

Integration and Tax Competition: An Empirical Study for OECD Countries*

Åsa Hansson and Karin Olofsdotter
Department of Economics
Lund University, Sweden
April, 2004

Abstract

This paper considers the effect of integration on capital taxation in a number of OECD countries over several decades. Unlike previous papers on the subject, we include key features from the new economic geography theory in addition to the standard tax competition framework. To set a baseline that can be compared with previous studies, we first ignore the new economic geography framework and include only tax competition variables and find support for the hypothesis that increased integration leads to lower corporate tax rates. Next, we control simultaneously for both explanations and find some changes in the results for the traditional tax competition setting together with some weak empirical support for the new economic geography.

Key words: tax competition, new economic geography, economic integration

JEL classification: F12, F15, H72

* We thank Professor Dennis Quinn for providing data on openness and capital account liberalization. Participants at the SNEE Conference in Mölle 2003 have also contributed with helpful suggestions.

I. Introduction

The last decades have witnessed increased economic integration worldwide, removing many obstacles to trade and investments between countries. Along with this globalization process, there has been a surge in the number of regional integration areas. In some of these areas – the European Union being the most prominent so far – national borders among member countries tend to lose their economic importance. However, these trends have also been accompanied with a growing concern that increased integration may jeopardize the future of the welfare state (Sinn (2002), Tanzi (2002)). This may be natural given that free factor mobility allows both firms and workers to locate where tax rates are lowest, thereby pressing countries to lower tax rates in order to retain and attract dynamic firms and able workers. Furthermore, this competition can make it difficult for countries to maintain desired tax rates, leading to a “race to the bottom”. Indeed, an extensive literature suggests that tax competition may lead to inefficiently low tax rates and sub-optimal levels of public spending (Wilson (1999)).

However, it is not just tax rates that matter when firms and workers choose where to locate. Factors such as market access, infrastructure, national stocks of “know-how”, experience and technology generate externalities that are also likely to be important. These factors often lead to concentrated economic activity which is the main focus of the relatively new field of economic geography. This research area emphasizes the importance of so-called agglomeration forces that tend to concentrate industrial location. Countries or regions that benefit from these forces may be able to keep mobile factors in spite of high tax rates and thus their existence is expected to have a dampening effect on the “race to the bottom”.

Most empirical studies of integration and taxation have focused on tax competition and have failed to address the implications stemming from the new economic geography field. Surprisingly, these studies find little evidence for the main implication of tax competition, viz. the notion that increased integration leads to lower tax rates. The purpose of this paper is to investigate whether taxes on mobile factors can be better explained by including variables that are related to agglomeration in addition to conventional variables measuring tax competition. The analysis focuses on the determinants of corporate tax rates and includes such economic geography variables as membership in regional integration areas, trade costs, closeness to markets, and the importance of industrial linkages in production, using data from a number of OECD countries over the last decades. The paper, thus, attempts to meet the need for an extensive empirical analysis that takes into account explanatory variables from both settings.

The potential policy implications from a study of this kind should be obvious in light of the ongoing liberalization and increasing economic dependency among countries. The results may be of specific importance with respect to European integration and the need for tax harmonization between existing as well as with new members. In particular, if agglomeration forces affect the ability to tax mobile factors, the need for harmonization may be less acute than previously thought and the fear of harmful tax competition overstated.

The paper is organized as follows. The next section outlines the theoretical implications from the standard tax competition literature, together with the main findings from the new economic geography literature. Section III summarizes previous empirical studies on integration and taxation and the statistical analyses are presented in sections IV. Sections V and VI provide a discussion of the results and some concluding remarks, respectively.

II. Theoretical background

Tax competition has traditionally been analyzed in the public finance literature (e.g. Zodrow & Mierzkowski (1986), Wildasin (1988) and Wilson (1991, 1999); see also Schulze & Ursprung, (1999), and Haufler (2001) for surveys of the literature).¹ Recently, however, the relationship between integration and taxation has also gained attention by researchers in the new economic geography field (Andersson & Forslid (1999), Haufler & Wooton (1999), Ludema & Wooton (2000), Kind *et al* (2000), Baldwin & Krugman (2000), and Baldwin *et al* (2003)). This section presents, in a non-technical way, the basic insights from the two frameworks.

The Standard Tax Competition Model

In the basic setting, there are two factors of production, (physical) capital and labor. While capital can move freely across countries, labor is immobile. Governments provide a public good financed by levying taxes on capital and labor employed within their national borders, i.e. taxes are assumed to be source-based. For simplicity, assume that tax rates on capital and labor are identical. When maximizing the utility of a representative consumer, government sets the marginal social benefits (MSB) of an increase in the provision of the

¹ In addition, integration and tax rate determination have received interest from the public choice theory, though this perspective has recently been included in the tax competition literature. According to public choice proponents, however, tax competition need not be particularly harmful as it serves to discipline wasteful governments (see e.g. Edwards & Keen (1996), Eggert (2001) and Sato (2003)).

public good equal to the marginal social costs (MSC). If capital were immobile, MSC would be the tax revenue increase needed to finance the additional supply of the public good. When capital is mobile, however, an increase in tax rates leads to an outflow of capital, reducing the tax base and income of the representative consumer. Hence, marginal social cost must be higher and the tax rate below the optimal rate. This is illustrated in Figure 1 where the downward sloping MSB curve reflects the benefits of public goods and MSC and MSC' are constant marginal social costs of raising tax revenues when capital is immobile and perfectly mobile, respectively. Comparing the tax rates and the implicit amount of public spending, the lower tax rate t' implies a sub-optimal supply of the public good and the figure suggests a negative relationship between factor mobility and tax rates. In other words, due to increased factor mobility, continuing integration will be associated with ever-decreasing tax rates, the race to the bottom case.

In case taxes on capital and labor are allowed to differ, it can be shown that the immobile factor will face a greater tax burden as countries attempt to retain their tax bases. The model also suggests that larger countries, as measured by the stock of labor, will be able to maintain higher tax rates than smaller countries since the negative effect of capital outflows of higher taxes is smaller in per capita terms when labor is assumed to be immobile. However, smaller countries may be better off since they will have higher capital to labor ratios and there is an incentive for them to play the role of tax havens and thereby achieve higher welfare than larger countries (Schulze & Ursprung (1999)).

The New Economic Geography Framework

In contrast to most traditional tax competition models, economic geography models focus on scale economies, imperfect competition and trade costs (see e.g. Krugman (1991) and Krugman & Venables (1995)). In addition, the existence of linkages between producers (e.g. between suppliers of intermediates and producers of final goods) as well as between producers and consumers are thought to create tendencies for agglomeration of production. Integration, as reflected by reductions in trade costs, increases the importance of the agglomeration forces and leads to a concentration of production in certain countries or regions. As the agglomeration forces within a region tend to “lock in” the industries in that particular area, they decrease the mobility of factors. An interesting effect is that those

countries where industries choose to locate – the countries that gain the “core” – will experience increased tax bases and will be able to raise tax rates in general.²

The main implications of agglomeration forces on tax rate policy are illustrated in Figure 2 which depicts the relationship between the real return to the mobile factor (capital), termed agglomeration rents, and the degree of openness in a core country, i.e. the country in which all capital has concentrated (see Baldwin *et al* (2003)). As trade costs start to decrease, agglomeration rents increase in the core country. Eventually, these rents will decline as integration continues since the advantages of the core-location will diminish when trade is sufficiently free (location is irrelevant when trade costs are zero).³ This agglomeration rent creates an opportunity for governments to tax mobile factors. Hence, as long as this rent is positive and “locks” the capital to the core, it will be possible to tax internationally mobile capital up to some point without experiencing an outflow of capital (Baldwin *et al* (2003)).⁴ In Figure 2, the agglomeration rent is positive if the degree of openness is higher (or trade costs are lower) than θ . This suggests that the core country can maintain a positive tax on capital for the whole interval between θ and 1. A peripheral country, obviously, does not have this opportunity. The negative agglomeration rent at very low levels of integration, i.e. less than θ , implies that it is not feasible for the core to have a positive tax rate on capital since the locational advantage is less pronounced.

The basic insight of the new economic geography is the importance of the interaction between trade costs and agglomeration. If the assumption of complete concentration is relaxed and agglomeration forces are allowed to vary with the level of integration, these forces may be too weak at levels of integration less than θ to induce tax differentials across countries. As integration deepens, though, the agglomeration forces get stronger and prevent a race to the bottom.⁵ This non-monotonic relationship between integration and tax rate policy does not occur in the basic tax model. Moreover, it is the larger country in the new economic geography framework that has higher capital to labor ratios and thus higher welfare in equilibrium. As pointed out by Ludema & Wooton (2000), the u-shaped relationship between trade costs and tax rates restores the possibility of fiscal autonomy since deeper

² As pointed out by Baldwin *et al* (2003), while agglomeration forces tend to favor further concentration in the context of new economic geography, concentration of the mobile factor in the standard tax competition model reduces factor rewards (due to diminishing returns), reversing the tendencies toward concentration.

³ The new economic geography framework generally finds that the benefits of being in the core are highest at intermediate levels of trade costs.

⁴ It is assumed that agglomeration is complete in the sense that all capital is located in one place.

⁵ However, at very high levels of integration (i.e. when agglomeration rents starts to fall in figure 2) the scope for taxing mobile factors declines in the core country and tax rates between the core and periphery will tend to narrow.

integration may reduce the degree of tax competition. Hence, starting from high levels of trade costs, reductions in trade barriers will, in line with the traditional tax competition literature, intensify tax competition, while further integration tends to increase the importance of agglomeration forces and consequently decrease tax competition.

III. Earlier empirical studies on integration and taxation

Surprisingly few studies have examined the relationship between integration and taxation empirically, most of them focusing on tax competition. The results of these studies have generally failed to confirm the theoretical predictions of the standard tax competition literature, that is the hypotheses of a negative correlation between integration and capital taxation and higher tax rates in larger countries than in smaller (e.g. Bucovetsky (1991) and Wilson (1991)). Using corporate tax revenues, positive relationships between capital taxation and trade liberalization are for example found by Garrett (1995) and Quinn (1997). Also, a study by Swank (1998) provides support for a positive relationship between capital taxation and three different measures of capital mobility using panel data on 17 OECD countries over the time period 1966 to 1993.⁶

Researchers using alternative measures of tax policy – typically based on the average effective tax rates suggested by Mendoza *et al* (1994) – have not been much more successful in reaching consensus. Rodrik (1997), for instance, performs a pooled cross-section, time-series analysis based on average effective tax rates over the time period 1965 to 1992 for 18 OECD countries. He finds a negative correlation between openness, measured as the sum of exports and imports over GDP, and capital taxation and support for the hypothesis that taxation shifted from capital to labor. Similarly, Bretschger & Hettich (2002) finds a negative relationship between international capital mobility and average effective corporate tax rate in a panel study of 12 OECD countries over the time period 1967 to 1996. On the other hand, Kirchgässner & Pommerehne (1996) provide only weak evidence of increased tax competition between fiscally autonomous cantons in Switzerland, which is surprising since these cantons are much more economically integrated than the sample of OECD or EU countries observed in other studies. The results in Adserà & Boix (2002), however, support a

⁶ It should be noted that all three studies used corporate tax revenues as a share of GDP to proxy for capital taxation. This proxy has been criticized as being vulnerable to spurious relationships because the share of operating profit in GDP has generally risen since the early 1980s while effective capital tax rates have generally fallen.

positive relationship between tax rates and the degree of openness in a study of 65 countries between 1950 and 1990.

In short, the results of previous studies seem inconsistent, and provide only weak empirical support for the predictions of the tax competition theory. Schulze & Ursprung (1999) survey a large number of studies and conclude "... many of these studies find no negative relationship between globalization and the nation's ability to conduct independent fiscal policy". This may be attributable to various statistical problems including, among other things, the difficulty of determining a suitable model specification and of quantifying tax policy. Moreover, it may be an indication that there exist other factors that enable countries to conduct independent fiscal policy despite globalization. Krogstrup (2003) is one recent empirical study that has explicitly analyzed the potential problem of omitted new economic geography variables in earlier works on integration and tax competition. She starts by testing the main hypotheses in the standard tax competition literature and gets mixed results for the effects of capital mobility on corporate taxes. When including GDP per capita, however, she finds a positive and significant relationship between this variable and corporate tax rates. Interpreting GDP per capita as a measure of agglomeration forces (very strong assumption could also be a measure of market size, then saying that bigger countries have higher tax rates (a result from tax competition as well) supports the hypothesis that agglomeration forces may mitigate the race to the bottom.⁷

IV. The Effect of Tax Competition and New Economic Geography variables on Corporate Tax Rates

Background

Many observers have noticed that corporate tax rates have declined dramatically over the last decades (e.g. Bond & Chellens (2000), and Devereux *et al* (2002)). As shown in Figure 3 the average statutory corporate tax rate in the OECD has declined by almost one quarter, from around 45 percent in the early 1970s to under 35 percent in 2002. Figure 3 also presents the development over time of two measures of average effective corporate income tax rates. The tax rate based on the Mendoza *et al* (1994) definition (henceforth referred to only as Mendoza) generally increased from 1965 to a peak early in the 1980s, and appears to decline thereafter, but the variation is considerable. One reason that this average effective tax rate has

not decreased in line with the statutory rate may be a corresponding broadening of tax bases. This possibility is pointed out by Devereux *et al* (2002) who suggest the alternative measure of average effective tax rates (henceforth referred to as DGK) in Figure 3. These rates show a declining pattern more in line with the statutory tax rates.

During the same period, many obstacles to trade and investment between OECD countries were removed. As seen in Figure 4, the average trade volume (the sum of exports and imports as a share of GDP) in the OECD has risen from around 55 percent in the early 1970s to almost 80 percent in 1999. This development goes hand in hand with the decrease in trade costs, measured as c.i.f.-f.o.b. ratios, which has declined steadily during the observed period, from 1.08 in 1965 to 1.04 in 2000.

The trend toward increased integration is corroborated by two additional indices in Figure 5. The left axis shows a qualitative index of capital account regulations – where a country is allocated a value between 0 to 4 and, the higher the value, the less restricted are capital flows – which has increased from 2.5 in 1965 to 3.75 in 1997.⁸ On the right axis, a broader measure of integration is presented, including inward and outward capital and current account restrictions as well as international agreements constraining restrictions of exchange and capital flows. This index, whose range takes values between 0 and 14, increased from 9 to 13 between 1965 and 1997.⁹

Clearly, the decline in the statutory and the DGK tax rates is, at least superficially, correlated with increased integration. However, while prior to 1990 the annual reduction of these tax rates was 2.2 percent and 2.5 percent, respectively, the corresponding figures after 1990 are almost one percentage unit lower (1.3 percent and 1.6 percent, respectively). Thus, the decrease in these tax rates as well as the absence of a clear downward trend in the Mendoza based rates might indicate increases in forces mitigating a race to the bottom.

Indeed, figure 6 shows how two new economic geography measures have gained momentum over time. Linkages in production, measured as the use of intermediates, declined sharply in the 1970s but have since mid 1980s regained importance. During the observed period we also see an increase in potential market access, i.e. the economic size of trade partners discounted by geographic distance.¹⁰ Taken together with the decline in trade costs, this clearly suggests an increase in actual market access.

⁷ As the author points out there are problems with multicollinearity.

⁸ For details, see the description in Quinn (1997).

⁹ Ibid.

Econometric Approach

To examine whether these relationships are coincidental or whether they support one or both of the two explanations, we estimate the relationship statistically using country-specific data on a sample of OECD countries. Specifically, we regress corporate tax rates on variables capturing each of the two explanations as well as variables known to affect tax rates generally. Because many important factors are not measurable or are unobservable, and therefore impossible to include in regressions, and in order to control for trends over time, we use the panel nature of the data to control for country- and time-invariant factors explicitly using both fixed and random effects regression.

We analyze corporate income tax rates, as corporate income is usually considered more mobile than most other capital tax bases since it does not include immobile property (Bretschger & Hettich (2002)). Most countries, however, tax international capital streams according to the residence principle. Hence, it can be argued that the scope is limited for tax competition because incomes are taxed in the country of residence regardless of where the profits were made. Control, administration problems, and lack of international treaties, however, make it hard to enforce the residence principle in practice. In reality corporate profits are often taxed closer to the source than the residence principle (Tanzi & Bovenberg (1990), Sørensen (1995), and Keen (1997)), which makes corporate income the most natural tax base to study. We would expect, based both on the tax competition and new economic geography literatures, the effect of integration to be largest on this tax base.

Measuring the left-hand-side variable, corporate tax rates, is problematic. As we have seen, the three measures of corporate tax rates presented in Figure 3 follow different trends. Statutory rates may be particularly sensitive since they are one of the more important instruments that politicians have available for attracting capital. In addition, statutory rates have been found to be important determinants for firms' incentives to shift income between countries as well as localization decisions made by multinational firms (DGK (2002)). On the other hand, it is well known that statutory tax rates give an incomplete picture because they neglect depreciation rules, inventory valuation, and loss-offset provision. This argues in favor for effective rates. The drawback with effective rates, however, is that they are hard to measure accurately and, as shown in Figure 3, different measures may vary greatly. Therefore, we include effective rates based both on the Mendoza definition, as used in many earlier studies, and the alternative rates based on DGK (see appendix for definitions of the

¹⁰ See appendix for further details.

different tax rates). In addition, by using both statutory and average effective corporate tax rates we are able to compare and contrast their respective results.

Adequately specifying the econometric model is complicated by a generally poor understanding of the determinants of tax structure. In addition to integration, numerous other factors such as political views and values, market shares, indicators of the macro economy, national culture, legal-political institutions, and historical background are also probable determinants, though some of these are hard to quantify and therefore difficult to include in empirical analyses. We control explicitly for as many of these factors as possible in the regression to limit the effect of confounding factors. The fixed effects regression framework, moreover, controls for any other time-invariant country-specific factors that might otherwise confound the estimates.

Specifically, we estimate the following equation

$$y_{it} = \alpha + X_{it}\beta + Z_{it}\gamma + \mu_i + \tau_t + v_{it} \quad (1)$$

where y_{it} is the corporate tax rate for country i in year t (either statutory or average effective); X_{it} is a vector of variables such as trade volume, market size, and the macro economy (growth and government size) that have been found to explain tax rate in the tax competition literature; and Z_{it} is a vector of measures capturing the new economic geography context, such as market access, linkages between firms, trade costs and membership in preferential trade arrangements. μ_i is a vector of country-specific fixed effects, τ_t is a vector of time-specific fixed effects, and v_{it} is an idiosyncratic disturbance term that varies by country and year and is assumed to be independently and identically distributed with mean zero and variance σ_ε^2 .¹¹ The standard errors are corrected for heteroscedasticity and normally distributed.

In the regression equation above the explanatory variables are divided into two categories - tax competition and new economic geography. This division is to some extent artificial since there are variables that lend support to both frameworks. However, most variables are closer to one of the two categories or reflect some specific aspects that are more in line with one than the other. For instance, several measures of integration are used but we consider variables reflecting the degree of capital mobility as tax competition variables, while

¹¹ We also estimate the equation under the assumption that the error term is heteroskedastic across the panels, using panel corrected standard errors (pcse). In general, using pcse results in smaller standard errors. The fixed-effect model, however, is generally preferred.

variables of the level of trade costs are more in line with new economic geography.¹² Thus, starting with tax competition, we consider three measures of integration: trade, openness and liberalization of capital restrictions. The capital restrictions variable is directly linked to the mobility of capital and the expected sign of the estimated coefficient on corporate tax rates is therefore negative. This is true for trade and openness too in so far they measure capital mobility. However, as these variables at the same time are likely to reflect the degree of openness and vulnerability to economic disturbances, the tax competition literature also supports a positive effect and the expected signs therefore ambiguous. Market size is anticipated to be positive related to tax rates since smaller countries have greater incentives to play the role of tax havens. In addition, the demand for public spending increases when an economy (in per capita terms) grows larger (Wagner's law). The relation between labor taxes and capital taxes is uncertain. On the one hand, if integration increases capital mobility we would expect labor taxes to substitute for capital taxes. On the other hand, in larger countries where capital supply is less elastic¹³, or in high-tax countries, both types of tax bases could face high tax rates. Thus, the expected sign is ambiguous.

In addition to these variables we control for factors that have been identified as important determinants of corporate tax rates that are not directly tied to the tax competition model. Political views and values, for instance, are likely to affect corporate tax rate. To control for this, the number of conservative party legislative seats is included, and is expected to have a negative effect on capital taxes. In addition, we include government size and growth rates. The effect of government size is assumed to have a positive sign since larger government expenditures is generally associated with higher tax rates. The growth rate, finally, is expected to have a negative impact as governments trying to balance their budget will cut taxes if the country experience economic expansion.¹⁴

It should be emphasized that the variables suggested by the new economic geography are hard to measure and quantify over time and across countries. Also, the empirical proxies are much less refined in this framework in comparison to the tax competition literature. As the main integration variable, we use trade costs measured as the ratio of cost, insurance, and freight (c.i.f.) valued imports in relation to free on board (f.o.b.) valued imports,¹⁵ in addition we include dummy variables of memberships in EU, EFTA or other preferential trading arrangements (PTAs). Different measures of agglomeration forces are used that, at

¹² This division has no bearing on the results.

¹³ See Bucovetsky (1991) and Wilson (1991).

¹⁴ For this argument, see Bretschger & Hettich (2002).

¹⁵ This measure is also used by e.g. Baier & Bergstrand (2001).

sufficiently low trade costs (or high level of integration), are expected to have a positive effect on corporate tax rates. A variable that was included above as a tax competition variable, domestic market size, can equally well be treated as new economic geography variable as larger economies tend to indicate agglomeration economies as well. Furthermore, we use market potential, which reflect a country's access to foreign markets. Market potential is defined as the neighboring countries' real GDP in dollars divided by the distance to them. A country that has a short distance to a large market thus has a large market potential. Furthermore, we include linkages in production and the variable is constructed in two steps. First, based on an OECD input-output table for ten OECD countries, we calculate each industry's average use of domestic intermediates.¹⁶ Second, we rank industries according to their use of intermediates and measure the importance of the ten highest ranked industries by calculating their share of total manufacturing production for each country. This, we believe, is the most direct measure of linkages between firms and, hence, agglomeration forces. The problem is that we only have consistent data until 1994 and for only a subset of countries,¹⁷ and in some estimations we include an alternative measure - real wages in the manufacturing sector where higher real wages are expected in regions/countries where agglomeration forces are stronger. This measure has the advantage of being easily accessible over time and across countries and could be compared with the GDP per capita measure of agglomeration forces used by Krogstrup (2003).

Results

Table 1 reports results of regressions of the statutory and the two average effective corporate income tax rates on the standard tax competition variables and other control variables. We also report the regression for a sub-sample of current EU members. We do not report results from the random-effects regressions since the fixed-effects specification was generally favored by specification tests.

In general, integration has different effects on corporate tax rates depending on both the different measures of integration as well as measures of corporate tax rates. Trade, for instance, has a negative effect when average effective rates are used, while only statistically significant for data from Mendoza. For the statutory rate, however, the coefficient is positive, and significant in the EU-country sample.¹⁸ Openness, however, is positively correlated with

¹⁶ The use of intermediates as a measure of agglomeration forces is also used by Middelfart-Knarvik *et al* (2002).

¹⁷ Data are missing for France, Portugal and Switzerland.

¹⁸ The differences between the statutory and the average effective corporate tax rate regressions found are in some cases remarkable. Since the data included are different when statutory and average effective tax rates are

tax rates in all regressions. In line with expectations, however, liberalization of capital restrictions has negative and statistically significant coefficients in all regressions. We find little empirical support for the anticipated positive relationship between market size and corporate tax rates. For the whole sample the effect is rather negative, while we do find more support for a positive correlation in the EU sample. In addition, there seems to be no empirical support for the notion that lower corporate taxes are offset by higher labor taxes; rather they seem to move in the same direction. Conservative party legislative seats as a percentage of all legislative seats and total size of government are in general negatively correlated with corporate tax rates. In line with the tax competition literature economic growth is also important for corporate tax rates, with a negative coefficient.

Interestingly, these regressions seem to find some support for the role of tax competition, i.e., that increased integration leads to lower corporate tax rates, perhaps more so than in the previous literature. We also found, consistent with theory, that smaller countries were more affected by tax competition, and hence by increased integration, than larger countries. The trade variable had a larger negative magnitude and was more significant in the sub-sample of smaller countries (results not reported).

We next incorporate factors proposed by new economic geography including membership in different types of regional integration areas (RIAs) such as the EU, EFTA or any other PTA, trade costs, and agglomeration factors like market potential and linkages in production. The results are presented in Table 2. Again, we report results for statutory and the two average effective corporate tax rates. When agglomeration forces are included, the effect of trade on corporate tax rates is somewhat reduced. Similarly, effects of openness and, to a lesser extent, liberalization of capital restrictions seem to lose their significant impact on the average effective tax rates. Interestingly, EU membership has a negative effect on statutory corporate tax rates while the effect is positive but insignificant on the two average effective corporate tax rates. This could suggest that membership in the EU has led to lower statutory rates accompanied by increased tax bases. For the whole sample, trade costs have a positive impact on statutory tax rates while the effect is negative or insignificant for the average effective tax rates. The results for market potential and linkages do not provide much support for the economic geography framework, as the coefficients are either negative or

used, respectively, we re-estimate our regressions using a sample restricted to those countries and years that coincide to establish whether the differences are due to the use of different observations. The results are quite similar suggesting that the differences in results and explanatory powers are not caused by the different data. The positive correlation between trade and tax rates found for the statutory tax rates in Table 1, however, was due to use of different data.

statistically insignificant. In general, however, the explanatory power is higher when agglomeration forces are included and the effect of tax competition is to some extent reduced.

As indicated earlier, we expect the impact of agglomeration forces on taxes to depend on the degree of trade costs. The simple inclusion of the economic geography variables may not fully capture the essence of the new economic geography framework and could explain the mixed results of Table 2. Therefore, we estimate the model including the interaction term between our trade costs variable and the different measures of agglomeration forces. The interaction terms are intended to measure the impact of agglomeration forces on corporate tax rates as a function of trade costs. Since the effect of agglomeration on tax rates is assumed to be larger the lower the trade costs, we expect a negative sign of the coefficient. In particular, we consider the interaction effect of trade costs, on one hand, and market potential and industrial linkages, respectively, on the other.¹⁹²⁰ In addition, we take into account the alternative measure real wages in the manufacturing sector. Table 3 shows the results when these interaction terms are added. The only interaction variable that is significant (at the 0.10 significance level) with expected sign is the market potential variable in the first column. The other two interaction terms show positive and highly significant signs for the statutory as well as the DGK average effective tax rate. The total effects of these agglomeration variables, are, however, more interesting. These total effects, expected to be positive, are obtained by adding the direct effect of the agglomeration variable in question and the indirect effect given by the interaction term. This results in total negative effects for countries with lower trade costs but positive effects for higher trade costs countries. On average (what do we mean by on average?), however, the total effects are actually positive and, again, the explanatory power increases for all estimations compared to the results in Table 1.²¹ (The total effect is not positive for Mendoza data or in column i using statutory rates. Maybe we should be more explicit here so we don't give the impression that we are trying to mislead the reader.)

Since capital liberalization is a relatively recent phenomenon - to a large degree liberalization of international capital markets took place in the end of the 1980s - we divide the sample into two sub-samples, one prior and one after 1990. We expect capital mobility to

²⁰ The interaction effect of market size and trade costs has also been tested, resulting, in insignificant estimates and due to space limitations therefore not reported.

²¹ Since the mean value of the trade costs variable is 1.058, the average total effect of linkages on statutory tax rates in column ii is 756.6, while the effects of linkages and wages on DGK rates in column ii and iii are 621.2 and 0.001, respectively.

be more restricted in the earlier period. The economic geography variables are in general negative in all estimations in Table 4. However, in cases where the coefficients for these variables are statistically significant in the first period, they become insignificant in the second period.

Dynamic Specification

The mixed results found in Tables 2 and 3 could be due to mis-specification. For instance, it is likely that tax rates change slowly over time and that today's tax rates depend on previous tax rates. To investigate this further, we re-estimate the regressions presented in Table 2 using a dynamic model; namely the GMM estimator suggested by Arellano and Bond (1991). This estimator first-differences the estimating equation to remove unobservable time-invariant country-specific effects.²² It is also likely that some of the explanatory variables in the estimating equation are endogenous. To account for this we estimate the dynamic model using instruments as well. The variables we treat as endogenous are market size, labor tax, and growth. We use the difference of the variables lagged two periods as instruments.²³ Since several cross-sections are lost from taking first difference and from constructing lags it is not possible to estimate the regression including linkages when average effective tax rates are used. Moreover, no EFTA country is included in the regression employing average effective rates.

Table 5 reports results from the GMM estimations. The last row in the table, the Sargan test, reports the p-value for the null hypothesis of valid specification. In the first two columns the statutory tax rate is used and linkages in production are included, while the following two columns omit linkages. The last four columns present results when average effective tax rates based on Mendoza and DGK are employed, respectively. The second column in each set of corporate tax rate measure treats market size, labor tax, and growth as endogenous.

When statutory corporate tax rates are employed the results are relatively unaffected by the inclusion of linkages as well as the use of instruments. In line with expectations, market size has a positive and significant effect and liberalization of capital restrictions has a negative and significant effect at the 0.10 significance level. Linkages also have a negative and significant effect at that level. Compared to Table 2, (note that Table 2 is estimated in levels) openness, conservative party legislative seats, and market potential are no longer significant.

²² Taking first-difference may also mitigate the possible problem of unit roots.

²³ Using levels does not change the results noticeably.

The Sargan test does not reject the hypothesis that the model is correctly specified and lagged corporate tax rates are highly significant supporting the use of a dynamic model.

When using the Mendoza based average effective tax rates trade and growth are negatively and statistically significant at the conventional 0.05 significance level. At the 0.10 significance level market size and labor tax are positively correlated with corporate tax rates, while government size is negatively correlated. The p-values for the Sargan test are large here as well, with little difference between the exogenous and endogenous model. Compared to Table 2, labor tax, EU membership, and trade costs no longer have significant impacts on average effective corporate tax rates.

Using average effective tax rates based on DGK government size, growth, and membership in EU or other PTAs have statistically significant coefficients. Compared to Table 2, government size and growth now both have the expected negative coefficient. EU membership is negatively correlated with corporate average effective tax rates while membership in other PTAs is positively correlated.

V. Discussion

Unlike many previous studies we find support for the conjecture that increased integration has led to lower corporate tax rates. In most specifications we find that at least one of our measures capturing increased integration - trade, openness or liberalization of capital restrictions - is negatively correlated with corporate tax rates. In Tables 3 and 5, for instance, trade is negatively correlated with corporate tax rates when Mendoza's average effective tax rates are employed, while liberalization of capital restrictions are negatively correlated with corporate tax rates when statutory and DGK's average effective tax rates are used.

A common and puzzling result for proponents of the traditional tax competition view in earlier studies is a positive correlation between openness and corporate tax rates. In Table 1, where only traditional tax competition variables are included, we also find a positive relationship between these variables. This positive and statistically significant correlation, however, weakens or vanishes when variables capturing agglomeration forces are included. In Table 4 the coefficient of openness is positive and statistically significant only in the statutory tax rates regression, and in the GMM estimation reported in Table 5, openness has no statistically significant impact on corporate tax rates. Likewise, Krogstrup (2003) found that including openness without controlling for agglomeration forces in the specification resulted in a positive and statistically significant correlation between openness and corporate

tax rates. When accounting for agglomeration forces this correlation became negative and statistically significant. One interpretation of this, as Krogstrup suggests, is that openness capture agglomeration forces and that the positive correlation commonly found between openness and corporate tax rates, hence, may result from the openness variable picking up the influence of agglomeration forces.

With respect to the economic geography framework, the analysis considers several measures reflecting agglomeration forces. It is, however, difficult to draw any far-reaching conclusions since there are mixed results for the different measures. In many of the estimations, the coefficients for trade costs, market potential and linkages turn out negative and/or insignificant. Domestic market size is more variable but becomes, in line with expectations, positive and significant for statutory as well as the Mendoza tax rate, in the latter estimations.

In the new economic geography setting, the anticipated effect of agglomeration forces depends on the level of integration. The expected negative relationship is, however, only found in one of the estimations in Table 3. On the other hand, the results in Table 3 show, in line with our hypothesis, total positive effects of agglomeration forces on two of the tax rates measures. Moreover, the results from the time period estimations indicate that maybe something is happening over time. The negative effects of linkages or real wages are only significant prior to 1990, while they become insignificant in the second period. In addition, the positive effect of market size is significant after 1990.

One explanation of these results could be that agglomeration forces are still not strong enough to outweigh the tax competition effect of increased integration, at least not at country levels. As pointed out in the theoretical background, the new economic geography setting assumes a u-shaped relationship between trade costs and tax rates so that a positive correlation is not expected until trade costs are low enough. If, however, agglomeration forces are mainly to be found at sectoral or, perhaps, regional levels, country based empirical analysis may fail to identify these effects.

VI. Conclusions

This paper seeks to identify the effect of economic integration on statutory and average effective corporate tax rates. Most previous studies have focused on the effects of tax competition between countries or regions, with relatively equivocal results. Economic geography offers an alternative, not mutually exclusive, explanation of tax rates, with

potentially contradicting predictions. Rather than limiting the effect of economic integration to arise strictly via tax competition like most earlier attempts, we have opened the analysis to control for the effects of new economic geography factors as well.

Theoretically, at relatively low levels of integration even the new economic geography model predicts a decline in tax rates of mobile factors as integrating countries face lower trade costs. However, as trade costs are further reduced, the importance of agglomeration forces increases and a taxable positive rent is created. Thus, tax competition is likely to occur at initial stages of an integration process although agglomeration forces that come to play at later stages may dampen a race to the bottom. Our empirical results provide some evidence supporting this hypothesis. In fact, we find support for both the tax competition and, although to a lesser extent, the new economic geography models.

We see this analysis as a starting point for researchers in this emerging area. First, we need alternative measures of agglomeration forces in combination with increased coverage to further test the implications from the new economic geography framework on tax rates. Second, regional analysis using more disaggregated data may be required in order to detect agglomeration forces. Third, in order to be able to say something about the dynamics, differences across countries of different size and across different time periods should be further explored. Finally, the mixed results for statutory tax rates relative to average effective tax rates should be investigated.

References:

- Adserà, A., and C. Boix, (2002), "Trade, democracy and the size of the public sector: the political underpinnings of openness", *International Organization*, 56, 229-262
- Andersson, F., and R. Forslid, (1999), "Tax competition and economic geography", *CEPR Discussion Paper No. 2220*, CEPR
- Arellano, M., and S. Bond, (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *Review of Economic Studies*, 58, 277-297.
- Baier, S:L., and J:H: Bergstarnd, (2001), "The growth of world trade: tariffs, transport costs, and income similarity", *Journal of International Economics*, 53, 1-27.
- Baldwin, R.E., R. Forslid, P. Martin, G. Ottaviano and F. Robert-Nicoud, (2003) *Economic Geography and Public Policy*, Princeton University Press.
- Baldwin, R.E., and P. Krugman, (2000), "Agglomeration, integration and tax harmonization", HEI Working Paper No 01/2001
- Bond, S., and L. Chennells, (2000), "Corporate income taxes and investment: a comparative study", report from The Institute for Fiscal Studies, London
- Bretschger, L., and F. Hettich, (2002), "Globalisation, capital mobility and tax competition: theory and evidence for OECD countries", *European Journal of Political Economy*, 18, 695-716
- Bucovetsky, S., (1991), "Asymmetric tax competition," *Journal of Urban Economics*, 30, 167-181
- Devereux, M., Griffith, R., and A. Klemm, (2002), "Corporate income tax: reforms and tax competition," *Economic Policy: A European Forum*, 0(35), 449-488
- Eggert, W., (2001), "Capital Tax Competition with socially wasteful government consumption," *European Journal of Political Economy*, 17, 517-529
- Edwards, J., and M. Keen, (1996), "Tax competition and Leviathan," *European Economic Review*, 40, 113-134
- Garrett, G., (1995), "Capital mobility, trade, and the domestic politics of economic policy," *International Organization*, 49, 657-687
- Haufler, A., (2001), *Taxation in a Global Economy*, Cambridge university press, Cambridge
- Haufler, A., and I. Wooton, (1999) "Country size and tax competition for foreign direct investment", *Journal of Public Economics*, 71, 121-139
- Keen, M., (1997), "Simple rules for the optimal taxation of international capital income," *Scandinavian Journal of Economics*, 99, 447-461
- Krogstrup, S., (2003), "Are capital taxes racing to the bottom in the European Union", HEI Working Paper No 01/2003
- Krugman, P., (1991), "Increasing returns and economic geography", *Journal of Political Economy*, 99, 483-499
- Krugman, P. and A.J. Venables, (1995), "Globalization and the inequalities of nations", *Quarterly Journal of Economics*, 110, 857-880
- Kind, H., K.H. Midelfart Knarvik and G. Schjeldrup, (2000), "Competing for capital in a "lumpy" world", *Journal of Public Economics*, 78, 253-274
- Kirchgässner, G., and W. Pommerehne, (1996), "Tax harmonization and tax competition in the European Union: lessons from Switzerland," *Journal of Public Economics*, 60, 351-371
- Ludema, R., and I. Wooton, (2000), "Economic geography and the fiscal effects of regional integration", *Journal of International Economics*, 52, 331-357
- Mendoza, E., Razin, A., and L. Tesar, (1994), "Effective tax rates in macroeconomics: Cross-country estimates of tax rates on factor incomes and consumption," *Journal of Monetary Economics*, 45, 46-68

- Midelfart-Knarvik, K.H., H.G. Overman, S.J. Redding and A.J. Venables (2002), "The location of European industry", *European Economy* 2002.
- Quinn, D., (1997), "The correlates of change in international financial regulations," *American Political Science Review*, 91, 531-551
- Razin, A., E. Sadka, and P. Swagel, (2002), "Tax burden and migration: a political economy," *Journal of Public Economics*, 85, 167-190
- Rodrik, D., (1997), "Trade, social insurance, and the limits to globalization," *NBER Working Paper* No. 5905
- Sato, M., (2003), "Tax competition, rent-seeking and fiscal decentralization," *European Economic Review*, 47, 19-40
- Schulze, G.G., and H.W. Ursprung, (1999), "Globalization of the economy and the nation state", *World Economy*, 22 (3)
- Sinn, H.-V., (2002), "EU enlargement and the future of the welfare state," *Scottish Journal of Political Economy*, 49, 104-105
- Sørensen, P.B., (1995), "Changing views of the corporate income tax," *National Tax Journal*, 48, 279-295
- Swank, O., (1998), "Partisan policies, macroeconomic performance and political support," *Journal of Macroeconomics*, 20, 367-86
- Tanzi, V., and L.A. Bovenberg, (1990), "Is there a need for harmonizing capital income taxes within EC countries?", in Siebert, H. (ed.), *Reforming Capital Income Taxation*, Mohr, Tübingen
- Tanzi, V. (2002), "Globalization and the future of social protection," *Scottish Journal of Political Economy*, 9, 116-127
- Volkerink, de Haan, (2000), "Tax ratios: A critical survey", <http://www.volkerink.net/>
- Wilson, J., (1991), "Tax competition with interregional differences in factor endowments", *Regional Science and Urban Economics*, 21, 423-452
- Wilson, J., (1999), "Theories of tax competition", *National Tax Journal*, 52, 269-304
- Wildasin, D., (1988), "Nash equilibria in models of fiscal competition", *Journal of Public Economics*, 35, 229-240
- Zodrow, G. and P. Mierszkowski, (1986), "Pigou, property taxation and the underprovision of local public goods", *Journal of Urban Economics*, 19, 356-370

Appendix

Data description

Variable	Definition	Source	Mean	Standard Deviation
Statutory corporate tax rate	Top statutory tax rate on corporate income	World Tax Data base, Office of Tax Policy Research	36.53	9.20
Average effective tax rate on corporate income	Taxes on income from profits, capital gains of corporations over operating surplus of the economy minus surplus of private unincorporated enterprises	Mendoza <i>et al</i> (1994), and Volkering and de Haan (2000)	32.65	15.37
Average effective tax rate on corporate income	NPV of tax payments as share of NPV of total pre-tax income	Devereux <i>et al</i> (2002)	34.43	11.17
Trade	Import and export as a share of GDP	PWT6.1	65.60	40.74
Openness	Qualitative index of restrictions on trade and capital accounts	Quinn (1997)	9.63	3.39
Capital	Qualitative index of capital account restrictions	Quinn (1997)	2.71	1.03
Market size	Real GDP in dollars	PWT6.1	409 million	1220 million
Statutory tax rate on labor income	Top statutory tax rate on labor income	OECD, Taxing Wages, various years	54.09	12.32
Average effective tax rate on labor income	See text below	Mendoza <i>et al.</i>	33.38	10.36
Right party legislative seats	Conservative party legislative seats as percentage of all legislative seats	Swank (1998)	37.99	20.06
Government size	Total government expenditures as share of GDP	PWT6.1	44.37	9.4
Growth	Annual growth in real GDP	PWT6.1	2.24	2.5
Trade costs	Ratio of c.i.f.-valued imports to f.o.b.-valued imports	IMF International Statistics	1.06	0.3
Market potential	Market size divided by distance to countries in sample	Own calculations based on data from PWT6.1 and gravity model	4.37 million	3.39 million
Linkages	Importance, based on production shares, of the ten manufacturing industries with highest use of intermediates from other sectors in each country	Own calculations based on OECD input-output tables and OECD STAN databases	0.011	0.003
Wages	Real wages in manufacturing sector	OECD STAN database for Industrial Analysis	19810.0	10693.5

Statutory and average effective corporate tax rate data do not coincide exactly by countries and years so the samples included in the various regressions vary somewhat. Statutory corporate tax rate data are available for Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK and the US for the time period 1980 to 1997. Average effective tax rates using Mendoza *et al* (1994) are available for the above except Austria, Germany, and Ireland for the time period 1971 to 1996. Average effective tax rates using Devereux *et al* (2002) are available for the same countries as the statutory data with exceptions of Australia, Denmark, Norway, and Switzerland and cover the years 1982 to 1997.

The average effective tax rates on corporate income by Mendoza *et al* (1994) are calculated as the ratio of tax revenues from taxes on income, profits, and capital gains of corporations to operating surplus of the economy minus the operating surplus of private unincorporated enterprises. Since figures on operating surplus are not available for all countries and are not always reliable, average effective tax rates must be interpreted with care. In our sample, three observations are either negative or exceed several hundred percent and are therefore omitted.

Average effective tax rates from Devereux *et al* (2002) are defined as the net present value (NPV) of tax payments as a proportion of the NPV of total pre-tax capital income. The average effective tax rates are calculated for a particular investment, in this case an investment in plant and machinery earning expected real rate of economic profit of 10 percent and financed by equity.

Two labor tax measures are used. In the estimations on statutory corporate tax rates, top statutory labor tax rate is employed, while average effective tax rates on labor income based on Mendoza are used in the estimations on average effective tax rates. The average effective tax rates on labor income are defined as the ratio of the personal income tax (defined as the ratio of revenues from taxes on income, profits and capital gains of individuals to the base consisting of wages and salaries, operating surplus of unincorporated enterprises and the property and entrepreneurial income of households) multiplied by wages and salaries plus total social security contributions and taxes on payroll and workforce over the sum of wages and salaries plus employers' social security contributions.

Figure 1.

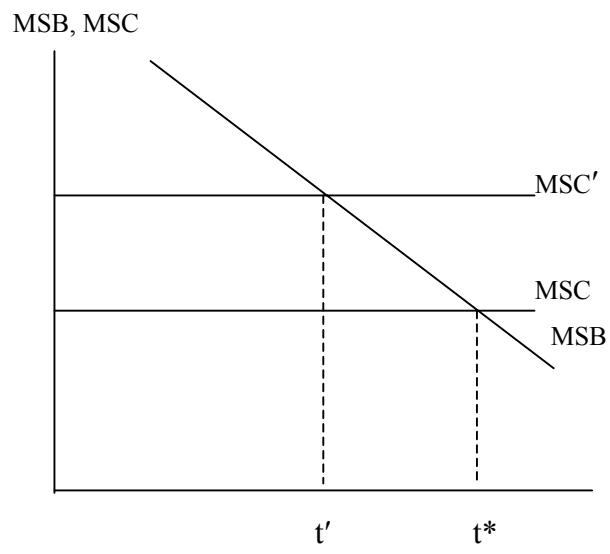


Figure 2.

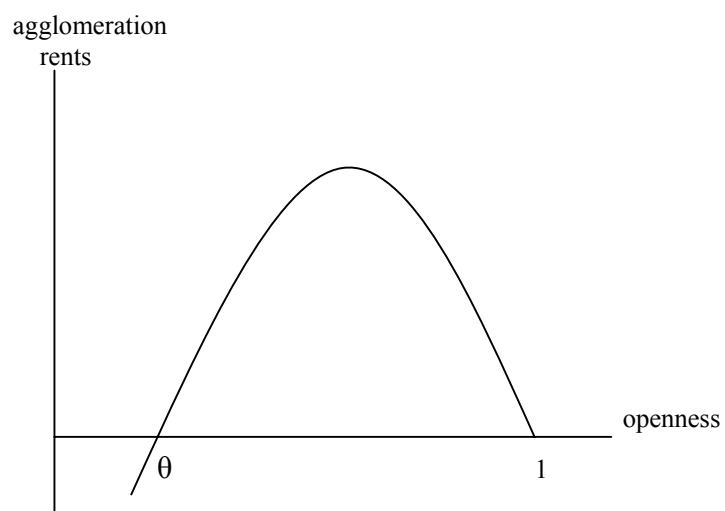


Figure 3.

Statutory and average effective tax rates, OECD averages

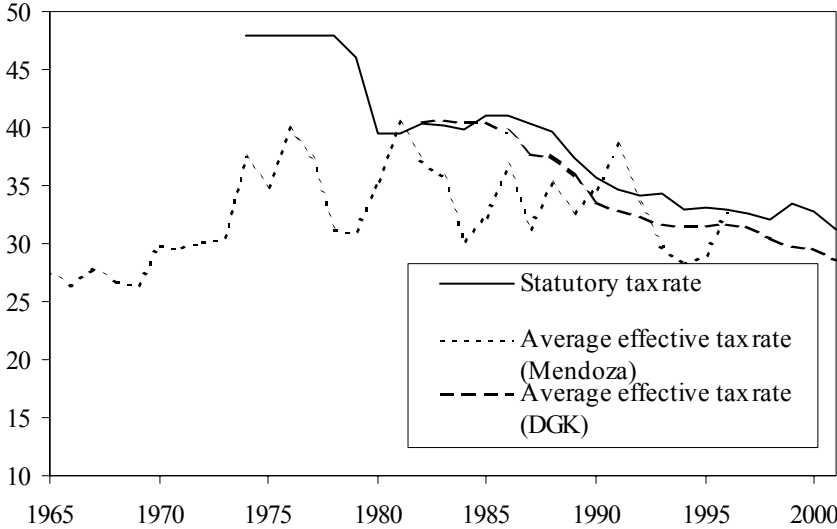


Figure 4.

Trade (percent of GDP) and trade costs, OECD averages

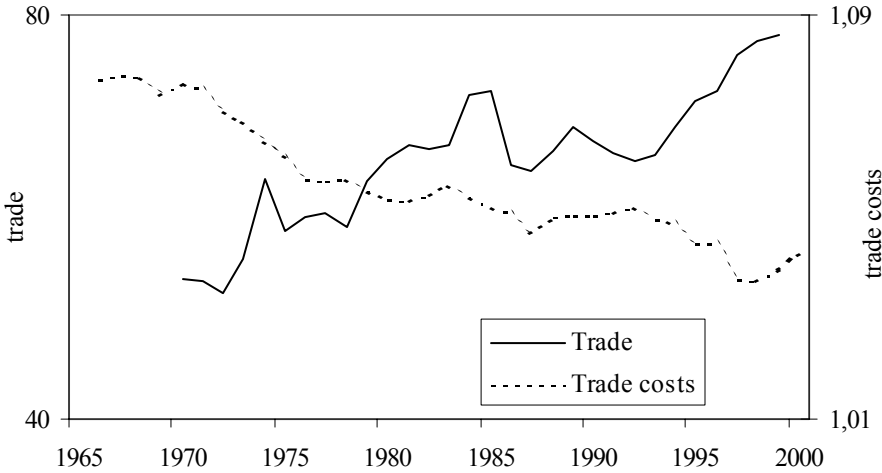


Figure 5.

Openness and capital account liberalization, OECD averages

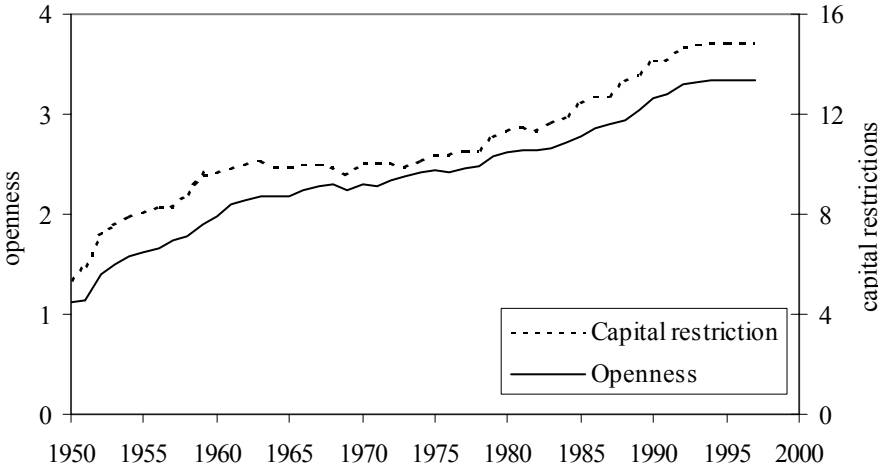


Figure 6.

Linkages in production and potential market access, OECD averages

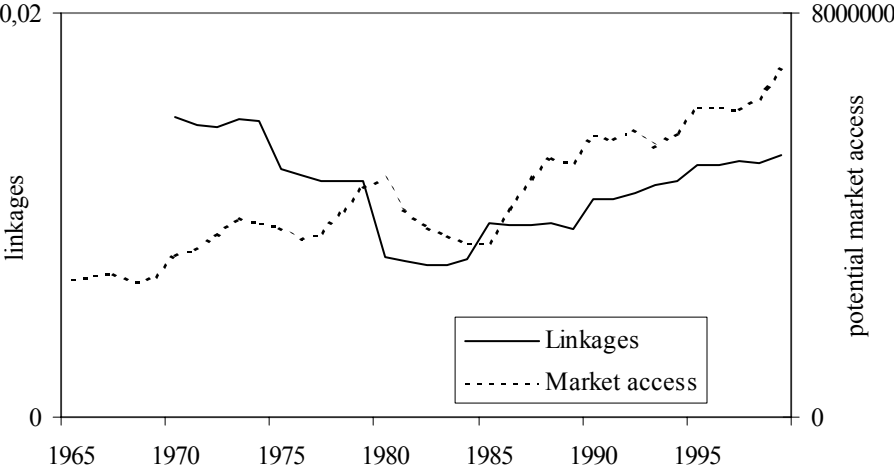


Table 1. Corporate tax rates and "tax competition" variables*

	<u>Whole sample</u>			<u>EU countries</u>		
	Statutory Tax Rate	Average Effective Tax Rate		Statutory Tax Rate	Average Effective Tax Rate	
		Mendoza	DGK		Mendoza	DGK
Trade	0.02 (0.40)	-0.66 (-5.94)	-0.07 (-0.83)	0.17 (2.18)	-0.89 (-5.65)	-0.17 (-1.43)
Openness	2.15 (5.77)	2.49 (3.02)	2.19 (5.33)	3.31 (8.22)	3.33 (3.44)	3.18 (7.73)
Capital	-4.55 (-3.57)	-7.65 (-2.90)	-9.53 (-6.19)	-6.42 (-4.23)	-8.07 (-2.27)	-11.10 (-6.89)
Market size	$-3.01 \cdot 10^{-9}$ (-2.61)	$-1.22 \cdot 10^{-9}$ (-0.96)	$1.13 \cdot 10^{-9}$ (1.04)	$-2.24 \cdot 10^{-9}$ (-0.45)	$3.63 \cdot 10^{-9}$ (0.32)	$1.25 \cdot 10^{-8}$ (3.14)
Labor tax	-0.04 (-0.69)	0.57 (2.13)	0.83 (4.04)	0.02 (0.32)	0.51 (1.80)	0.81 (3.84)
Right party legislative seats	-0.04 (-1.03)	-0.12 (-1.93)	0.05 (1.10)	-0.06 (-1.03)	-0.22 (-2.14)	0.12 (1.95)
Government size	-0.19 (-1.78)	0.09 (0.42)	-0.46 (-3.58)	-0.33 (-2.83)	0.18 (0.83)	-0.43 (-3.04)
Growth	-0.13 (-0.63)	-1.95 (-3.82)	-0.27 (-1.11)	-0.57 (-1.83)	-3.07 (-4.03)	-0.13 (-0.40)
Number of countries	19	16	15	13	10	12
N	342	338	208	234	205	163
R ²	0.33	0.26	0.55	0.47	0.39	0.64

*Notes: Numbers in parentheses are *t*-statistics.
Time dummies are included but not reported.

Table 2. Corporate tax rates, "tax competition" variables and agglomeration variables*

	Whole sample			EU countries		
	Statutory Tax Rate	Average Effective Tax Rate		Statutory Tax Rate	Average Effective Tax Rate	
		Mendoza	DGK		Mendoza	DGK
Trade	0.04 (0.38)	-0.52 (-1.88)	-0.10 (-0.83)	0.09 (0.59)	-0.84 (-2.12)	-0.21 (-1.04)
Openness	2.50 (3.42)	-2.13 (-0.92)	1.45 (1.51)	4.22 (5.31)	-1.60 (-0.60)	2.34 (2.48)
Capital	-6.10 (-2.39)	-8.49 (-1.38)	-9.04 (-4.01)	-8.51 (-2.95)	-12.87 (-1.81)	-11.04 (-4.24)
Market size	$5.93 \cdot 10^{-9}$ (2.25)	$3.03 \cdot 10^{-9}$ (0.70)	$1.26 \cdot 10^{-9}$ (-0.60)	$-1.16 \cdot 10^{-9}$ (-0.08)	$2.12 \cdot 10^{-8}$ (0.41)	$-2.38 \cdot 10^{-8}$ (-1.48)
Labor tax	-0.12 (-1.29)	2.56 (3.15)	1.18 (3.28)	-0.03 (-0.34)	2.55 (2.83)	1.22 (2.73)
Right party legislative seats	-0.10 (-2.41)	-0.16 (-1.78)	0.06 (1.41)	-0.14 (-1.83)	-0.29 (-1.76)	0.06 (0.79)
Government size	-0.30 (-0.94)	0.06 (0.12)	-0.41 (-1.65)	-0.07 (-0.24)	0.02 (0.04)	-0.11 (-0.36)
Growth	-0.29 (-0.94)	-2.45 (-2.46)	0.21 (0.68)	-0.66 (-1.64)	-4.12 (-3.04)	0.48 (0.81)
EU	-5.45 (-1.49)	19.46 (1.68)	4.98 (0.91)	-9.95 (-2.53)	26.34 (1.82)	2.16 (0.39)
EFTA	-0.01 (-0.00)	19.09 (1.46)	17.80 (3.33)	-5.06 (-1.16)	21.78 (1.60)	14.14 (2.79)
Other PTAs	-1.63 (-0.77)	-4.08 (-0.68)	7.07 (3.67)			
Trade costs	61.58 (1.29)	-164.2 (-1.98)	1.85 (0.05)	-9.92 (-0.21)	-245.3 (-1.00)	73.81 (0.71)
Market potential	$-1.95 \cdot 10^{-6}$ (-2.32)	$-9.78 \cdot 10^{-7}$ (-0.72)	$-3.84 \cdot 10^{-7}$ (-0.53)	$8.44 \cdot 10^{-7}$ (0.76)	$-3.85 \cdot 10^{-6}$ (-1.17)	$1.43 \cdot 10^{-6}$ (1.21)
Linkages	-631.9 (-1.58)	-3650.0 (-3.47)	-579.5 (-1.34)	-582.4 (-1.41)	-2433.5 (-1.78)	-458.7 (-0.83)
Number of countries	14	12	13	11	9	10
N	202	188	152	157	127	113
R ²	0.44	0.47	0.54	0.55	0.57	0.70

*Notes: Numbers in parentheses are *t*-statistics.
Time dummies are included but not reported.

Table 3. Corporate tax rates, "tax competition" variables and agglomeration variables*

	Statutory Tax Rate			Average Effective Tax Rate		
	Mendoza					
	i	ii	iii	i	ii	iii
Trade costs × Market potential	-0.00002 (-1.91)			$1.36 \cdot 10^{-6}$ (0.07)		
Trade costs × Linkages		80223.6 (6.42)			-39090.0 (-1.80)	
Trade costs × Wages			0.006 (1.54)			0.0001 (0.02)
Trade	0.03 (0.38)	0.17 (1.63)	-0.001 (-0.10)	-0.61 (-5.03)	-0.56 (-2.17)	-0.59 (-4.40)
Openness	3.04 (5.28)	2.49 (3.91)	2.14 (3.83)	0.53 (0.34)	-3.01 (-1.20)	0.55 (0.35)
Capital	-6.33 (-3.61)	-6.70 (-2.89)	-3.48 (-1.93)	-3.81 (-0.94)	-7.94 (-1.27)	-3.66 (-0.90)
Market size	$-2.55 \cdot 10^{-9}$ (-1.72)	$8.38 \cdot 10^{-9}$ (3.86)	$1.66 \cdot 10^{-9}$ (1.21)	$-1.09 \cdot 10^{-9}$ (-0.67)	$3.25 \cdot 10^{-9}$ (0.77)	$1.4 \cdot 10^{-9}$ (0.78)
Labor tax	-0.02 (-0.28)	-0.14 (-1.88)	-0.07 (-1.14)	0.64 (2.16)	2.57 (3.35)	0.66 (2.05)
Right party legislative seats	-0.12 (-3.42)	-0.09 (-2.60)	-0.12 (-3.64)	-0.14 (-1.95)	-0.14 (-1.52)	-0.16 (-2.16)
Government size	-0.30 (-2.06)	-0.21 (-1.25)	-0.08 (-0.61)	-0.21 (-0.84)	0.14 (0.30)	-0.20 (-0.79)
Growth	-0.05 (-0.27)	-0.51 (-1.81)	-0.13 (-0.62)	-2.31 (-4.27)	-2.43 (-2.56)	-2.38 (-4.39)
EU	-7.01 (-2.32)	-3.29 (-1.00)	-4.17 (-1.40)	16.28 (2.07)	22.90 (1.87)	15.93 (1.98)
EFTA	-2.81 (-0.77)	1.07 (0.29)	1.58 (0.49)	7.33 (0.78)	23.33 (1.78)	6.64 (0.68)
Other PTAs	-2.99 (-1.85)	-1.20 (-0.55)	-2.34 (-1.38)	-2.47 (-0.88)	-3.01 (-0.49)	-3.67 (-1.13)
Trade costs	177.8 (4.81)	-792.0 (-5.35)	14.01 (0.23)	-113.4 (-2.48)	371.5 (1.13)	-117.7 (-1.93)
Market potential Linkages	0.00002 (1.75)			$-2.54 \cdot 10^{-6}$ (-0.13)		
Linkages		-84120.0 (-6.47)			37182.6 (1.62)	
Wages			-0.01 (-1.80)			-0.001 (-0.18)
Number of countries	19	14	17	16	12	15
n	316	202	284	329	188	322
R ²	0.44	0.53	0.50	0.30	0.49	0.31

*Notes: Numbers in parentheses are *t*-statistics.
Time dummies are included but not reported.

Table 3. continued

	Average Effective Tax Rate		
	DGK		
	i	ii	iii
Trade costs × Market potential	0.00001 (0.71)		
Trade costs × Linkages		70411.4 (4.45)	
Trade costs × Wages			0.02 (3.39)
Trade	-0.07 (-0.81)	0.06 (0.54)	0.0005 (0.01)
Openness	1.50 (2.07)	2.09 (2.32)	1.69 (2.46)
Capital	-8.22 (-4.59)	-9.26 (-4.19)	-8.74 (-4.92)
Market size	-1.29·10 ⁻⁹ (-0.85)	7.67·10 ⁻¹⁰ (0.35)	-1.33·10 ⁻⁹ (-0.93)
Labor tax	0.88 (3.88)	0.73 (2.18)	0.90 (4.02)
Right party legislative seats	0.03 (0.67)	0.05 (1.45)	0.01 (0.33)
Government size	-0.44 (-2.53)	-0.35 (-1.56)	-0.54 (-2.97)
Growth	-0.16 (-0.76)	-0.09 (-0.30)	-0.13 (-0.56)
EU	5.79 (1.26)	4.17 (0.83)	4.50 (0.97)
EFTA	18.11 (4.20)	13.68 (2.46)	17.18 (3.61)
Other PTAs	4.02 (2.14)	7.91 (3.67)	4.47 (2.10)
Trade costs	-66.89 (-1.51)	-793.7 (-4.43)	-375.1 (-3.59)
Market potential Linkages	-0.00001 (-0.70)	-73874.1 (-4.47)	
Wages			-0.02 (-3.40)
Number of countries	15	13	14
n	200	152	190
R ²	0.50	0.71	0.66

Table 4. Corporate tax rates. "tax competition" variables and agglomeration variables – time period estimations*

	Statutory Tax Rate				Average Effective Tax Rate Mendoza			
	- 1989		1990 -		- 1989		1990 -	
	i	ii	iii	iv	i	ii	iii	iv
Trade	0.01 (0.03)	-0.09 (-0.87)	0.15 (1.63)	0.11 (1.61)	-0.70 (-2.19)	-0.65 (-4.67)	-0.67 (-2.00)	-0.59 (-2.34)
Openness	4.05 (2.84)	2.21 (1.73)	1.15 (1.83)	1.31 (2.24)	-2.95 (-0.96)	0.88 (0.47)	-1.11 (-0.46)	-0.81 (-0.41)
Capital	-4.83 (-1.22)	-3.96 (-1.63)	0.31 (0.13)	-0.54 (-0.27)	1.28 (0.20)	-3.80 (1.07)	-7.15 (-0.58)	-3.10 (-0.33)
Market size	$8.53 \cdot 10^{-9}$ (0.94)	$-9.49 \cdot 10^{-11}$ (-0.04)	$6.35 \cdot 10^{-9}$ (2.01)	$5.44 \cdot 10^{-9}$ (2.14)	$-4.88 \cdot 10^{-9}$ (-0.30)	$-1.67 \cdot 10^{-9}$ (-0.56)	$8.30 \cdot 10^{-9}$ (1.30)	$1.05 \cdot 10^{-8}$ (2.02)
Labor tax	-0.22 (-1.73)	-0.08 (-1.10)	-0.60 (-1.89)	-0.44 (-1.93)	5.15 (5.28)	0.66 (1.63)	0.42 (0.92)	0.58 (1.70)
Right party Leg.seats	-0.06 (-0.79)	-0.04 (-0.76)	0.05 (1.54)	0.04 (1.92)	-0.10 (-0.60)	-0.05 (-0.65)	-0.30 (-3.05)	-0.28 (-3.23)
Government size	-0.11 (-0.31)	0.10 (0.47)	-0.48 (-2.46)	-0.42 (-2.55)	-0.98 (-1.76)	-0.15 (-0.45)	-0.53 (-0.71)	-0.48 (-0.77)
Growth	-1.01 (-2.03)	-0.43 (-1.58)	0.05 (0.34)	0.04 (0.30)	-1.08 (-1.12)	-1.99 (-3.02)	-1.94 (-1.95)	-1.95 (-2.56)
Market potential	$-1.28 \cdot 10^{-6}$ (-1.29)		$-7.53 \cdot 10^{-6}$ (-0.62)		$3.52 \cdot 10^{-7}$ (0.15)		$3.58 \cdot 10^{-6}$ (0.65)	
Linkages	-2471.0 (-2.27)		-224.3 (-1.23)		-4931.6 (-2.78)		-1626.4 (-1.54)	
Wages		-0.002 (-3.89)		-0.0002 (-0.53)		-0.0002 (-0.19)		0.0004 (0.53)
Number of Countries	13	17	14	17	12	15	12	15
n	109	170	111	136	117	232	77	98
R ²	0.33	0.31	0.29	0.28	0.65	0.32	0.58	0.54

*Notes: Numbers in parentheses are *t*-statistics.
Time and RIA dummies are included but not reported.

Table 4. continued

	Average Effective Tax Rate			
	DGK			
	- 1989		1990 -	
	i	ii	iii	iv
Trade	-0.18 (-1.27)	-0.10 (-0.96)	-0.09 (-0.94)	-0.09 (-1.02)
Openness	0.28 (0.15)	-2.04 (-0.98)	-1.30 (-2.42)	-1.13 (-2.05)
Capital	-2.12 (-0.58)	0.69 (0.21)	5.31 (2.24)	3.96 (2.08)
Market size	$-3.00 \cdot 10^{-9}$ (-0.51)	$7.62 \cdot 10^{-10}$ (0.32)	$8.96 \cdot 10^{-10}$ (0.72)	$1.83 \cdot 10^{-10}$ (0.18)
Labor tax	0.99 (1.63)	0.41 (1.31)	0.41 (1.53)	0.44 (1.72)
Right party	0.11 (2.00)	0.04 (0.74)	0.05 (2.40)	0.04 (1.62)
Leg.seats	0.76 (2.63)	0.15 (0.57)	-0.44 (-3.31)	-0.46 (-3.75)
Growth	-0.11 (-0.45)	-0.21 (-0.85)	-0.29 (-1.38)	-0.29 (-1.47)
Market potential	$1.35 \cdot 10^{-7}$ (0.20)		$1.18 \cdot 10^{-6}$ (1.07)	
Linkages	-2694.2 (-2.93)		-51.26 (-0.18)	
Wages		-0.0004 (-0.46)		-0.0002 (-0.53)
Number of Countries	12	14	13	14
n	74	105	85	93
R ²	0.50	0.39	0.59	0.58

Table 5. GMM estimates of corporate tax rates, "tax competition" variables and agglomeration variables*

	Statutory Tax Rate				Average Effective Tax Rate			
					Mendoza		DGK	
	endogen.	endogen.	endogen.	endogen.	endogen.	endogen.	endogen.	endogen.
Corporate tax rate	0.69	0.68	0.62	0.64	0.40	0.39	0.44	0.44
lagged	(9.78)	(9.75)	(6.32)	(7.31)	(5.10)	(5.02)	(4.50)	(4.61)
Trade	0.11	0.12	0.11	0.08	-0.26	-0.26	0.04	0.04
	(1.18)	(1.28)	(1.58)	(1.05)	(-2.21)	(-2.13)	(0.41)	(0.42)
Openness	0.61	0.56	1.26	1.12	0.13	-0.07	-0.35	-0.38
	(0.90)	(0.82)	(1.51)	(1.43)	(0.06)	(-0.03)	(-0.40)	(-0.46)
Capital	-3.45	-3.63	-3.90	-3.94	2.29	2.38	-2.85	-2.63
	(-1.76)	(-1.72)	(-1.87)	(-1.92)	(0.46)	(0.49)	(-1.70)	(-1.68)
Market size	$3.20 \cdot 10^{-9}$	$3.18 \cdot 10^{-9}$	$3.53 \cdot 10^{-9}$	$2.95 \cdot 10^{-9}$	$4.34 \cdot 10^{-9}$	$4.08 \cdot 10^{-9}$	$1.41 \cdot 10^{-9}$	$1.33 \cdot 10^{-9}$
	(2.84)	(2.82)	(2.45)	(2.33)	(1.77)	(1.71)	(0.58)	(0.57)
Labor tax	0.06	0.04	0.09	0.09	0.61	0.60	0.40	0.40
	(0.52)	(0.33)	(0.63)	(0.68)	(1.78)	(1.79)	(2.58)	(2.41)
Right party	-0.026	-0.02	0.01	-0.001	-0.07	-0.07	0.03	0.04
legislative seats	(-0.63)	(-0.44)	(0.27)	(-0.04)	(-1.40)	(-1.37)	(1.04)	(1.22)
Government size	-0.013	-0.03	-0.006	-0.02	-0.56	-0.58	-0.47	-0.48
	(-0.09)	(-0.23)	(-0.04)	(-0.14)	(-1.64)	(-1.73)	(-2.76)	(-2.87)
Growth	-0.16	-0.16	-0.31	-0.28	-2.36	-2.43	-0.48	-0.47
	(-1.03)	(-1.03)	(-1.47)	(-1.41)	(-3.52)	(-3.51)	(-3.29)	(-3.03)
EU	6.66	7.10	-0.57	2.98	2.86	3.92	-3.65	-3.73
	(0.87)	(0.86)	(-0.18)	(0.62)	(0.70)	(0.96)	(-2.23)	(-2.33)
EFTA	5.42	5.60	2.35	1.20				
	(0.74)	(0.78)	(-0.67)	(0.26)				
Other PTAs	-2.88	-3.35	-0.63	-3.71	-2.50	-2.09	4.90	4.77
	(-1.33)	(-1.28)	(-0.47)	(-2.09)	(-0.79)	(-0.70)	(3.44)	(3.48)
Trade costs	-9.36	-5.66	-32.74	-31.81	-62.12	-67.13	-26.85	-27.44
	(-0.35)	(-0.20)	(-1.29)	(-1.31)	(-0.98)	(-1.03)	(-1.00)	(-1.02)
Market potential	$-1.52 \cdot 10^{-7}$	$-2.22 \cdot 10^{-7}$	$1.29 \cdot 10^{-6}$	$4.95 \cdot 10^{-7}$	$-9.74 \cdot 10^{-7}$	$-7.76 \cdot 10^{-7}$	$8.31 \cdot 10^{-7}$	$9.05 \cdot 10^{-7}$
	(-0.13)	(-0.19)	(1.86)	(-0.56)	(-1.14)	(-0.94)	(1.20)	(1.12)
Linkages	-520.8	-560.4						
	(-1.92)	(-1.96)						
Number of countries	14	14	14	14	9	9	11	11
n	178	178	182	182	203	203	132	132
Sargan	0.9911	0.9951	0.9999	0.9992	0.9941	0.9925	0.5489	0.6010

*Notes: Numbers in parentheses are t-statistics
Time dummies are included but not reported.