent of GDP regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.048	2.663	0.008	-0.009	-1.532	0.127	-0.123	-2.942	0.004
GR_{-1}	0.003	0.725	0.469	0.003	0.731	0.465	0.006	0.665	0.507
$INFL_{-1}$	0.004	0.646	0.519	0.006	0.968	0.334	-0.026	-1.817	0.072
$\Delta OPEN_{-1}$	-0.003	-2.617	0.010	-0.003	-2.517	0.013	-0.014	-3.831	0.000
$\Delta PART_{-1}$	0.016	0.940	0.348	0.018	1.055	0.293	0.003	0.134	0.894
LEFT	-0.108	-3.161	0.002	-0.102	-2.992	0.003	-0.130	-3.058	0.003
ΔUN_{-1}	-0.066	-5.720	0.000	-0.065	-5.817	0.000	-0.048	-2.242	0.027
$MAAS_{-1}$	0.214	6.820	0.000	0.221	7.168	0.000	0.155	2.988	0.004
ΔIR_{-1}	-0.009	-1.266	0.207	-0.009	-1.318	0.189	-0.009	-0.627	0.532
$ELEC_{+1}$	0.032	1.262	0.209	0.030	1.180	0.239	0.003	0.074	0.941
ELEC	0.035	1.383	0.168	0.039	1.563	0.120	-0.023	-0.607	0.545

Table 0-22: Robustness of the parameter estimates of the capital mobility index in the implicit tax rate on capital regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.071	0.267	0.790	0.126	1.524	0.129	-1.451	-2.912	0.004
GR_{-1}	-0.451	-5.242	0.000	-0.463	-5.526	0.000	-0.234	-2.214	0.029
$INFL_{-1}$	-0.381	-3.035	0.003	-0.374	-3.071	0.003	-0.498	-3.043	0.003
$\Delta OPEN_{-1}$	0.018	0.635	0.526	0.016	0.576	0.565	-0.113	-1.902	0.060
$\Delta PART_{-1}$	1.333	4.772	0.000	1.344	4.872	0.000	1.387	4.094	0.000
LEFT	0.214	0.419	0.676	0.185	0.367	0.714	-0.582	-1.155	0.251
ΔUN_{-1}	-2.387	-11.203	0.000	-2.411	-11.531	0.000	-1.831	-6.829	0.000
$MAAS_{-1}$	1.530	3.737	0.000	1.376	3.407	0.001	0.946	1.731	0.086
ΔIR_{-1}	0.352	3.271	0.001	0.335	3.228	0.002	0.343	1.962	0.052
$ELEC_{+1}$	0.390	1.030	0.304	0.462	1.260	0.209	0.727	1.751	0.083
ELEC	-1.051	-2.840	0.005	-0.994	-2.780	0.006	-1.484	-3.569	0.001

Table 0-23: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues to GDP regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.052	2.880	0.004	-0.008	-1.520	0.130	-0.106	-3.079	0.003
ΔGR_{-1}	0.003	0.602	0.548	0.003	0.587	0.558	0.006	0.716	0.475
$\Delta INFL_{-1}$	0.001	0.100	0.920	0.002	0.432	0.666	-0.030	-2.180	0.031
$\Delta OPEN_{-1}$	-0.003	-2.453	0.015	-0.003	-2.380	0.018	-0.014	-4.280	0.000
$\Delta PART_{-1}$	0.012	0.723	0.470	0.012	0.754	0.452	0.004	0.161	0.873
LEFT-1	-0.105	-3.246	0.001	-0.099	-3.031	0.003	-0.138	-3.413	0.001
ΔUN_{-1}	-0.063	-5.593	0.000	-0.063	-5.763	0.000	-0.048	-2.353	0.020
$MAAS_{-1}$	0.234	7.955	0.000	0.241	8.153	0.000	0.175	3.857	0.000

Table 0-24: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax rate regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.184	0.696	0.487	0.147	1.638	0.103	-1.839	-4.319	0.000
ΔGR_{-1}	-0.455	-5.320	0.000	-0.462	-5.564	0.000	-0.319	-3.084	0.003
$\Delta INFL_{-1}$	-0.129	-1.229	0.221	-0.121	-1.197	0.233	-0.437	-2.639	0.010
$\Delta OPEN_{-1}$	0.025	1.042	0.299	0.025	1.096	0.275	-0.133	-2.499	0.014
$\Delta PART_{-1}$	1.133	3.938	0.000	1.106	3.913	0.000	1.410	3.762	0.000
LEFT	0.167	0.327	0.744	0.113	0.225	0.822	-0.934	-1.731	0.086
ΔUN_{-1}	-2.498	-12.175	0.000	-2.496	-12.501	0.000	-2.209	-8.226	0.000
$MAAS_{-1}$	1.099	3.073	0.002	0.934	2.615	0.010	0.552	1.059	0.292

Table 0-25: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues to GDP regression to including total tax revenues in percent of GDP (controling for the trend of taxes to grow other the sample period)

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.044	3.067	0.002	-0.004	-0.985	0.326	-8.842	-2.650	0.009
ΔGR_{-1}	0.011	2.812	0.005	0.011	2.842	0.005	0.010	1.281	0.203
$\Delta INFL_{-1}$	-0.002	-0.554	0.580	0.000	-0.047	0.963	-0.022	-1.633	0.105
$\Delta OPEN_{-1}$	-0.003	-2.840	0.005	-0.003	-2.730	0.007	-0.011	-3.578	0.001
$\Delta PART_{-1}$	-0.020	-1.554	0.122	-0.019	-1.498	0.136	-0.009	-0.374	0.709
LEFT-1	-0.135	-4.744	0.000	-0.136	-4.688	0.000	-0.114	-2.826	0.006
ΔUN_{-1}	-0.068	-8.109	0.000	-0.067	-7.793	0.000	-0.031	-1.513	0.133
$MAAS_{-1}$	0.223	11.807	0.000	0.222	11.452	0.000	0.159	3.687	0.000
ΔTOTALTAX	0.079	12.788	0.000	0.078	12.765	0.000	0.050	4.182	0.000

Table 0-26: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax rate regression to including total tax revenues in percent of GDP (controlling for the trend of taxes to grow other the sample period)

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.663	3.409	0.001	0.144	1.868	0.063	-91.108	-3.457	0.001
ΔGR_{-1}	-0.313	-5.039	0.000	-0.302	-4.526	0.000	-0.095	-1.190	0.237
$\Delta INFL_{-1}$	-0.220	-3.653	0.000	-0.215	-3.329	0.001	-0.044	-0.368	0.714
$\Delta OPEN_{-1}$	0.000	0.024	0.981	0.005	0.215	0.830	-0.056	-1.291	0.199
$\Delta PART_{-1}$	0.794	4.097	0.000	0.781	3.800	0.000	1.087	3.602	0.001
ΔLEFT-1	0.647	1.715	0.088	0.647	1.620	0.107	-0.675	-1.535	0.128
ΔUN_{-1}	-2.459	-17.502	0.000	-2.463	-16.225	0.000	-1.659	-7.788	0.000
$MAAS_{-1}$	1.492	4.939	0.000	1.203	3.703	0.000	0.260	0.735	0.464
ΔTOTALTAX	2.158	27.097	0.000	2.163	24.686	0.000	1.843	12.205	0.000

Table 0-27: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues to GDP regression to including income per capita

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.05	2.63	0.01	-0.02	-2.15	0.03	-0.10	-2.78	0.01
$\Delta income_{-1}$	-0.01	-0.83	0.40	-0.00	-0.05	0.95	0.01	0.47	0.63
ΔGR_{-1}	0.02	2.41	0.02	0.03	2.70	0.01	0.03	1.91	0.05
$\Delta INFL_{-1}$	0.01	0.99	0.32	0.01	1.57	0.12	0.01	0.90	0.36
$\Delta OPEN_{-1}$	-0.01	-2.42	0.02	-0.01	-2.42	0.02	-0.01	-4.55	0.00
$\Delta PART_{-1}$	-0.02	-1.26	0.20	-0.03	-1.63	0.10	-0.03	-1.09	0.27
LEFT-1	-0.08	-2.93	0.00	-0.08	-2.90	0.00	-0.09	-2.63	0.01
ΔUN_{-1}	-0.03	-1.61	0.10	-0.03	-1.52	0.13	0.01	0.21	0.82
$MAAS_{-1}$	0.25	5.25	0.00	0.26	5.87	0.00	0.20	3.55	0.00

Table 0-28: Using the corporate implicit tax rate (corporate tax revenues divided by the gross operating surplus) as dependent variable. Only 9 countries are included in the sample (Austria, Finland, Greece, Ireland and Portugal are excluded from the sample due to lack of data.)

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.593	3.581	0.001	-0.004	-0.090	0.928	-1.015	-3.025	0.003
GR_{-1}	0.172	1.756	0.081	0.208	2.010	0.046	-0.068	-0.435	0.665
$INFL_{-1}$	0.056	1.363	0.175	0.051	1.175	0.242	-0.112	-1.304	0.196
$\Delta OPEN_{-1}$	11.693	3.202	0.002	12.060	3.242	0.002	12.291	2.082	0.041
$\Delta PART_{-1}$	0.264	0.946	0.346	0.263	0.910	0.365	0.574	1.558	0.123
$\Delta LEFT$	-1.074	-2.932	0.004	-1.188	-3.116	0.002	-1.256	-3.139	0.002
ΔUN_{-1}	-0.612	-4.027	0.000	-0.569	-3.521	0.001	-0.711	-3.023	0.003
$MAAS_{-1}$	1.812	6.060	0.000	1.607	5.145	0.000	0.798	1.722	0.089
No. Obs	158			158			96		
DW	1.845			0.204			1.892		
R2	0.211			1.827			0.239		

Robustness Tests for Hypothesis 3

Table 0-29: Robustness of the parameter estimates of the capital mobility index in the corporate revenue to total tax revenues of dropping countries from the sample

Excluding country:	Quinn 14		FDI Stocks		-CIP	
	parameter estimate	t-stat	parameter estimate	t-stat	parameter estimate	t-stat
AT	0.165	3.504	-0.022	-1.756	-0.246	-2.930
BE	0.160	3.137	-0.022	-1.959	-0.327	-3.702
DE	0.150	3.075	-0.014	-1.088	-0.248	-3.013
DK	0.149	3.336	-0.019	-1.906	-0.230	-2.643
FI	0.105	2.212	-0.032	-2.716	-0.254	-3.118
FR	0.131	2.733	-0.019	-1.699	-0.299	-3.437
GR	0.193	3.890	-0.021	-1.880	-0.254	-3.118
IE	0.148	2.985	-0.031	-2.891	-0.232	-2.800
IT	0.152	3.120	-0.027	-2.654	-0.292	-3.250
NL	0.152	3.251	0.003	0.183	-0.277	-3.376
SE	0.128	2.748	-0.014	-1.142	-0.171	-1.842
UK	0.167	3.535	-0.026	-2.336	-0.222	-2.629
ES	0.114	2.287	-0.014	-1.195	-0.280	-3.394
PT	0.196	4.415	-0.029	-2.654	-0.257	-3.002

Table 0-30: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax divided by the implicit labor income tax regression of dropping countries from the sample

Excluding country:	Quinn 14		FDI Stocks		-CIP	
	parameter estimate	t-stat	parameter estimate	t-stat	parameter estimate	t-stat
AT	0.001	0.167	0.003	1.147	-0.043	-3.097
BE	0.008	0.636	0.001	0.405	-0.044	-3.203
DE	0.000	-0.034	0.002	1.060	-0.044	-3.152
DK	0.009	1.118	0.002	0.985	-0.038	-2.989
FI	-0.001	-0.192	-0.001	-0.641	-0.045	-3.398
FR	-0.002	-0.189	0.003	1.140	-0.054	-3.740
GR	0.006	0.790	0.003	1.432	-0.045	-3.398
IE	-0.009	-0.988	0.001	0.535	-0.043	-3.068
IT	0.002	0.243	0.002	0.884	-0.040	-2.303
NL	-0.003	-0.421	0.001	0.271	-0.046	-3.312
SE	-0.004	-0.491	0.002	0.693	-0.053	-3.567
UK	-0.004	-0.475	0.001	0.321	-0.028	-2.453
ES	0.000	-0.027	0.002	0.970	-0.043	-2.988
PT	0.009	1.015	0.002	0.768	-0.045	-3.308

Table 0-31: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues in percent of total tax revenues to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.124	2.695	0.008	-0.022	-1.896	0.059	-0.362	-3.625	0.000
GR_{-1}	0.063	3.192	0.002	0.061	3.157	0.002	0.053	1.599	0.113
$INFL_{-1}$	0.009	0.954	0.341	0.007	0.902	0.368	0.001	0.038	0.970
$\Delta OPEN_{-1}$	-0.007	-1.958	0.052	-0.006	-1.749	0.082	-0.027	-3.817	0.000
$\Delta PART_{-1}$	-0.020	-0.429	0.669	-0.018	-0.391	0.696	-0.055	-0.912	0.364
LEFT	-0.306	-3.643	0.000	-0.297	-3.585	0.000	-0.283	-2.619	0.010
ΔUN_{-1}	-0.120	-3.238	0.001	-0.120	-3.251	0.001	-0.030	-0.433	0.666
$MAAS_{-1}$	0.649	8.042	0.000	0.670	8.623	0.000	0.274	2.066	0.041
ΔIR_{-1}	-0.022	-1.334	0.184	-0.018	-1.151	0.251	-0.062	-1.863	0.065
$ELEC_{+1}$	0.037	0.580	0.563	0.039	0.610	0.543	-0.023	-0.247	0.805
ELEC	0.124	1.950	0.053	0.148	2.351	0.020	-0.056	-0.581	0.562

Table 0-32: Robustness of the parameter estimates of the capital mobility index in the implicit tax rate on capital divided by the implicit tax rate on labor regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-0.004	-0.472	0.637	0.002	0.854	0.394	-0.032	-1.951	0.054
GR_{-1}	0.004	0.894	0.373	0.003	0.765	0.445	-0.002	-0.278	0.781
$INFL_{-1}$	-0.013	-5.787	0.000	-0.013	-5.741	0.000	0.000	-0.038	0.970
$\Delta OPEN_{-1}$	0.003	2.122	0.035	0.003	2.047	0.042	-0.002	-1.076	0.284
$\Delta PART_{-1}$	0.014	1.715	0.088	0.016	1.844	0.067	0.033	2.837	0.006
LEFT	0.005	0.320	0.750	0.004	0.312	0.755	-0.037	-2.379	0.019
ΔUN_{-1}	-0.065	-7.938	0.000	-0.066	-8.141	0.000	-0.060	-6.048	0.000
$MAAS_{-1}$	0.009	0.552	0.582	0.008	0.482	0.631	0.017	0.957	0.341
ΔIR_{-1}	0.007	1.719	0.087	0.007	1.689	0.093	0.008	1.515	0.133
$ELEC_{+1}$	-0.004	-0.386	0.700	-0.003	-0.263	0.793	-0.009	-0.680	0.498
ELEC	-0.033	-3.204	0.002	-0.033	-3.330	0.001	-0.038	-3.077	0.003

Table 0-33: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues to total tax revenues regression to including growth and inflation in levels

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.155	3.449	0.001	-0.021	-1.875	0.062	-0.258	-3.267	0.001
GR_{-1}	0.023	2.161	0.032	0.023	2.219	0.028	0.026	1.389	0.168
$INFL_{-1}$	0.003	0.197	0.844	0.006	0.493	0.623	-0.072	-2.182	0.031
$\Delta OPEN_{-1}$	-0.005	-1.479	0.141	-0.004	-1.234	0.219	-0.025	-3.483	0.001
$\Delta PART_{-1}$	-0.004	-0.097	0.923	-0.001	-0.032	0.974	-0.003	-0.046	0.964
LEFT	-0.267	-3.541	0.001	-0.258	-3.395	0.001	-0.279	-2.861	0.005
ΔUN_{-1}	-0.168	-6.060	0.000	-0.167	-5.983	0.000	-0.083	-1.730	0.086
$MAAS_{-1}$	0.603	9.250	0.000	0.620	9.202	0.000	0.383	3.730	0.000

Table 0-34: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax rate divided by the implicit labor tax rate regression to including growth and inflation in levels

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.013	1.557	0.121	0.003	1.466	0.144	-0.045	-3.710	0.000
GR_{-1}	-0.011	-4.498	0.000	-0.012	-4.765	0.000	-0.008	-2.558	0.012
$INFL_{-1}$	-0.010	-3.099	0.002	-0.010	-3.034	0.003	-0.005	-1.142	0.256
$\Delta OPEN_{-1}$	0.002	1.444	0.151	0.002	1.423	0.156	-0.003	-1.864	0.065
$\Delta PART_{-1}$	0.022	2.939	0.004	0.023	3.024	0.003	0.036	3.802	0.000
LEFT	0.009	0.564	0.574	0.006	0.388	0.699	-0.044	-2.610	0.010
ΔUN_{-1}	-0.092	-13.665	0.000	-0.092	-13.506	0.000	-0.069	-8.476	0.000
$MAAS_{-1}$	0.042	3.197	0.002	0.037	2.760	0.006	0.003	0.231	0.818

Table 0-35: Using the corporate implicit tax rate in percent of the implicit tax rate on labor as explanatory variable. Austria, Finland, Greece, Ireland and Portugal are excluded from the sample due to lack of data

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.584	3.844	0.000	0.008	0.211	0.833	-1.102	-3.538	0.001
GR_{-1}	0.027	0.479	0.633	0.052	0.845	0.399	-0.105	-1.194	0.236
$INFL_{-1}$	-0.092	-1.858	0.065	-0.081	-1.488	0.139	-0.337	-3.182	0.002
$\Delta OPEN_{-1}$	14.054	4.264	0.000	13.974	4.035	0.000	10.896	2.156	0.034
$\Delta PART_{-1}$	0.449	1.712	0.089	0.499	1.794	0.075	0.556	1.534	0.129
LEFT	-1.150	-3.223	0.002	-1.204	-3.228	0.002	-1.389	-3.821	0.000
ΔUN_{-1}	-0.759	-8.014	0.000	-0.744	-7.062	0.000	-1.063	-6.447	0.000
$MAAS_{-1}$	1.518	6.169	0.000	1.282	4.676	0.000	1.283	3.376	0.001
No. Obs	158			158			96		
DW	1834.000			1.821			2.034		
R2	0.208			0.200			0.266		

Table 0-36: Robustness of the parameter estimates of the capital mobility index in the corporate tax revenues to total tax revenues regression to including total tax revenues in percent of GDP (controlling for the trend of taxes to grow other the sample period)

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.146	3.374	0.001	-0.014	-1.480	0.140	-0.235	-2.957	0.004
ΔGR_{-1}	0.031	2.875	0.004	0.032	3.066	0.002	0.031	1.676	0.097
$\Delta INFL_{-1}$	0.000	-0.008	0.994	0.004	0.323	0.747	-0.064	-1.929	0.056
$\Delta OPEN_{-1}$	-0.005	-1.394	0.165	-0.005	-1.229	0.221	-0.022	-2.996	0.003
$\Delta PART_{-1}$	-0.044	-1.190	0.235	-0.043	-1.146	0.253	-0.017	-0.312	0.756
LEFT-1	-0.287	-3.944	0.000	-0.280	-3.802	0.000	-0.261	-2.670	0.009
ΔUN_{-1}	-0.175	-6.718	0.000	-0.173	-6.470	0.000	-0.060	-1.205	0.231
$MAAS_{-1}$	0.572	10.155	0.000	0.579	9.933	0.000	0.366	3.638	0.000
ΔTOTALTAX	0.089	5.477	0.000	0.090	5.569	0.000	0.055	1.957	0.053

Table 0-37: Robustness of the parameter estimates of the capital mobility index in the implicit capital tax rate relative to the implicit labor tax rate regression to including total tax revenues in percent of GDP (controling for the trend of taxes to grow other the sample period)

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.016	2.016	0.045	0.004	2.452	0.015	-0.034	-3.273	0.001
ΔGR_{-1}	-0.008	-3.572	0.001	-0.007	-3.437	0.001	-0.004	-1.401	0.164
$\Delta INFL_{-1}$	-0.011	-4.554	0.000	-0.010	-4.139	0.000	0.000	0.027	0.979
$\Delta OPEN_{-1}$	0.000	-0.386	0.700	0.000	-0.168	0.867	-0.002	-1.127	0.262
$\Delta PART_{-1}$	0.013	2.234	0.027	0.012	2.077	0.039	0.032	3.468	0.001
ΔLEFT-1	0.027	2.020	0.045	0.030	2.321	0.021	-0.035	-2.385	0.019
ΔUN_{-1}	-0.095	-16.598	0.000	-0.095	-16.789	0.000	-0.057	-7.466	0.000
$MAAS_{-1}$	0.054	4.038	0.000	0.045	3.592	0.000	0.000	0.004	0.996
ΔTOTALTAX	0.036	13.907	0.000	0.037	15.202	0.000	0.028	7.488	0.000

Robustness Tests for Hypothesis 4

Table 0-38: Robustness of the parameter estimates of the capital mobility index and the interaction of size and capital mobility in the corporate tax revenues to GDP regression of dropping countries from the sample

Excluding country:	Quinn 14		Quinn 14*SIZE		FDI Stocks		FDI Stocks*SIZE		-CIP		-CIP*SIZE	
	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat
AT	0.03	1.64	0.00	1.98	-0.01	-1.94	0.00	1.45	-0.136	-2.35	0.004	0.90
BE	0.04	1.57	0.00	1.65	-0.01	-2.09	0.00	1.45	-0.219	-3.49	0.010	1.96
DE	0.00	0.18	0.01	2.90	-0.01	-2.11	0.00	1.80	-0.125	-2.25	0.004	0.76
DK	0.03	1.56	0.00	2.04	-0.01	-2.04	0.00	1.56	-0.087	-1.41	0.001	0.20
FI	0.02	0.74	0.00	2.18	-0.02	-2.93	0.00	2.18	-0.138	-2.47	0.005	0.99
FR	0.03	1.35	0.00	0.90	-0.01	-2.37	0.00	2.13	-0.109	-1.73	-0.002	-0.22
GR	0.05	2.20	0.00	1.12	-0.01	-2.43	0.00	1.49	-0.138	-2.47	0.005	0.99
IE	0.03	1.27	0.00	2.41	-0.02	-2.95	0.00	1.69	-0.126	-2.16	0.004	0.84
IT	0.03	1.55	0.00	2.08	-0.01	-2.51	0.00	1.42	-0.181	-3.16	0.008	1.24
NL	0.03	1.55	0.00	1.87	-0.01	-0.70	0.00	1.70	-0.135	-2.40	0.004	0.81
SE	0.02	1.16	0.00	1.82	-0.01	-1.83	0.00	1.92	-0.087	-1.34	0.003	0.57
UK	0.05	2.27	0.00	-0.74	0.00	0.01	0.00	-2.52	-0.187	-3.32	0.012	2.51
ES	0.03	1.10	0.00	1.43	-0.01	-1.53	0.00	1.40	-0.163	-2.78	0.005	1.07
PT	0.05	2.64	0.00	1.54	-0.02	-2.86	0.00	2.01	-0.146	-2.37	0.005	1.05

Table 0-39: Robustness of the parameter estimates of the capital mobility index and the interaction of size and capital mobility in the implicit capital tax rate regression of dropping countries from the sample

Excluding country:	Quinn 14		Quinn 14*SIZE		FDI Stocks		FDI Stocks*SIZE		-CIP		-CIP*SIZE	
	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	t-stat
AT	-0.63	-1.98	0.08	2.85	0.26	2.37	-0.03	-2.95	-1.321	-1.54	-0.021	-0.33
BE	-0.77	-1.87	0.11	3.82	0.13	1.12	-0.02	-1.46	-1.495	-1.73	-0.016	-0.25
DE	-1.04	-3.12	0.15	4.91	0.05	0.45	0.00	0.29	-1.664	-1.71	0.010	0.14
DK	-0.04	-0.13	0.07	2.79	0.22	1.95	-0.03	-2.62	-0.538	-0.66	-0.060	-0.96
FI	-0.94	-3.42	0.09	3.70	0.06	0.56	-0.02	-1.32	-1.538	-1.88	-0.009	-0.14
FR	-0.80	-2.26	0.13	4.31	0.15	1.25	-0.02	-0.83	-1.647	-1.71	-0.051	-0.62
GR	-0.49	-1.47	0.08	3.32	0.23	2.08	-0.03	-2.63	-1.538	-1.88	-0.009	-0.14
IE	-0.98	-2.75	0.10	3.69	0.10	0.85	-0.02	-1.53	-1.272	-1.43	-0.017	-0.26
IT	-0.62	-1.96	0.07	2.56	0.23	2.00	-0.03	-2.10	-1.817	-2.06	0.027	0.38
NL	-0.68	-2.13	0.09	3.38	0.13	0.83	-0.03	-2.57	-1.219	-1.39	-0.025	-0.38
SE	-0.64	-1.93	0.10	3.96	0.19	1.69	-0.02	-1.87	-1.848	-1.82	0.028	0.39
UK	-0.32	-1.07	0.01	0.29	0.29	2.78	-0.05	-7.00	-1.469	-1.70	0.020	0.32
ES	-0.84	-2.40	0.11	4.10	0.18	1.59	-0.02	-1.67	-1.688	-1.88	-0.001	-0.02
PT	-0.18	-0.47	0.08	3.15	0.20	1.73	-0.02	-2.02	-1.723	-1.63	0.008	0.10

Table 0-40: Robustness of the parameter estimates of the capital mobility index and country size in the corporate tax revenues to GDP regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta icap_{-1}$	0.030	1.400	0.163	-0.014	-2.270	0.024	-0.196	-3.189	0.002
$\Delta(Icap*SIZE)_{-1}$	0.002	1.520	0.130	0.001	1.686	0.093	0.006	1.338	0.184
GR_{-1}	0.023	2.858	0.005	0.024	3.053	0.003	0.025	1.878	0.063
$INFL_{-1}$	0.007	1.976	0.049	0.008	2.338	0.020	0.009	0.942	0.349
$\Delta OPEN_{-1}$	-0.004	-2.929	0.004	-0.003	-2.890	0.004	-0.016	-4.497	0.000
$\Delta PART_{-1}$	-0.001	-0.037	0.970	-0.003	-0.160	0.873	-0.020	-0.752	0.454
LEFT	-0.112	-3.153	0.002	-0.109	-3.120	0.002	-0.136	-3.229	0.002
ΔUN_{-1}	-0.046	-3.141	0.002	-0.044	-3.095	0.002	-0.027	-1.001	0.319
$MAAS_{-1}$	0.255	7.804	0.000	0.271	8.537	0.000	0.148	2.623	0.010
ΔIR_{-1}	-0.007	-1.137	0.257	-0.006	-0.976	0.330	-0.026	-1.908	0.059
$ELEC_{+1}$	0.031	1.204	0.230	0.027	1.045	0.297	0.015	0.380	0.704
ELEC	0.037	1.456	0.147	0.036	1.419	0.158	-0.027	-0.718	0.474

Table 0-41: Robustness of the parameter estimates of the capital mobility index and country size in the implicit tax rate on capital regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta icap_{-1}$	-0.902	-2.865	0.005	0.161	1.619	0.107	-0.900	-0.922	0.359
$\Delta(Icap*SIZE)_{-1}$	0.110	4.204	0.000	-0.021	-1.978	0.050	-0.037	-0.585	0.560
GR_{-1}	-0.044	-0.295	0.768	-0.103	-0.650	0.516	0.113	0.599	0.550
$INFL_{-1}$	-0.128	-2.176	0.031	-0.108	-1.684	0.094	-0.055	-0.515	0.608
$\Delta OPEN_{-1}$	0.0412	1.305	0.194	0.036	1.064	0.289	-0.094	-1.317	0.191
$\Delta PART_{-1}$	0.9785	2.916	0.004	1.444	4.518	0.000	1.034	2.485	0.015
LEFT	0.4353	0.832	0.406	0.053	0.112	0.911	-0.470	-1.015	0.313
ΔUN_{-1}	-2.003	-7.359	0.000	-2.000	-7.379	0.000	-1.429	-4.137	0.000
$MAAS_{-1}$	0.9509	1.994	0.048	1.100	2.209	0.028	0.746	1.091	0.278
ΔIR_{-1}	0.3738	3.217	0.002	0.338	2.834	0.005	0.299	1.667	0.098
$ELEC_{+1}$	0.6259	1.706	0.090	0.422	1.132	0.259	0.928	2.125	0.036
ELEC	-0.601	-1.657	0.099	-1.055	-2.906	0.004	-1.420	-3.431	0.001

Table 0-42: Robustness of the parameter estimates of the capital mobility index and country size in the corporate tax revenues to GDP regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	0.031	1.628	0.105	-0.011	-1.865	0.064	-0.154	-2.761	0.007
$\Delta(Icap*SIZE)_{-1}$	0.003	2.455	0.015	0.001	1.089	0.277	0.005	1.104	0.272
$\Delta GRFD_{-1}$	0.003	0.612	0.541	0.002	0.501	0.617	0.005	0.567	0.572
$\Delta INFLFD_{-1}$	0.000	-0.010	0.992	0.002	0.364	0.717	-0.030	-2.156	0.033
$\Delta OPEN_{-1}$	-0.003	-2.393	0.018	-0.003	-2.362	0.019	-0.015	-4.378	0.000
$\Delta PART_{-1}$	0.007	0.424	0.672	0.009	0.573	0.567	0.002	0.090	0.929
LEFT	-0.102	-3.288	0.001	-0.098	-3.010	0.003	-0.147	-3.748	0.000
ΔUN_{-1}	-0.063	-5.731	0.000	-0.062	-5.758	0.000	-0.052	-2.574	0.011
$MAAS_{-1}$	0.233	8.381	0.000	0.242	8.164	0.000	0.172	3.828	0.000

Table 0-43: Robustness of the parameter estimates of the capital mobility index and country size in the implicit capital tax rate regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-0.225	-0.703	0.483	0.254	2.396	0.018	-1.957	-2.089	0.039
$\Delta(Icap*SIZE)_{-1}$	0.068	2.544	0.012	-0.022	-1.937	0.054	0.008	0.122	0.903
$\Delta GRFD_{-1}$	-0.435	-4.927	0.000	-0.441	-5.295	0.000	-0.322	-3.064	0.003
$\Delta INFLFD_{-1}$	-0.082	-0.780	0.437	-0.109	-1.076	0.283	-0.420	-2.447	0.016
$\Delta OPEN_{-1}$	0.028	1.141	0.256	0.026	1.109	0.269	-0.134	-2.386	0.019
$\Delta PART_{-1}$	0.867	2.728	0.007	1.203	4.239	0.000	1.405	3.691	0.000
LEFT	0.337	0.618	0.537	0.063	0.127	0.899	-0.953	-1.733	0.086
ΔUN_{-1}	-2.487	-12.021	0.000	-2.482	-12.439	0.000	-2.216	-7.891	0.000
$MAAS_{-1}$	1.072	2.822	0.005	1.066	2.944	0.004	0.562	1.072	0.286

Robustness Tests for Hypothesis 5

Table 0-44: Robustness of the parameter estimates of the capital mobility index and the interaction of agglomeration and capital mobility in the implicit capital tax rate regression of dropping countries from the sample

Excluding country:	Quinn 14		Quinn 14*AGGLOM		FDI Stocks		FDI Stocks*AGGLOM		-CIP		-CIP*AGGLOM	
	Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate		Parameter estimate	t-stat	Parameter estimate	t-stat	Parameter estimate	
AT	-1.61	-3.27	0.08	3.17	-0.03	-0.10	0.01	0.40	0.30	0.19	-0.09	-1.07
BE	-1.74	-3.34	0.10	3.64	-0.09	-0.25	0.01	0.38	0.40	0.25	-0.10	-1.20
DE	-1.42	-1.55	0.07	1.67	-0.01	-0.02	0.00	0.22	-0.01	-0.01	-0.07	-0.82
DK	-2.39	-5.13	0.15	6.71	-0.19	-0.55	0.01	0.76	-1.93	-1.20	0.04	0.48
FI	-1.24	-3.26	0.05	2.42	0.01	0.05	0.00	-0.12	-0.07	-0.05	-0.07	-0.92
FR	-1.96	-3.84	0.09	3.69	-0.03	-0.09	0.01	0.39	0.57	0.33	-0.14	-1.47
GR	-1.90	-3.60	0.10	4.01	-0.36	-1.03	0.02	1.25	-0.07	-0.05	-0.07	-0.92
IE	-2.57	-4.84	0.11	4.55	-0.14	-0.40	0.01	0.41	-0.36	-0.23	-0.06	-0.69
IT	-1.86	-3.77	0.09	3.42	0.28	0.78	-0.01	-0.49	1.45	0.76	-0.12	-1.33
NL	-1.98	-4.21	0.10	4.21	-0.49	-1.30	0.02	1.15	0.23	0.15	-0.08	-0.99
SE	-1.59	-3.10	0.08	3.23	0.04	0.11	0.00	0.13	0.57	0.34	-0.11	-1.21
UK	-1.86	-4.11	0.08	3.66	0.03	0.08	0.00	0.08	0.59	0.39	-0.08	-1.07
ES	-2.05	-3.70	0.09	3.47	0.16	0.44	0.00	-0.17	-0.68	-0.42	-0.05	-0.58
PT	-1.24	-1.79	0.07	2.42	0.08	0.20	0.00	0.02	-0.59	-0.31	-0.05	-0.51

Table 0-45: Robustness of the parameter estimates of the capital mobility index and agglomeration economies in the implicit tax rate on capital regression to including interest rates and election year dummies in as regressors

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-1.711	-3.797	0.000	-0.038	-0.119	0.906	-0.339	-0.193	0.847
$\Delta(Icap*AGGLOM)_{-1}$	0.075	3.435	0.001	0.005	0.347	0.729	-0.046	-0.550	0.583
GR_{-1}	-0.138	-0.958	0.339	-0.116	-0.720	0.472	0.095	0.503	0.616
$INFL_{-1}$	-0.107	-1.652	0.100	-0.100	-1.568	0.119	-0.030	-0.265	0.792
$\Delta OPEN_{-1}$	0.037	1.090	0.277	0.032	0.940	0.348	-0.095	-1.330	0.187
$\Delta PART_{-1}$	1.470	4.910	0.000	1.377	4.101	0.000	0.980	2.327	0.022
LEFT	0.047	0.101	0.920	0.134	0.282	0.778	-0.490	-1.000	0.320
ΔUN_{-1}	-1.833	-6.891	0.000	-2.006	-7.358	0.000	-1.538	-4.622	0.000
$MAAS_{-1}$	0.814	1.681	0.095	0.927	1.864	0.064	0.807	1.125	0.263
ΔIR_{-1}	0.373	3.093	0.002	0.358	3.018	0.003	0.266	1.424	0.157
$ELEC_{+1}$	0.562	1.574	0.117	0.613	1.678	0.095	0.860	1.933	0.056
ELEC	-1.023	-2.834	0.005	-0.951	-2.619	0.010	-1.413	-3.306	0.001

Table 0-46: Robustness of the parameter estimates of the capital mobility index and agglomeration economies in the implicit capital tax rate regression to including growth and inflation in first differences

	Quinn 14			FDI Stocks			-CIP		
	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value	parameter estimate	t-stat	p-value
$\Delta Icap_{-1}$	-1.665	-3.205	0.002	-0.315	-0.975	0.331	-1.031	-0.639	0.524
$\Delta(Icap*AGGLOM)_{-1}$	0.095	4.039	0.000	0.019	1.417	0.158	-0.037	-0.448	0.655
$\Delta GRFD_{-1}$	-0.476	-5.607	0.000	-0.480	-5.722	0.000	-0.304	-2.960	0.004
$\Delta INFLFD_{-1}$	-0.099	-0.959	0.339	-0.130	-1.298	0.196	-0.381	-2.152	0.034
$\Delta OPEN_{-1}$	0.024	0.965	0.336	0.029	1.239	0.217	-0.134	-2.346	0.021
$\Delta PART_{-1}$	1.348	4.765	0.000	1.203	4.100	0.000	1.343	3.551	0.001
LEFT	-0.067	-0.131	0.896	-0.019	-0.038	0.970	-1.023	-1.819	0.072
ΔUN_{-1}	-2.181	-10.225	0.000	-2.390	-11.272	0.000	-2.206	-7.887	0.000
$MAAS_{-1}$	0.946	2.675	0.008	0.820	2.283	0.024	0.560	1.018	0.311