The effects of tax competition and new economic geography on taxation in OECD countries[*]

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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 as well as the standard tax competition theory. When we do not control for key features from the new economic geography literature, we find support for the role of tax competition, that is increased integration leads to lower corporate tax rates. By controlling for both explanations simultaneously, however, we find that the role for tax competition is reduced, and some empirical support suggesting that the implications from the new economic geography theory are important.

I. Introduction

There is a widespread fear within the European Union (EU) 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, which in turn pressures countries to lower their tax rates to retain and attract dynamic firms and able workers. This competition can make it difficult for countries to maintain desired tax rates, and lead to a "race to the bottom" since EU countries have so far been unsuccessful in harmonizing tax rates. Indeed, an extensive tax competition literature suggests that this tax competition leads 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 provide important externalities that are also likely to be important. These factors tend to concentrate economic activity and are the main focus of the quite recent economic geography literature. Countries or regions that can provide these so called agglomeration factors may be able to retain mobile factors in spite of high tax rates, thus providing a dampening effect on the "race to the bottom".

Most empirical studies of integration and taxation have focused on the first explanation, tax competition, but have failed to address the second. These studies find surprisingly little evidence for the notion that increased integration leads to lower tax rates, however, the main implication of tax competition. The purpose of this paper is to investigate whether corporate tax rates can be better explained by including variables that capture agglomeration in addition to conventional variables measuring tax competition, using data from a number of OECD countries over several decades. In particular we include such agglomeration forces as membership in trade unions, trade costs, closeness to markets, as well as the importance of industrial linkages in production.

The policy implications from this study may be highly relevant in light of ongoing European integration. It is important to understand the effect of integration on tax structure within, as well as outside, EU borders in order to anticipate and resolve problems along the way. In particular, the results may well offer guidance on tax harmonization between existing as well as with new members.

The paper is organized as follows. In the next section, we summarize the theoretical implications from the standard tax competition literature, together with the main findings from the new economic geography literature. In section III, we summarize previous empirical

studies on integration and taxation. Section IV describes our own statistical analyses and section V concludes the paper.


II. Theoretical background

Tax competition has traditionally been analyzed in the public finance literature (e.g. Zodrow & Mierzkowski, Wildasin [1988] and Wilson [1991, 1999], see also Schulze & Ursprung, [1999], and Haufler [2001] for surveys of the literature).[1] Recently 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* [2002]). This section presents, in a non-technical way, the basic insights from the two models.

The Standard Tax Competition Model

The basic setting involves perfect competition and two factors of production, (physical) capital and labor. While capital can move freely across countries, labor is completely 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 marginal social benefits (MSB) of an increase in the provision of the public good equal to marginal social costs (MSC). If capital where immobile, MSC is the tax rate 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 will rise and the optimal tax rate will decline. This is illustrated in figure 1 where the downward sloping MSB curve reflects the benefits of higher tax revenue and MSC and MSC′ are constant marginal social costs 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.

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[1] Integration and tax rate determination has also received interest from the public choice theory, though this perspective has recently been included in the tax competition literature. According to public choice proponents,

Figure 1.

MSB, MSC
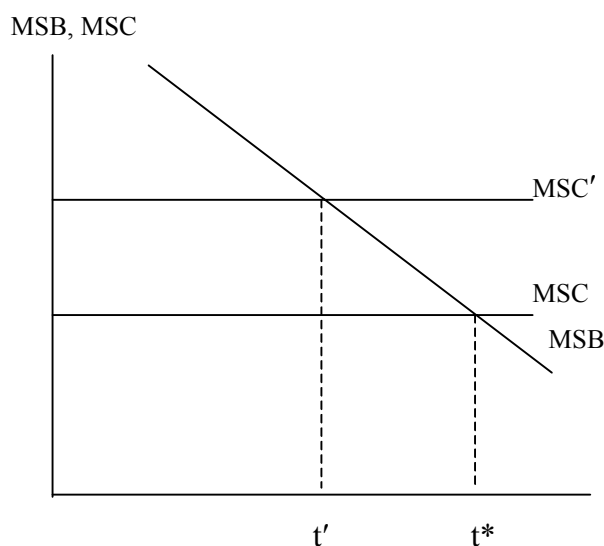
In contrast to the extreme cases where capital is either perfectly mobile or completely fixed, figure 1 suggests a negative relationship between factor mobility and tax rates. In other words, since increased factor mobility can be thought of as a reduction in trade costs, continuing integration will be associated with ever decreasing tax rates, the race to the bottom case.

If we allow taxes on capital and labor to differ, it can be shown that the immobile factor will face a greater tax burden as countries attempt to keep their tax bases within their national border. The model also suggests that larger countries, 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 per 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

While most traditional tax competition models assume perfect competition, economic geography models are based 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

however, tax competition may not be particulary harmful as it serves to discipline wasteful governments (see e.g. Edwards & Keen [1996], Eggert [2001] and Sato[2003]).

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goods) as well as between producers and consumers are thought to create tendencies for agglomeration of production. Integration, in terms of 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 will decrease the mobility of factors. Thus, with regard to taxes, an interesting effect is that those countries where industries choose to locate –hence, the countries that gain the "core"– will increase their tax base and may be able to increase tax rates in general.[2]

The main implications of agglomeration forces on tax rate policy are shown in figure 2 (see Baldwin *et al* [2002]). The figure 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. As trade costs start to decrease, agglomeration rents increases 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] For the purpose of our analysis it is precisely this agglomeration rent that 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 experience any outflow of capital (Baldwin *et al* [2002]).[4] In figure 2, the agglomeration rent is positive if the degree of openness is higher (or trade cost is lower) than θ. This suggests that the core country can maintain a positive tax on capital for the whole interval between θ and 1. The periphery country, on the other hand, obviously does not share this opportunity. The negative agglomeration rent at very low levels of integration, i.e. if < 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.

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[2] As pointed out by Baldwin *et al* [2002] the favorable effects of agglomeration forces are in sharp contrast to the negative effects of concentration in the standard tax competition model that is due to diminishing returns.

[3] It is often emphasized in the new economic geography framework that the benefits of being in the core are highest at intermediate levels of trade costs.

[4] Note that here there is complete agglomeration where all capital is located in the same place.

Figure 2.

agglomeration
  rents
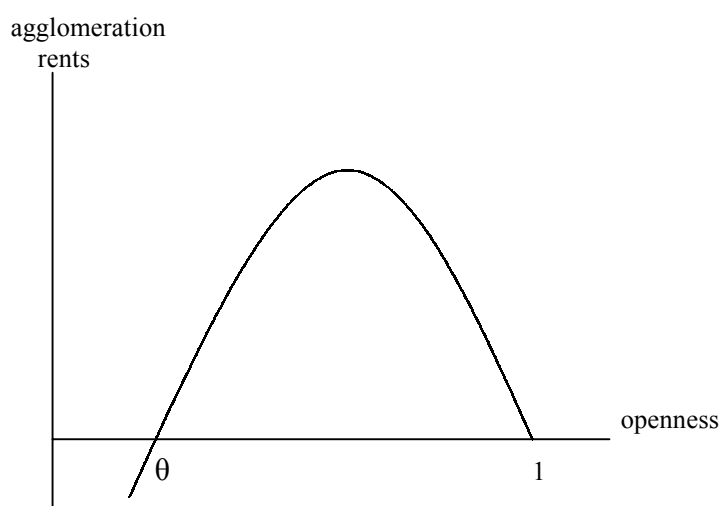
The basic insight of the new economic geography is the importance of an interaction between trade costs and agglomeration. If we relax the assumption of complete agglomeration and allow agglomeration forces to vary with the level of integration, agglomeration forces may be too weak at low levels of integration (if less than θ) to induce tax differentials across countries. As integration deepens, though, agglomeration forces get stronger preventing a race to the bottom.[5] This non-monotonic relationship between integration and tax rate policy does not occur in the basic tax model. Furthermore, in the new economic geography framework it is the larger country that has higher capital per labor ratios and in consequence 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 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 literature, intensify tax competition, while further integration tends to increase the importance of agglomeration forces and, as a result, decrease tax competition.

III. Earlier empirical studies on integration and taxation

Surprisingly few studies have examined the relationship between integration and taxation empirically, all 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, however, including the expected negative correlation between integration and

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

capital taxation (the most mobile production factor) and higher tax rates in larger countries than in small (e.g. Bucovetsky [1991] and Wilson [1991]). Garrett [1995] and Quinn [1997], for example, found instead positive relationships between capital taxation and trade liberalization, and Swank [1998] found 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, though all three studies used corporate tax revenues as a share of GDP to proxy for capital taxation, which has been criticized as being vulnerable to spurious relationships.[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, performed 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 found that openness, measured as the sum of exports and imports over GDP, is negatively correlated with capital taxation. Rodrik [1997] also found support for the hypothesis that taxation shifted from capital to labor. Similarly, Bretschger and Hettich [2002] found 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. Kirchgässner & Pommerehne [1996], on the other hand, found only weak evidence of increased tax competition between fiscally autonomous cantons in Switzerland, which may be surprising because these cantons are much more economically integrated than the OECD or EU countries in other studies. Adserà and Boix [2002], however, found support for a 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 are inconsistent, and provide only weak empirical support for the predictions of the tax competition theory. Schulze and Ursprung [1999] surveyed 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," which may be attributable to various statistical problems including, among other things, the difficulty of determining a suitable model specification and of quantifying tax policy. It may also be an indication that there exist other factors that enable countries to conduct independent fiscal policy despite globalization, however, a hypothesis tested in the next section.

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[6] This relationship may be spurious because the share of operating profit in GDP has generally risen since the early 1980s while effective capital tax rates have generally fallen.

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 and Chellens [2000], and Deveurex, Griffith, and Klemm [2002]). Figure 3 presents the average OECD statutory corporate tax rate from the early 1970s to present. It has declined by almost one quarter, from around 45 percent to under 35 percent in 2002. Figure 3 also presents the development over time of effective corporate income tax rates, measured according to the Mendoza et al [1994] definition. These rates generally increased from 1965 to a peak early in the 1980s, perhaps declined thereafter, but the variation is considerable. One reason that the average effective tax rate has not decreased in line with the statutory rate may be a corresponding broadening of tax bases (Deveurex, Griffith, and Klemm [2002]).

Figure 3. Average statutory and effective corporate tax rates over time in OECD countries
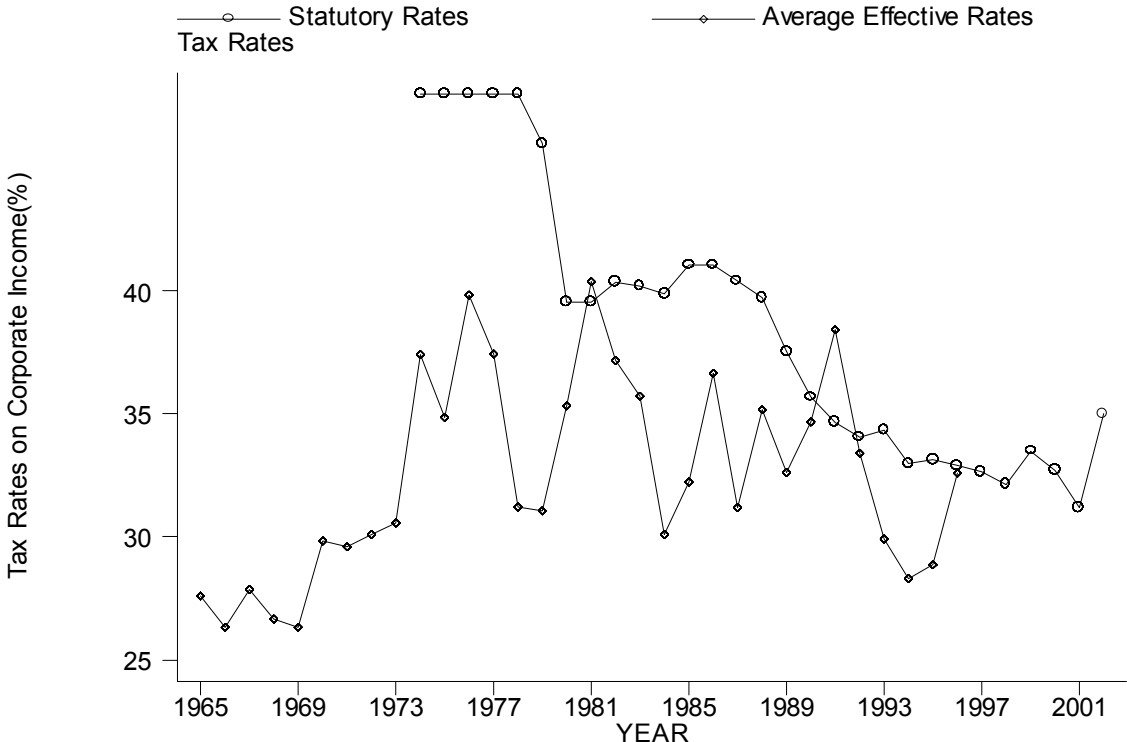
At the same time, many obstacles to trade and investment between OECD countries were removed. As figure 4 shows, average trade volumes (measured as the sum of exports

and imports as a share of GDP) in the OECD have risen from around 40 percent in the early 1970s to over 60 percent in 1996.

Figure 4. Average trade volumes over time in OECD countries

OECD Trade Averages
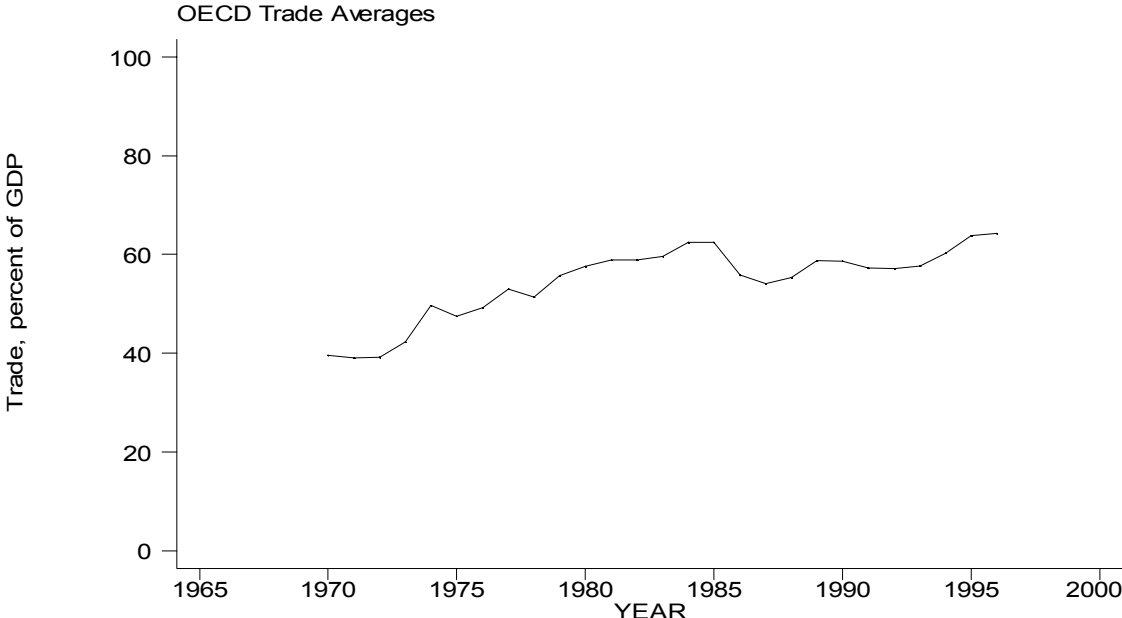
This trend toward increased integration is corroborated by two additional indices in Figure 5. Measured on the left axis, a qualitative index of capital account regulations increases from 2.5 in 1965 to 3.75 in 1996 in the OECD, where 0 is completely restricted and 4 is completely unrestricted.[7] Measured on the right axis, a broader measure of integration which measures inward and outward capital and current account restrictions as well as international agreements constraining restrictions of exchange and capital flows, increased from 9 to 13 between 1965 and 1996, where 0 is the most closed and 14 the most open.[8]

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[7] For details, see the description in Quinn [1997].
[8] Ibid.

Figure 5. Openness and capital account liberalization over time in OECD countries
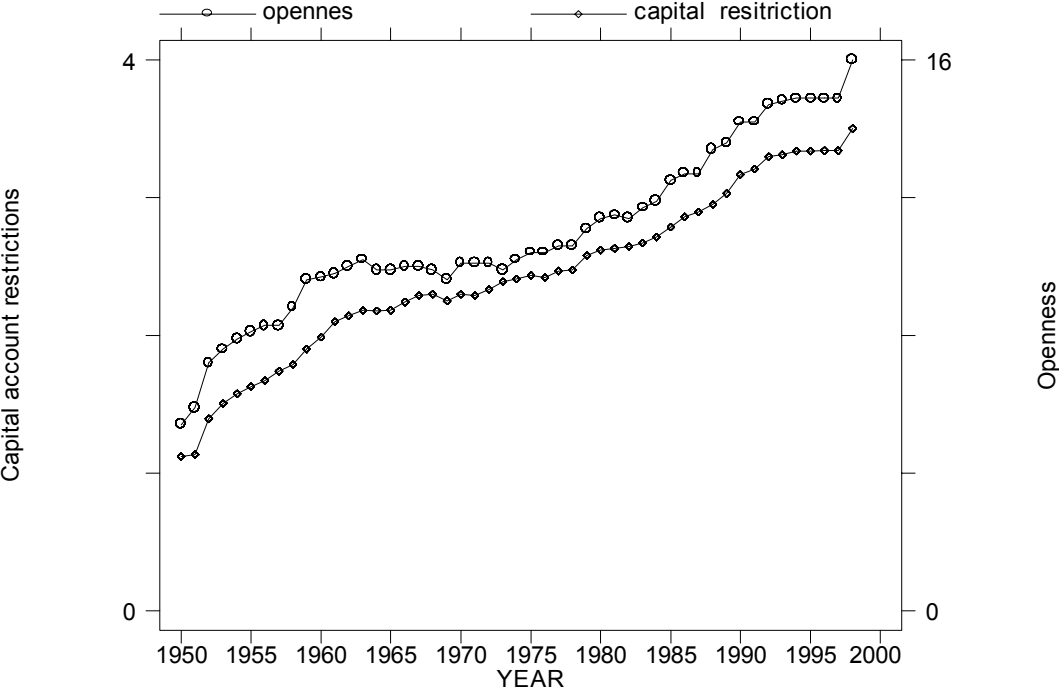
Clearly, the decline in statutory tax rates is at least superficially correlated with increased integration. The absence of a similar decline in effective corporate tax rates, however, might indicate increases in forces restraining a race to the bottom. Figure 6, shows how two important measures of new economic geography have increased in importance since the mid 1980s. Specifically, trade costs declined steadily from 1.08 in 1965 to 1.04 in 2000. Linkages in production declined sharply in the 1970s, but have since regained previous importance. At least since 1980, thus, the economic environment appears to have been favorable for agglomeration forces.

Figure 6. Average trade cost and linkages in production in OECD countries
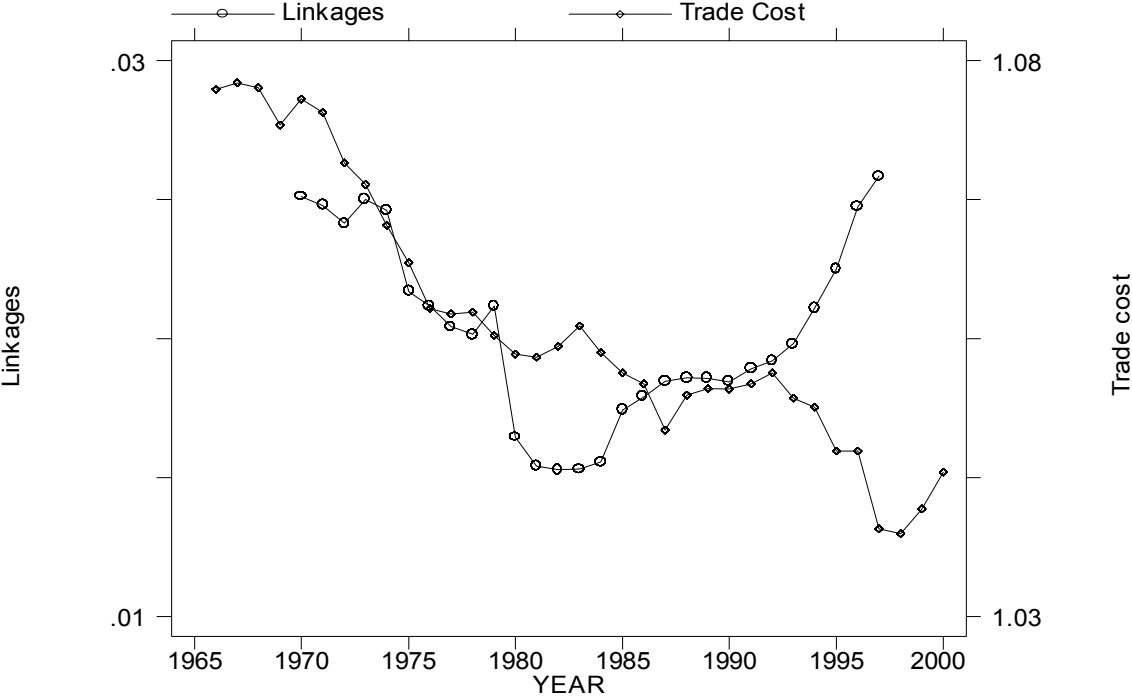
Econometric Approach

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 (unobservable) and hence impossible to include in regressions, and to control for non-secular 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 because corporate income is usually considered more mobile than most other capital tax bases since it does not include immobile property (Bretschger and Hettich [2002]). However, since most countries tax international capital streams according to the residence principle, 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 principal in practice. In reality corporate profits are often taxed closer to the source than the residence principle (Tanzi and Bovenberg [1990], Keen [1997], and Sørensen [1995]), 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 two measures of corporate tax rates presented in figure 4.1 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. 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, which argues for using effective rates. Effective rates, however, are extremely hard to measure accurately. We use both statutory and average effective corporate tax rates, thus, and compare and contrast their respective results.

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

Specifically, we estimate the following equation

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

where y_{it} is the corporate tax rate for country i in year t, either the statutory or the average effective rate; 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 agglomeration forces, such as domestic market size, potential market size, industrial linkages, membership in trade unions, and trade costs. 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.[9] The standard errors are corrected for heteroscedasticity and normally distributed.

The data are described in the appendix. Statutory and average effective corporate tax rate data do not coincide exactly, so the countries and years included vary somewhat across the various regressions. For instance, the statutory tax rate data span from 1980 to 1997 for 17 countries but the corresponding average effective tax rate data span from 1971 to 1996 for 15 countries. The agglomeration factors are admittedly hard to measure and quantify over time and across countries. In addition to the domestic market size, 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. In addition, we include linkages in production and trade costs. The former variable is constructed in two steps. First, based on OECD input-output table for ten OECD countries, we calculate each industry's average use of domestic intermediates.[10] 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, would be a better measure of linkages between firms and, hence, agglomeration forces, than market size or market potential. The problem, though, is that we only have consistent data until 1994 and not for the whole country sample.[11]

Results

Table 1 reports the results of regressions of statutory and average effective corporate income tax rates on the standard tax competition variables and other control variables, in line with most previous studies. We also report the regression for a sub-sample of current EU members. We do not report results from the random-effects regressions since fixed-effects specification generally is preferred.

In line with expectations, trade and current account liberalization as measures of integration have negative and often statistically significant coefficients. Openness, however, is positive correlated with tax rates. We find no empirical support for the anticipated positive correlation between market size and corporate tax rates. In addition, there seems to be no

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[9] We also estimate the equation under the assumption that the error term is hetroskedastic 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.

[10] The use of intermediates as a measure of agglomeration forces is also used by Middelfart-Knarvik *et al* [2000].

[11] Data are missing for France, Portugal and Switzerland.

empirical support for the notion that lower corporate taxes are offset by higher labor taxes; rather they seem to move in the same direction. In line with the tax competition literature economic growth is also important for corporate tax rates, with a negative coefficient. Left party legislative seats as percentage of all legislative seats and total size of government are both insignificant in each of the regressions.

The differences between the statutory and the average effective corporate tax rate regressions are relatively small. It is noteworthy, however, that our variables have greater explanatory power for statutory tax rates than for average effective tax rates and for the EU sub-sample than for the whole sample.

Since the data included are different when statutory and average effective tax rates are used, respectively, we reestimate the models using a sample restricted to those countries and years that coincide to establish whether the differences are due to the included observations. The results are quite similar suggesting that the differences in explanatory power are not caused by the different data.

We have also investigated whether large and small countries differ systematically. According to theory, smaller countries should be more affected by tax competition and, hence, by increased integration than larger countries, so we estimate the model separately for smaller countries and for larger countries. The effect of trade has, indeed, a larger negative magnitude and is more significant in the smaller countries (results not reported).

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 now include factors proposed by new economic geography including membership in different types of free trade areas (e.g the EU, Efta or an any other PTA), trade costs, and agglomeration factors. The results are presented in table 2. Again, we report the results for statutory and average effective corporate tax rates. We include membership in trade unions, market potential and linkages in production. When these agglomeration forces are included the negative effect of trade on corporate tax rates is reduced. Openness and capital account liberalization lose their significant impact on the average effective tax rates. Interestingly, EC membership and trade cost have opposite effects for the two different tax measures. EC membership has a negative effect on statutory corporate tax rates while the effect is positive on average effective corporate tax rates. This could suggest that EC membership have lead to lower statutory rates accompanied by increased tax bases. Trade cost has a positive impact on statutory tax rates while the effect is negative for average effective tax rates. Neither market

potential nor linkages in production have significant effects on either tax rate. In general, however, the explanatory power is higher when agglomeration forces are included and the effect of tax competition is reduced.

As emphasized in section II, 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, hence, and could explain the mixed results of table 2. Therefore, we also estimate the model including the interaction between our trade cost variable and the different measures of agglomeration forces by simply multiplying the variables. 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 three potential agglomeration variables: domestic market size, market potential and a country's production share of industries characterized by high degrees of linkages to other industries.

Table 3 shows the results when the interaction terms are added. We do not include the separate effects of the variables except market size variable which we consider to be a tax competition variable as well. While the first two interaction terms have the expected sign for the statuary tax rate they are not significant. However, the variable that is anticipated to be the best proxy for agglomeration forces has indeed the expected sign and is significant. A possible interpretation of the coefficient for trade costs × linkages is that in countries where agglomeration forces are stronger and trade costs lower, the statutory tax rates are higher (or that agglomeration plays a smaller role when trade costs are high). On the other hand, there are no significant effects for the average effective tax rate, although the explanatory powers increase for all estimations. Table 3 provide some, although vague, support for the economic geography framework.

V. Conclusions

This paper tries to identify the effect of economic integration on tax rates, both statutory and average effective. 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 variables 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, in turn, creates a positive rent that could be taxed. Thus, tax competition are 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. The empirical results in the paper provide some evidence of this hypothesis. In fact, we find support for both the tax competition and the new economic geography models. Moreover, the effects of agglomeration forces seem more pronounced in countries with lower trade costs suggesting that these forces become more important at deeper levels of integration.

We see this paper as a starting point for further research. 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, 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. Third, the mixed results for statutory tax rates versus 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

Baldwin, R.E., R. Forslid, P. Martin, G. Ottaviano and F. Robert-Nicoud, (2002) *Economic Geography and Public Policy*, manuscript

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 Economic*s, 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

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 (2000), "The location of european industry", Report prepared for the Directorate General for Economic and Financial Affairs, European Commission

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, Tübringen

Tanzi, V. (2002),"Globalization and the future of social protection," *Scottish Journal of Political Economy*, 9, 116-127

Volkering, 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 et al [1994], and Volkering and de Haan [2000]	32.65	15.37
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 Account	Qualitative index of capital account restrictions	Quinn [1997]	2.71	1.03
Market Size	Real GDP in dollars	PWT6.1	409 million	1220 million
Marginal tax rate on labor income	Marginal tax rate for multiples of average production worker	OECD, Taxing Wages, various years	44.98	13.46
Average Effective tax rate on labor income	See text below	Mendoza et al.	33.38	10.36
Left party legislative seats	Left party legislative seats as percentage of all legislative seats	Swank [1998]	39.24	13.0
Growth	Annual growth in real GDP	PWT6.1	2.24	2.5
Government Size	Total government expenditures	PWT6.1	44.37	9.4
Trade cost	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
Agglomeration 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	0.020	0.005

Including countries when using statutory corporate tax rates are Australia, Austria, Belgium,

Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal,

Spain, Sweden, Switzerland, and the UK, and the time period used is 1980 to 1997. Including countries when average effective tax rates are used are the above expect Austria and Germany, and the time period used is 1971 to 1996. In the EU sample we include Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, and the UK when statutory corporate tax rates are used, and the above minus Austria and Germany when average effective tax rates are used.

Average effective tax rates on corporate income (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 not always fully reliable these average effective tax rates must be interpreted with care. In our sample, we treat three observations of this variable as outliers and drop them. Specifically, those are tax rates that are negative and over several hundred percent. Average effective tax rate on labor income is measured in a similar manner. The average effective tax rate on labor income is 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 with 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.

When statutory corporate tax rates are used the statutory labor tax rate is used. We do that by using different multiples of the marginal tax rate for the average production worker. The result is not sensitive to the choice of multiple.

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

	Statutory Tax Rate	Average Effective Tax Rate	Statutory Tax Rate (EU only)	Average Effective Tax Rate (EU only)
Trade	-0.15	-0.67	-0.07	-0.92
	(-1.99)	(-4.84)	(-0.68)	(-4.89)
Openness	2.24	2.42	3.49	3.12
	(4.99)	(2.48)	(7.19)	(2.68)
Capital restrictions	-4.73	-7.22	-5.52	-7.29
	(-3.10)	(-2.47)	(-3.05)	(-1.92)
Market size	-8.00	3.34	-8.49	4.01
	(-1.89)	(0.31)	(-0.18)	(0.31)
Labor tax	-0.009	0.58	0.03	0.41
	(-0.19)	(2.22)	(0.47)	(1.32)
Left party leg. Seats	0.06	-0.00005	0.11	0.21
	(1.14)	(-0.00)	(1.73)	(1.52)
Government size	0.07	0.05	-0.08	0.19
	(0.61)	(0.22)	(-0.64)	(0.64)
Growth	-0.20	-1.97	-0.62	-3.00
	(-0.92)	(-4.36)	(-2.11)	(-4.47)
Number of countries	17	15	12	10
N	306	312	216	205
R^2	0.3861	0.2735	0.5431	0.3813

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

	Statutory Tax Rate	Average Effective Tax Rate
Trade	-0.05	-0,93
	(-0.39)	(-3,53)
Openness	3,23	-0.83
	(4.04)	(-0.50)
Capital restrictions	-7,11	-0,29
	(-3.38)	(-0.07)
Market size	1,46	1,44
	(0,27)	(1,23)
Labor tax	0.19	1,71
	(2,64)	(3,70)
Left party leg. Seats	0.25	-0.10
	(2,07)	(-0.56)
Government size	-0.02	-2,35
	(-0.13)	(-2,07)
Growth	-0.14	-2.35
	(-0.50)	(-4,32)
EC	-11,0	24,5
	(-2,33)	(2.50)
EFTA	-16,72	-3,18
	(-3,44)	(-0,23)
PTAs	-3,75	-4,04
	(-1,33)	(-0.80)
Trade cost	126,6	-112,4
	(2.86)	(-1,82)
Market potential	-1.78	-1.31
	(-1,89)	(-0,81)
Linkages	-25,85	71,04
	(-0,12)	(0,21)
Number of countries	14	12
N	194	213
R^2	0.4556	0.4020

Table 3. Corporate tax rates. "tax competition" variables and interactive effects of agglomeration variables

	Statutory Tax Rate			Average Effective Tax Rate		
	i	ii	iii	i	ii	iii
Trade costs × Market size	-0.26 (-0.87)			0.012 (0.03)		
Trade costs × Market potential		-0.10 (-0.11)			-1.97 (-1.23)	
Trade costs × Linkages			-933.60 (-2.40)			154.67 (0.24)
Trade	-0.25 (-1.97)	-0.22 (-1.79)	-0.39 (-1.59)	-0.74 (-3.36)	-0.65 (-2.75)	-0.62 (-1.34)
Openness	4.24 (5.22)	4.18 (5.14)	5.99 (3.89)	0.16 (0.08)	-0.02 (-0.01)	0.28 (0.11)
Capital restriction	-9.22 (-4.28)	-9.21 (-4.22)	-8.92 (-2.95)	-5.27 (-1.12)	-4.87 (-1.04)	-5.15 (-0.93)
Market size	0.26 (0.84)	-0.001 (-0.28)	-0.02 (-0.54)	0.07 (0.14)	0.08 (2.90)	0.11 (3.34)
Labor tax	-0.15 (-2.06)	-0.16 (-2.10)	0.11 (0.75)	0.64 (1.17)	0.78 (1.41)	1.47 (1.87)
Left party leg. seats	0.14 (2.92)	0.14 (2.88)	0.18 (1.84)	0.23 (2.06)	0.22 (1.98)	-0.02 (-0.14)
Government size	0.37 (1.89)	0.35 (1.74)	0.02 (0.06)	0.47 (1.08)	0.28 (0.61)	-0.31 (-0.54)
Growth	-0.15 (-0.50)	-0.18 (-0.62)	-0.47 (-1.02)	-3.44 (-5.09)	-3.47 (-5.16)	-4.28 (-4.79)
EC	-9.11 (-1.89)	-9.17 (-1.90)	-16.52 (-2.12)	10.40 (0.93)	11.25 (1.01)	13.70 (1.04)
EFTA	-1.78 (-0.33)	-1.44 (-0.27)		16.80 (1.14)	19.59 (1.32)	
N	160	160	96	158	158	82
R^2	0.56	0.55	0.60	0.56	0.56	0.84