

Closer Economic Integration and Corporate Tax Systems*

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Abstract

This article investigates two aspects of corporate income taxation: the determinants of corporate tax rates and the determinants of corporate tax revenues. In the context of theoretically informed empirical models, the analysis examines the influence of increasing economic integration on corporate tax rates and corporate tax revenues, focusing in particular on the case of European Union member and applicant countries. The investigation utilizes a data set of 36 OECD and European countries over the period from 1979 to 2002. Findings are consistent with theoretical expectations: more integrated countries chose lower corporate tax rates, while larger countries, those with bigger governments, and those with higher individual income tax rates chose higher rates. Corporate tax revenues are found to be parabolically related to tax rates. Further, this parabolic relationship is steeper as economies are more integrated, implying a lower revenue-maximizing tax rate for such countries.

KEYWORDS: corporate income taxation, corporate income tax revenues, tax competition, multi-national corporations

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I. Introduction

In recent decades, the world has experienced persistent and large increases in international economic integration. Yet sovereign national governments are left with substantial independence in their setting of economic policies, even as their policy decisions create different consequences in the presence of greater international goods and factor mobility. For example, with increasing international mobility, economic actors are more able to respond to the constraints of national taxation by earning more income in lightly taxed locations. In turn, governments may respond to increasing mobility by changing their tax systems; such responses can have important effects on the efficiency, equity, and revenue-generating capacity of the tax system.

This article considers two facets of tax competition in a context of increasing economic integration among countries, focusing solely on corporate income taxation. First, it considers the relationship between the process of closer economic integration and government decisions regarding corporate income tax rates. Second, it considers how economic integration affects the relationship between corporate tax rates and corporate tax revenues. These questions are considered in the context of theoretically informed empirical models of tax rates and revenues.

This study extends the current literature in two important ways. First, while there have been prior studies that consider the relationship between economic openness and tax rates, there has been very little work regarding the impact of economic integration on the consequences of tax rate choices for government revenues. The nature of this impact has fundamental implications regarding the dynamic of tax competition. Second, this study extends previous work by directly considering how the process of European integration has affected corporate income tax competition, in terms of both the setting of tax rates and the determinants of tax revenues.

The empirical analysis considers a data set of 36 OECD and European countries between 1979 and 2002. By conventional measures, there is a great deal of variation in the extent of international economic integration in this sample. There is also an additional distinction between countries that will be utilized in this analysis. In particular, some countries are members of the European Union or have applied for membership. Members of the European Union share a common trade policy as well as most components of a common market, including substantial harmonization of standards, increasingly free mobility of labor and capital, and (in some years and cases) a common currency. Thus, European integration provides an example of a particularly well-integrated market that crosses national boundaries. At the same time, member nations retain autonomy on most matters of taxation, including the most essential aspects of the corporate

tax system. Thus, while a multinational corporation today may view Europe as a single market, they also face 25 different corporate tax systems. The systems vary in terms of the tax rate, the tax base definition, and the question of whether foreign income of resident firms is exempt from taxation.

The first part of the analysis considers the determinants of corporate income tax rates. Informed by the tax competition literature, corporate tax rates are hypothesized to depend on several factors, including the individual income tax rate, the size of government spending, the size of the economy, the political orientation of the government, and the extent of international economic integration. In addition, the effect of current or prospective EU membership on tax rates is considered. Results confirm theoretical expectations.

The second part of the analysis considers the determinants of corporate tax revenues. The initial step in this inquiry is to build a framework for considering factors that likely explain variation in corporate tax revenues; these include the statutory income tax rate, the breadth of the tax base, corporate profitability, and the size of the corporate sector in the economy. A role for international factors is also considered, as multinational firms may respond to taxation by locating in low-tax countries or shifting profits to such countries. Such responses are facilitated by greater economic integration as well as membership in a common market. Again, results are consistent with theory.

II. Background and Previous Work

Models of Tax Competition

Wilson (1999) and Fuest et al (2003) provide excellent surveys of the tax competition literature. It has long been recognized that the international mobility of capital raises the marginal costs of public good provision through capital taxation, due to the negative costs associated with a lower tax base as capital moves in response to taxation. This process is often described as a (positive) fiscal externality, as foreign countries gain capital and revenue when tax rates are raised at home.

The consequences of such competition can include suboptimal degrees of public good provision. Also, capital is misallocated internationally, with high tax regions experiencing a (sub-optimally) lower capital stock, and a higher marginal product of capital, than low tax regions. Further, with a lower capital stock, high tax countries have a lower marginal product of labor, and hence lower wages, than do low tax countries.

When countries vary in size or economic openness, this can generate situations where smaller and/or more open countries set lower tax rates, as such countries face more elastic capital supply curves. Such countries then become

the beneficiaries of capital inflows and the resulting gains in the marginal product of labor. With international trade, this mechanism can also influence the patterns of comparative advantage such that countries with low-tax rates are more inclined to specialize in capital-intensive production processes. Other models, such as Baldwin and Krugman (2004) and Haufler and Wooten (1999), have emphasized that agglomeration effects may help insulate core nations from the effects of tax competition, allowing them to set higher tax rates without losing capital.

Subsequent literature on tax competition has reached a series of ambiguous conclusions regarding tax competition, finding in some cases that tax rates end up at suboptimally high levels. Tax competition outcomes depend on a variety of considerations, including the size of countries, the degree of economic integration, the availability of different tax instruments, the possibility of income shifting, and how one conceives of the government's objective function. For instance, the interaction between different tax instruments can be important. Fuest and Hemmelgarn (2005) consider a model where the corporate income tax acts as a backstop to the individual income tax, such that tax competition results in lower corporate tax rates and a beneficial role for welfare-improving tax policy coordination.

Empirical Work on Corporate Tax Rates

There is a small body of empirical work that has addressed the question of how countries set their corporate tax rates, including Slemrod (2004), Mutti (2003), Bretschger and Hettich (2002), Devereux et al (2002), Rodrik (1997), and work by political scientists Swank and Steinmo (2002) and Garrett (1998). Slemrod (2004) considers variation in corporate tax rates over 90 countries and 4 years (1980, 1985, 1990, and 1995). Dependent variables examined include the individual income tax rate, an interaction term with capital gains exclusion, the government expenditure to GDP ratio, oil, electricity, and measures of openness. Findings indicate some support for the notion that the corporate tax is a "backstop" for the individual income tax; there is a strong and statistically significant relationship between these two tax rates in the analysis. Results also indicate that there is little evidence that corporate tax rates are driven by a country's revenue needs; expenditures are not related to tax rates.

Mutti (2003) considers the determinants of changes in corporate income tax rates across countries. The analysis focuses on 60 countries in the years 1984, 1992, and 1996. He considers how the change in the corporate income tax rate is affected by the initial rate as well as dummy variables for poor countries, small countries, and openness. Mutti finds that small countries and countries with higher initial statutory tax rates are both likely to see greater reductions in their statutory corporate income tax rate than other countries. Bretschger and Hettich

(2002) examine the determinants of corporate income tax rates for 14 OECD countries between 1967 and 1996. They find evidence in support of their hypothesis that greater international integration will lower corporate income tax rates. Rodrik (1997) has a similar finding.

A few recent papers consider how countries have reacted to one another in the setting of corporate tax rates in recent history. Altshuler and Goodspeed (2002) find evidence of strategic interaction in the setting of corporate tax rates among OECD countries between 1968 and 1996. Devereux et al. (2004) also find evidence of strategic interaction in corporate tax rate setting for 21 OECD countries between 1982 and 1999, particularly in the case of open economies. Stewart and Webb (2006) use cointegration methodology to establish that there is little evidence of convergence of corporate tax burdens for OECD countries, although there may be some harmonization among smaller groups of countries, particularly in Northern Europe.

Tax Competition And Government Revenues

In addition to the question of how government decisions on taxation are influenced by the international mobility of capital, there is also the question of how international factors affect the consequences of any particular tax rate choice for government revenue. For example, as tax bases become more elastic, one might expect (*ceteris paribus*) countries with relatively low tax rates to experience increases in revenue while countries with relatively high tax rates experience decreases in revenue.

In general, how much revenue a country raises from corporate taxation will depend on the corporate tax rate, the definition of corporate income which determines the tax base, the profitability of the corporate sector, and the size of the corporate sector in the economy. Considering revenue from corporate taxation relative to the size of an economy (GDP), we would expect the following relationship to hold.

$$\frac{\text{Corporate Tax Revenue}}{\text{GDP}} = T * f * \Pi * CS \quad (1)$$

where:

$$T = \frac{\text{Taxes Due}}{\text{Tax Base}} \quad \text{and} \quad f = \frac{\text{Tax Base}}{\text{Corporate Profits}}$$

$$\text{and} \quad \Pi = \frac{\text{Corporate Profits}}{\text{Corporate Value Added}} \quad \text{and} \quad CS = \frac{\text{Corporate Value Added}}{\text{GDP}}$$

This ratio is equal to the multiple of the statutory tax rate (T), the fraction of corporate income that is taxed (f), the profit rate of corporations (Π), and the share of the corporate sector in GDP (CS).

A country's choice of statutory tax rate affects corporate income tax revenues relative to GDP in four ways. As the government changes T , revenues change as follows.

$$\begin{aligned} \frac{\partial \text{Revenue}}{\partial T} = & f * \Pi * CS + T * \frac{\partial f}{\partial T} * \Pi * CS \\ & + T * f * \frac{\partial \Pi}{\partial T} * CS + T * f * \Pi * \frac{\partial CS}{\partial T} \end{aligned} \quad (2)$$

The four terms of the right hand side of equation (2) describe four different effects. The first term is the direct effect of the tax increase on revenues. If taxable income were perfectly inelastic with respect to the tax rate, this would be the only effect of changing tax rates. With no behavioral response to the tax change, revenues would simply increase proportionately.

However, firms have many ways to respond to increased corporate taxation. As tax rates increase, more tax avoidance activity occurs, as firms have increased incentives to take steps that reduce their tax burden. The second, third and fourth terms of equation (2) demonstrate three types of firm responses. The second term captures changes in firms' activities that affect f , the fraction of income that is taxed.¹ Tax avoidance efforts can reduce f , as firms undertake more tax preferred activities relative to activities that generate ordinary taxable income.² The third term captures tax avoidance activities that affect firms' profit rates. For example, multinational firms may reduce total domestic profits by shifting such profits to low tax countries.³ The final term of equation (2) captures tax avoidance activities that reduce the corporate share in the economy.⁴

¹ Profitability itself may also affect f , as increased profitability likely reduces the importance of allowances.

² As just one example, the recent U.S. corporate income tax legislation (The Jobs Creation Act of 2004) allows a deduction for income that is generated from production activities; this encourages firms to undertake more of such tax-preferred activities relative to non-production activities, to engage in relabeling efforts, and to manipulate transfer prices between the firm's production and non-production divisions.

³ There is a great deal of evidence on this point, reviewed in Hines (1997, 1999). Altshuler and Grubert (2006) note that tax planning by companies appears increasingly important in the most recent period (1998 on), due in part to the use of more aggressive strategies such as hybrid entities.

⁴ To the extent that corporations respond to increases in taxation by simply undertaking less economic activity, this would reduce both corporate value added and GDP, although it would reduce corporate value added disproportionately, thus decreasing the corporate share of the economy (CS). It is also possible that increases in taxation would lead to a reallocation of economic activity from the corporate to the non-corporate sector, also lowering the corporate share

Thus, the overall effect of an increase in tax rates on the revenue/GDP ratio is ambiguous. This ambiguity is obvious in equation (2), as higher tax rates increase this ratio directly (through the first term) but may also increase incentives for tax avoidance, reducing the second, third, and fourth terms of the equation. International types of tax responses are likely to be increasingly utilized as economies become more integrated.

Empirical Work on Corporate Tax Revenues

Devereux et.al. (2002), Bond et. al. (2000), and Griffith and Klemm (2004) provide an overview of trends in corporate income tax revenues, but these studies stop short of analyzing the sources of these trends. Gropp and Kostial (2000) and Bénassy-Quéré et al (2000) both consider the relationship between foreign investment, tax rates, and corporate tax revenues. Both analyses demonstrate that foreign investment is sensitive to tax rate differences; Gropp and Kostial find that this effect is statistically significantly larger for countries that exempt foreign income from taxation. The papers then proceed to perform simulated calculations regarding how EU tax rate harmonization would affect revenues in EU countries. Gropp and Kostial suggest that high tax countries would gain revenue from harmonization; both studies find that the net FDI positions of EU countries would likely be affected.

Bartelsman and Beetsma (2003) consider a related question, how tax motivated transfer pricing affects corporate income tax revenues. Their empirical approach relates differences in tax rates (between the country and the OECD average) to a ratio of value added to labor compensation. The data set considers this relationship for 16 countries over 19 years (1979-1997). Findings indicate a negative relationship between value added and country tax rates, evidence that the authors interpret as indicating profit shifting toward low-tax countries. The authors then perform back-of-the-envelope calculations that suggest that a one percent increase in the corporate income tax rate will lead to a small decrease in corporate tax revenues.

Auerbach and Poterba (1988) consider the sources of the decline in U.S. corporate income tax revenues over the period 1959-1985; Douglas (1990) does a similar analysis for Canada over the period 1960-1985. Both papers decompose the tax revenue share into the tax rate and the profit rate, as $\text{Taxes/Assets} = \text{Taxes/Profits} * \text{Profits/Assets}$. Both studies conclude that it is declining

variable. For example, Gordon and Slemrod (2000) find evidence of income shifting between the corporate and personal income tax bases. Finally, to the extent that multinational firms' location decisions are driven by tax differences, the tax rate of the country also affects the amount of real economic activity multinational firms choose to locate in that country, likely disproportionately influencing the corporate sector of the economy.

profitability, rather than declining tax rates, that explains the bulk of the reduction in corporate income tax revenues. The sources of the declining profitability are not systematically addressed. Auerbach (2006) considers the more recent period since the 1980s, noting that corporate income taxes relative to GDP have been relatively constant during this period. He observes a declining ratio of nonfinancial C corporation profits, although this is offset by an increasing average tax rate due to the increasing importance of tax losses.

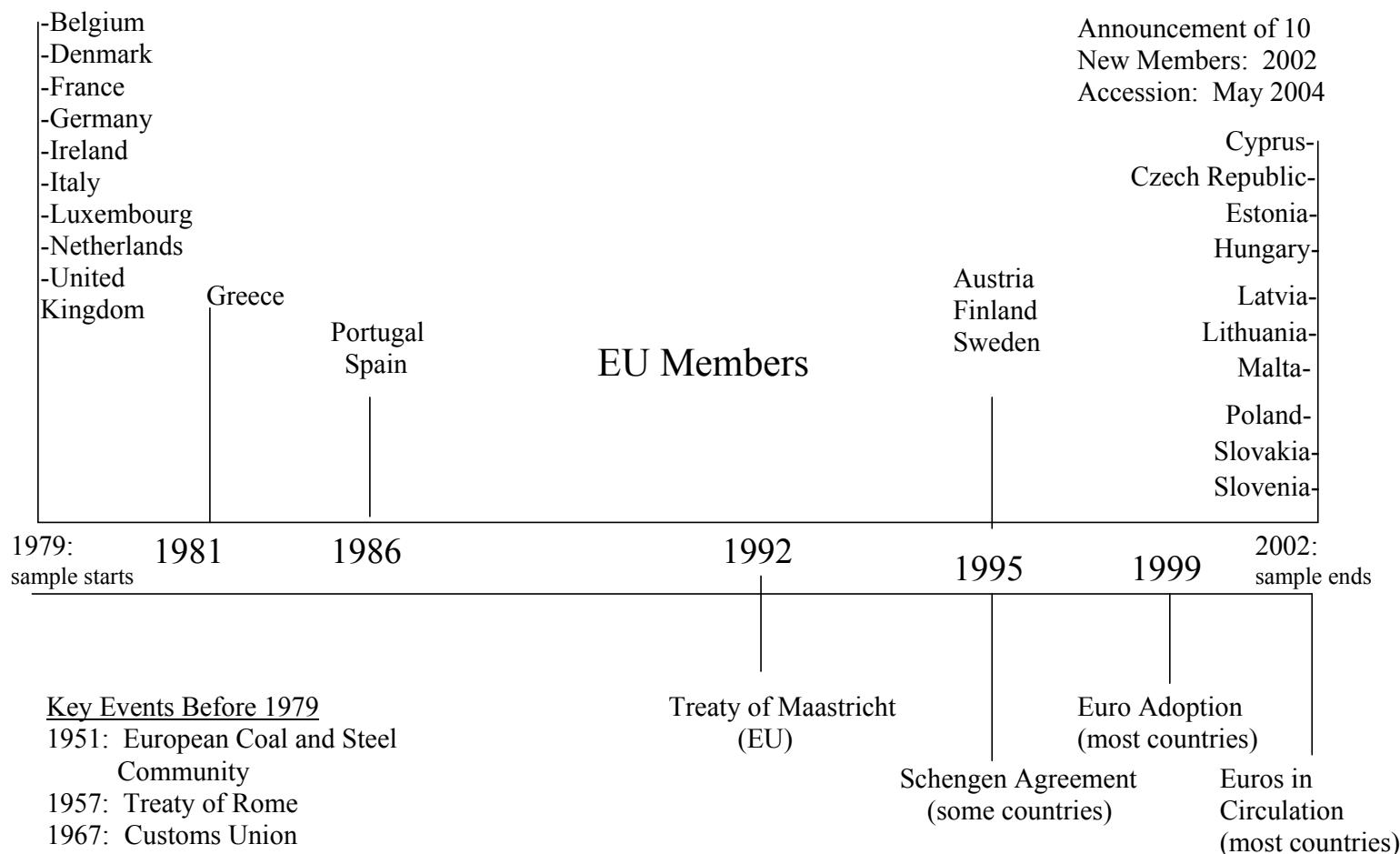
Clausing (2007) undertakes a more comprehensive analysis of the determinants of corporate income tax revenues, estimated for OECD countries between 1979 and 2002. This work finds a parabolic relationship between tax rates and revenues, and the revenue-maximizing rate is found to decrease as economies are smaller and more integrated with the world economy. The current article takes this study forward by considering both the determination of tax rates as well as the determination of tax revenues. In addition, it utilizes the process of European integration as a policy experiment that creates variation in the extent of economic integration across countries, effectively heightening tax competition pressures for current and prospective EU members.

European Integration

The Europeans have pursued an ambitious agenda of closer market integration in the context of substantial national autonomy over important economic policy decisions, including nearly autonomous tax systems. The process of European integration thus provides a particularly useful experiment for understanding the consequences of closer economic integration when countries have disparate tax systems.

The Europeans have a long history of pursuing closer economic integration. In 1951, the European Coal and Steel Community (Belgium, W. Germany, Luxembourg, France, Italy and the Netherlands) integrated important industries among the core nations of Europe. This was followed by the Treaty of Rome (1957), which proposed moving member states toward a common market. A customs union was adopted in 1967, with common external trade policy and free internal trade. In 1973, Denmark, Ireland, and the United Kingdom joined the group. Integration proceeded with the Single European Act (ratified 1986/1987), the Treaty of Maastricht in 1992, and the eventual adoption of euro for 12 of the 15 countries of the European Union in 1999, with euro currency circulating beginning in 2002. Figure 1 indicates some of the milestones of European integration, focusing in particular on the time period of this analysis.

Figure 1: European Integration



In this article, the process of European integration will be quantified by considering three types of dummy variables. The first simply indicates whether countries are currently EU members. The second indicates whether countries have applied for membership; if the same country then rejects membership in a referendum (as in the case of Switzerland and Norway), they are still included as applicants up until the point when the referendum is held. The third indicates when countries have completed accession negotiations and are slated to join. Table 1 shows which countries are included in each group.

Table 1: EU Integration Dummy Variables, 1979-2002 period

Country	EU member	EU applicant	EU complete
Austria	1995-2002	1989-1992	1993-1994
Belgium	1979-2002		
Cyprus		1990-2001	2002
Czech Republic		1996-2001	2002
Denmark	1979-2002		
Estonia		1995-2001	2002
Finland	1995-2002	1992	1993-1994
France	1979-2002		
Germany	1979-2002		
Greece	1981-2002		1979-1980
Hungary		1994-2001	2002
Ireland	1979-2002		
Italy	1979-2002		
Latvia		1995-2001	2002
Lithuania		1995-2001	2002
Luxembourg	1979-2002		
Malta		1990-2001	2002
Netherlands	1979-2002		
Norway		1992	1993
Poland		1994-2001	2002
Portugal	1986-2002	1977-1984	1985
Slovakia		1995-2001	2002
Slovenia		1996-2001	2002
Spain	1986-2002	1977-1984	1985
Sweden	1995-2002	1991-1992	1993-1994
Switzerland		1992	
United Kingdom	1979-2002		

One potential issue associated with exploring the link between European integration and corporate tax systems concerns the exogeneity of European integration. For instance, one could argue that agreements arise in part due to concerns regarding tax competition, and thus establishing how the agreements affect corporate tax rates and corporate tax revenues would be difficult due to causal mechanisms operating in both directions. In addition, common influences may affect both the formation of economic agreements as well as the choice of tax rates. For example, a more market-friendly government might be inclined to pursue both economic integration and simultaneously lower corporate taxes. While these concerns are important, there are several reasons to suspect that the underlying relationships between economic integration, tax rates, and tax revenues will still be discernible.

Foremost, there are myriad reasons for forming economic agreements, and most of these reasons likely far outweigh concerns of corporate taxation in policy-maker decision making. In this case, it is widely believed that the European Union was founded in large part for political reasons, in an attempt to prevent the European countries from engaging in further warfare by giving them a common economic destiny. Similarly, countries often join the Union for reasons that are as political as they are economic. In addition, the process by which the European Union considers new candidates for membership (for example, the ten Central and Eastern European countries that joined in 2004) entails multifaceted decisions for both the candidate countries and the Union itself. There is also quite a bit of variation in countries' dates of application, completion of process, and accession, as apparent from Table 1. In several cases, the decision to join (or not join, in the case of Norway and Switzerland) was made on the basis of a narrowly won (or lost) voter referendum.

In addition, even in the possible case where countries simultaneously pursue economic integration and lower corporate income tax rates (for some third reason), the fact that they are experiencing greater economic integration should affect the relationship between their tax rate choice and government revenues. Thus, the second part of the analysis should be relatively immune from these concerns.

III. Data and Specifications

The subsequent data analysis will employ data from 36 OECD and European countries for the period 1979-2002; a country list is included in Appendix A. Data are summarized in Table 2; data sources are described in Appendix A.

Table 2: Summary Statistics

Variable	n	Mean	Standard Deviation
Corporate Tax Rate	725	.348	.099
Individual Top Rate	701	.501	.128
Outward Foreign Investment Stock/ GDP	637	.133	.163
GDP, in billion \$	814	584	1,390
GDP per-capita, in dollars	814	15,415	9,597
Left Exec. & Legislature	864	.138	.345
EU member	864	.343	.475
EU applicant	864	.117	.321
EU complete	864	.024	.154
Central Government Corporate Income Tax Revenue / GDP	693	.024	.013
Profit Rate: Corporate Operating Surplus / Corp. Value Added	298	.372	.082
Corporate Share: Corporate Value Added/GDP	300	.559	.071
Credit System	720	.340	.474
Mixed System	720	.340	.474
Growth Rate	690	.0275	.0291
Unemployment Rate	609	.0728	.0431

The first set of specifications will estimate the determinants of country corporate tax rates.

$$\text{Corporate Tax Rate}_{it} = \alpha + \beta_1 \text{Individual Tax Rate}_{it} + \beta_2 \text{Government Consumption/GDP}_{it} + \beta_3 \text{FDI-out/GDP}_{it} + \beta_4 \ln(\text{GDP})_{it} + \beta_5 \ln(\text{GDP per-capita})_{it} + \beta_6 \text{Left}_{it} + \beta_7 \text{EU}_{it} + \beta_8 \text{EU complete}_{it} + \beta_9 \text{EU apply}_{it} + \nu_{it} \quad (3)$$

It is expected that β_1 , β_2 , β_4 , and β_6 will be positive and β_3 , β_7 , β_8 , and β_9 will be negative. These expectations emerge from the theoretical considerations discussed above. In particular, higher corporate tax rates are chosen in order to serve as a backstop for higher individual tax rates and to generate more revenue for countries with larger government consumption. A larger economy may be more insulated from tax competition, and thus able to choose higher rates, *ceteris paribus*. Also, governments where the left party controls both the executive branch and all relevant houses are more likely to favor higher corporate tax rates.

However, countries more exposed to international integration, such as those with more foreign direct investment activity or those who are members (or aspiring members) of economic agreements, may be inclined to choose lower corporate tax rates, due to expectations of a greater responsiveness of the tax base to taxation. I do not have strong *a priori* expectations regarding β_5 , although I include this term to capture the possibility that richer economies may choose systematically higher or lower corporate tax rates.

Figure 2 shows the evolution of the statutory corporate tax rate for this sample of countries and this time period. There has been a noticeable decline in the average corporate tax rate for this sample of countries, from 43% to 28%. In addition, the standard deviation of corporate tax rates is declining slightly over this time period. Trends for EU countries are quite similar to those for the full sample.

Figure 3 shows the evolution of central government corporate tax revenues for the same time period, the subject of the next set of specifications. Despite the decline in corporate tax rates, corporate tax revenues have been increasing for both the entire sample and the EU member subset, from about 2% of GDP to about 3% of GDP.

Figure 2: Corporate Tax Rates, 1979-2002

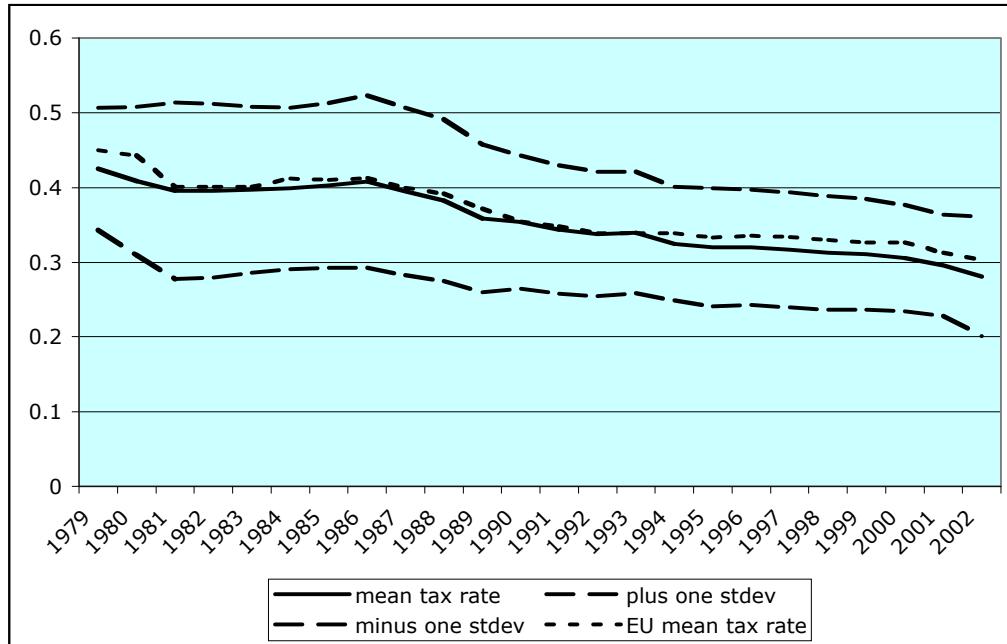
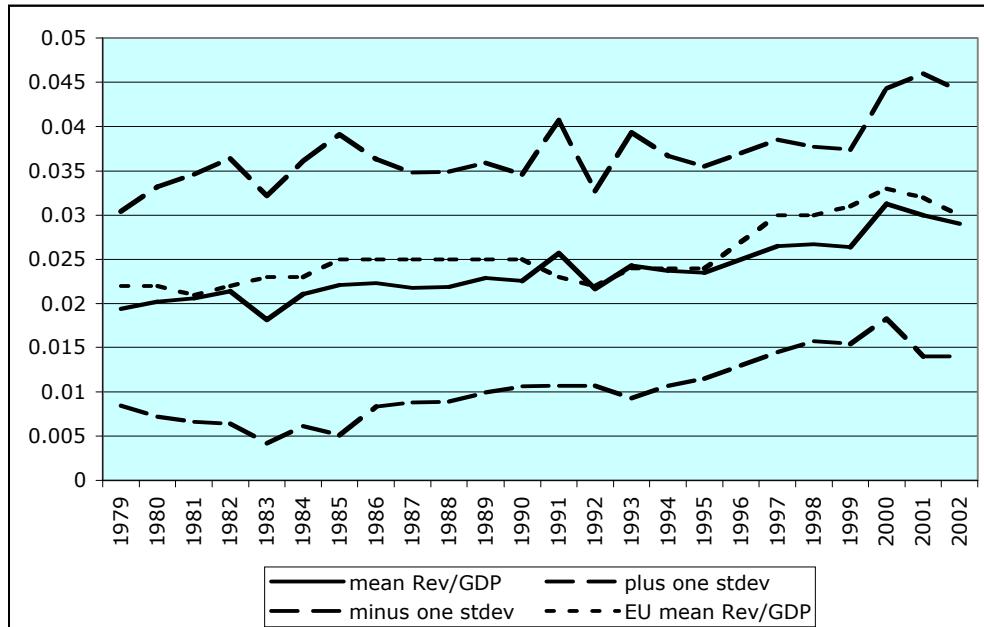


Figure 3: Central Government Corporate Tax Revenues/GDP



The second set of specifications will investigate the determinants of corporate tax revenues. The following is the baseline specification.

$$\begin{aligned} \text{Corporate Tax Revenue/ GDP}_{it} = & \alpha + \beta_1 \text{Tax Rate}_{it} + \beta_2 \text{Tax Rate}_{it}^2 \\ & + \beta_3 \text{Corporate Profitability}_{it} \\ & + \beta_4 \text{Size of the Corporate Sector}_{it} \end{aligned} \quad (4)$$

It is expected that β_1 will be positive while β_2 will be negative, reflecting the fact that for low tax rates, an increase in the tax rate should increase tax revenues at a decreasing rate, and for higher tax rates, an increase in the tax rate should decrease tax revenues at an increasing rate. It is also expected that β_3 and β_4 will be positive, so that increases in corporate profits or the corporate share of the economy increase corporate tax revenues.

The OECD reports some data on the size of the corporate sector and corporate profits. There is very little change in the average size of the corporate sector for OECD countries over this time period; at both the beginning and end of the sample, the average OECD country has approximately 55% of its GDP as corporate value added. This variable does vary by country a fair amount; the United Kingdom (66%), the United States (62%), and Switzerland (68%) have large corporate shares, shown in parentheses, while Greece (28%), Poland (45%), and Portugal (48%) have small corporate shares.

The OECD also reports the operating surplus of the corporate sector. One should treat this variable with some caution, as it is not perfectly analogous to corporate profits.⁵ Still, it is the closest variable that is available, although there are a large number of unreported countries. This variable has been trending upwards over time. Operating surplus is about 33% of corporate value added at the beginning of the sample, rising to 39% of corporate value added by the end of the sample.

Unfortunately, not all OECD countries report these data on the corporate sector; using these variables reduces the overall number of observations to approximately half that of the total sample. Also, several important countries are left out, including Australia, Canada, Japan, and two of the important low-tax countries in the sample, Ireland and Luxembourg. Therefore, in some specifications, these two variables will be replaced with other macroeconomic indicators that are likely to be correlated with corporate profits and the corporate share of the economy.

⁵ One should be careful to distinguish (a) economists' definition of "economic profit", which would be income net of payments to all providers of capital (b) the tax law definition ,which is typically based on income net of payments to lenders (but not equity holders), and (c) definitions used by data sources, including the OECD's operating surplus, defined as income prior to any inclusion of interest paid or received.

Also, variables will be added to the specification to reflect the nature of the corporate tax system. In particular, some countries tax resident firms on their worldwide income (with a tax credit for foreign taxes paid); this is known as a *credit* system. Other countries tax resident firms only their domestic income, a *territorial* system. The remaining countries have corporate tax systems with attributes of both territorial and credit systems; such countries are referred to as *mixed* system countries in the subsequent analysis. Roughly one third of the sample falls into each category.

Of most interest, variables will be included to examine the hypothesis that countries that are more open or more closely integrated with other countries (such as EU members) should experience different relationships between their tax rate choices and revenues. In particular, interaction terms can be included in order to examine whether more internationally integrated countries experience higher tax revenues at lower tax rates and lower tax revenues at higher tax rates, as would be expected if the tax base is more responsive in such countries.

IV. Results

Tax Rate Specifications

Table 3 presents the first set of results estimating the corporate tax rate of 36 OECD and European countries. Column (1) presents a baseline specification, column (2) adds a time trend, column (3) adds year fixed effects, column (4) adds country effects, and column (5) adds both country and year level effects. The results typically confirm theoretical expectations.

A higher top individual income tax rate is positively and statistically significantly associated with a higher corporate tax rate in four of the five specifications. A top individual rate ten percentage points higher is associated with a 2.6 percentage point higher corporate income tax rate in column (1); columns (2) to (4) report similar point estimates. In general, these findings support the notion that the corporate income tax may act as a backstop for the personal income tax.

In all specifications, a higher share of government consumption expenditure in GDP is positively and statistically significantly associated with a higher corporate tax rate. In column (1), a ten percentage point higher government consumption share is associated with a 7.5 percentage point higher corporate tax rate; columns (2) and (3) report similar results while in columns (4) and (5) the point estimate of this effect is smaller. These results support the expectation that countries with higher revenue needs, due to higher government expenditures, choose higher tax rates.

Table 3: Regressions Explaining Corporate Statutory Tax Rates, 1979-2002

	(1)	(2)	(3)	(4)	(5)
individual top rate	0.262 (0.027)**	0.215 (0.034)**	0.193 (0.035)**	0.229 (0.028)**	0.011 (0.037)
government share	0.755 (0.090)**	0.770 (0.090)**	0.789 (0.089)**	0.303 (0.137)*	0.374 (0.128)**
FDI-out/GDP	-0.211 (0.025)**	-0.191 (0.028)**	-0.203 (0.027)**	-0.098 (0.021)**	-0.020 (0.024)
ln(GDP)	0.013 (0.003)**	0.013 (0.003)**	0.013 (0.003)**	-0.001 (0.008)	0.011 (0.006)
ln(GDP p-c)	-0.034 (0.007)**	-0.037 (0.007)**	-0.037 (0.007)**	-0.020 (0.015)	-0.010 (0.012)
left	0.037 (0.007)**	0.036 (0.007)**	0.034 (0.008)**	0.016 (0.009)	0.020 (0.008)*
EU	-0.015 (0.008)*	-0.012 (0.008)	-0.010 (0.008)	-0.074 (0.011)**	-0.051 (0.011)**
EU complete	-0.083 (0.017)**	-0.079 (0.016)**	-0.078 (0.016)**	-0.110 (0.015)**	-0.095 (0.014)**
EU apply	-0.080 (0.010)**	-0.076 (0.010)**	-0.076 (0.011)**	-0.100 (0.011)**	-0.086 (0.011)**
year		-0.001 (0.001)*			
Constant	0.114 (0.069)	0.156 (0.073)*	0.218 (0.074)**	0.467 (0.197)*	0.186 (0.157)
Observations	583	583	583	583	583
R-squared	0.46	0.46	0.48		
Country Effects	no	no	no	yes	yes
Year Effects	no	no	yes	no	yes

Robust standard errors are in parentheses. * significant at 5%; ** significant at 1%

Countries that have more foreign direct investment activity, as measured by the ratio of outward FDI stocks to GDP, experience lower tax rates. In column (1), a ten percentage point higher FDI ratio is associated with a 2.1 percentage point lower corporate tax rate; columns (2) to (4) also report a negative and statistically significant relationship between outward FDI activity and tax rates. This finding corroborates the expectation that more internationally integrated countries face a greater incentive to choose lower tax rates due to the enhanced responsiveness of the tax base.

An alternative measure of openness to foreign direct investment would be to consider inward flows or stocks of FDI; however, one might be concerned that this measure in part captures the fact that countries with low tax rates attract more inward foreign direct investment.⁶

An additional alternative is to use other measures of international openness. For example, one might employ a policy-based measures, such as that of Quinn. This measure is based on IMF data on capital controls, discussed in Quinn (1997). Using this measure instead provides broadly consistent results for Columns (1) to (3), where greater capital market openness is associated with lower tax rates, although these results are only statistically significant with 90% confidence. Once country-specific effects are included, the coefficient on this variable is no longer statistically significant, likely due to the fact that the variation in this variable is primarily due to cross-section variation, rather than variation over time within countries.⁷

Columns (1) to (3) indicate that countries with larger economies choose higher corporate income tax rates, fitting the expectation that such economies should be more insulated from the pressures of tax competition. The point estimate from column (1) indicates that an economy one percent larger chooses a corporate income tax rate that is 1.3 percentage points higher. When country effects are included in columns (4) and (5), however, this relationship is not apparent.

Results also indicate that richer economies (measured by their GDP per capita) choose lower tax rates; this result is also not robust to the inclusion of country effects. In four of the five specifications, a leftist government (defined such that the executive and legislature are both left parties) is associated with higher corporate tax rates.

⁶ In a similar vein, one might be concerned that high tax rates would be correlated with a high stock of outward foreign direct investment, as firms respond to higher taxation by undertaking more investment abroad. However, this influence would work against the finding here, which indicates that more internationally integrated domestic firms are associated with *lower* tax rate choices at home.

⁷ Tables of results for such measures are available upon request.

The inclusion of a time trend in column (2) supports the notion that corporate tax rates are falling over time, at a pace of approximately 1 percentage point per decade, *ceteris paribus*. Year-level fixed effects, included in specifications (3) and (5), are typically statistically significant and more negative in later years.

Turning to the measures of European integration, the results indicate that EU member countries generally choose lower tax rates than non-members, although this result is only estimated with 95% confidence in three of the five specifications. Those countries applying to be EU members or awaiting membership have larger and more statistically significant negative effects on their choice of corporate tax rate. Applicant countries choose rates that are typically eight percentage points lower than other countries, *ceteris paribus*.

Recall from Table 1 that applicant countries are both geographically and chronologically diverse. All of these specifications were also estimated excluding the (ten) recent central and eastern European accession countries. In every case, the estimated effect of the European integration process on tax rates was quite similar and statistically significant.

Tax Revenue Specifications

Table 4 reports five regressions that explain corporate income tax revenues relative to GDP for the same sample of 36 OECD and European countries between 1979 and 2002. Column (1) considers the simple relationship between the tax rate and corporate revenues, finding a parabolic relationship, illustrated in Figure 4. The shape of this curve is intuitively plausible, implying that revenues increase with the tax rate at a decreasing rate, until the tax rate reaches a certain point, after which revenues decrease with the tax rate at an increasing rate. The implied revenue maximizing tax rate is 32%.^{8,9}

⁸ If $\text{Rev}/\text{GDP} = .158T - .245T^2$, then the revenue-maximizing tax rate is calculated by setting $dR/dT=0$, so that $.158 - 2*.245 T = 0$, so $T=0.32$.

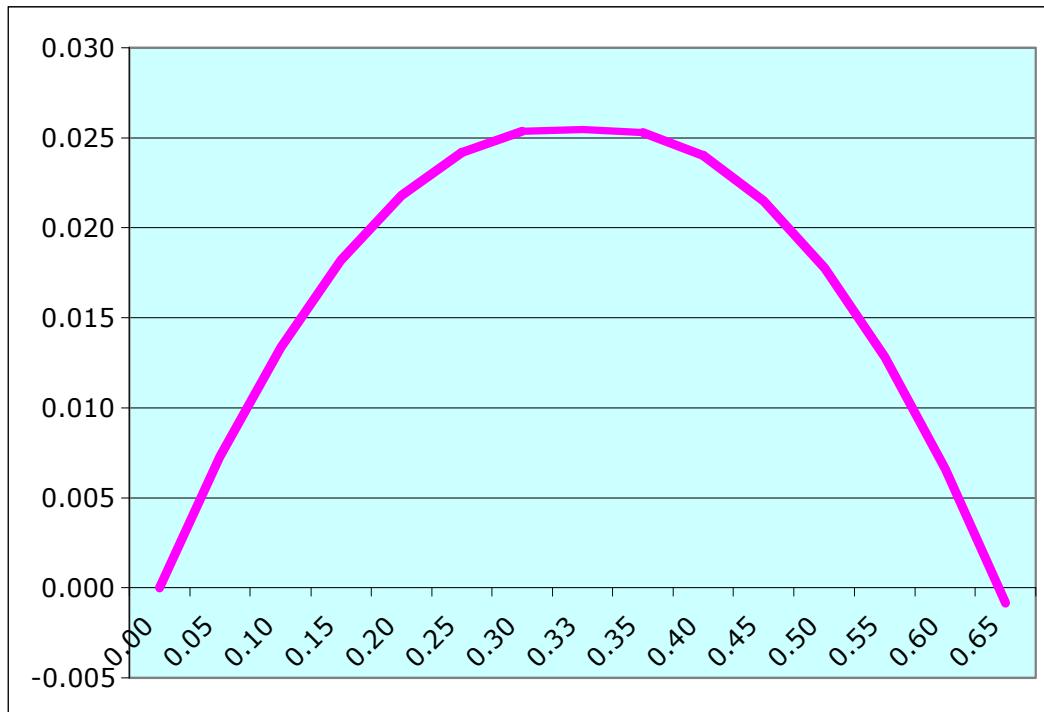
⁹ Here revenues are scaled by GDP in order to generate useful comparisons across countries. This is necessary in order to have a meaningful interpretation of regression coefficients. Thus, the “revenue maximizing” tax rate refers to the tax rate that maximizes the amount of revenue collected *relative to GDP*. When the regression is considered in levels instead (not scaled by GDP), one finds a very similar revenue maximizing tax rate, but the coefficients are more difficult to interpret. Of course, it is possible for the ratio of revenue to GDP to decrease even at times when absolute revenues are increasing. However, the relationship between GDP and tax rates is not modeled here and lies outside the scope of this analysis. It is important to emphasize that the revenue maximizing tax rate considered in this analysis may not be optimal, even from the perspective of a government official.

Table 4: Regressions for Corporate Income Tax Revenue/GDP, 1979-2002

	(1)	(2)	(3)	(4)	(5)
tax rate	0.158 (0.018)**	0.146 (0.025)**	0.136 (0.018)**	0.098 (0.020)**	0.078 (0.020)**
tax rate ²	-0.245 (0.027)**	-0.171 (0.044)**	-0.180 (0.030)**	-0.110 (0.038)**	-0.072 (0.039)
profit rate		0.105 (0.012)**			
corp. share		0.040 (0.009)**			
credit		0.005 (0.001)**	0.010 (0.001)**	0.012 (0.001)**	0.013 (0.001)**
mixed		-0.001 (0.001)	0.005 (0.001)**	0.006 (0.001)**	0.006 (0.001)**
growth			0.062 (0.024)*	0.046 (0.024)	0.044 (0.024)
unemployment			-0.010 (0.012)	-0.038 (0.012)**	-0.044 (0.012)**
ln(gdp p-c)			0.004 (0.001)**	0.003 (0.001)**	0.001 (0.001)
EU*tax				0.074 (0.017)**	0.062 (0.016)**
EU*tax ²				-0.147 (0.041)**	-0.128 (0.039)**
international*tax					0.041 (0.017)*
international*tax ²					-0.058 (0.040)
Observations	662	284	562	562	554
R-squared	0.08	0.43	0.18	0.24	0.28

Robust standard errors are in parentheses. * significant at 5%; ** significant at 1%. Specifications (4) and (5) include interaction terms for application and consideration countries. These were statistically insignificant and not reported for reasons of space.

Figure 4: Revenue Curve for Table 4, Column 1



Column (2) adds variables suggested by Section II above, the profit rate of firms as well as the size of the corporate sector, using OECD data on the corporate operating surplus and the share of corporate value added in GDP. The limitations of these variables are discussed in Section III above; note here that the sample size is dramatically reduced when these variables are employed. Results are plausible, indicating that countries with ten percentage points more corporate operating surplus receive one percentage point more corporate tax revenue relative to GDP. As the corporate share of the economy is ten percentage points higher, the corporate tax revenue ratio increases by 0.4 percentage points.

Column (2) also includes dummy variables to indicate the system of taxing international corporate income. The excluded group are those countries that employ a territorial system of corporate income taxation, exempting the foreign income of resident firms from taxation. A *credit* system taxes foreign income, but allows a foreign tax credit for taxes paid to foreign governments.¹⁰ Some countries have tax systems that I refer to as *mixed* since they contain elements of both the territorial and the tax credit systems. Results from column

¹⁰ This credit is typically limited to the domestic tax liability. Also, taxes on foreign income are typically only due when such income is repatriated to the home country; this is known as deferral.

(2) indicate that credit countries receive more revenue than do territorial countries.

In this specification, note that the parabolic relationship between tax rates and revenues is retained, despite controlling for measures of corporate profit and the size of the corporate sector. This is likely due in part to the fact that these measures are imperfect proxies for the underlying variables. Reducing taxable profits through profit shifting, for example, need not necessarily reduce the OECD measure of corporate operating surplus, as the tax authority's measure of taxable profits and the OECD measure likely differ substantially. In fact, firms may respond to taxation in several ways that are not captured by these two variables. For instance, they may undertake more tax preferred activities or they may do more tax planning, and such responses need not affect these measures.

Column (3) captures some of the same influences as equation (2) while retaining a higher number of observations due to the use of more commonly available variables. GDP per-capita is used to proxy for the size of the corporate sector. The GDP growth rate and the unemployment rate are used to proxy for cyclical variables that should influence the profitability of corporate firms. As expected, the GDP per-capita and growth rate variables have a positive influence¹¹ on revenues while the unemployment rate has a negative influence on revenues.¹¹ The coefficients on the tax variables (tax, tax²) are statistically similar to those found in previous equations. The coefficients on the tax system variables (credit, mixed) are now statistically significantly larger, indicating that tax credit countries can expect the ratio of corporate tax revenues to GDP to be 1 percentage point higher than exemption countries, while mixed system countries can expect the ratio of corporate tax revenues to GDP to be .5 percentage points higher.¹²

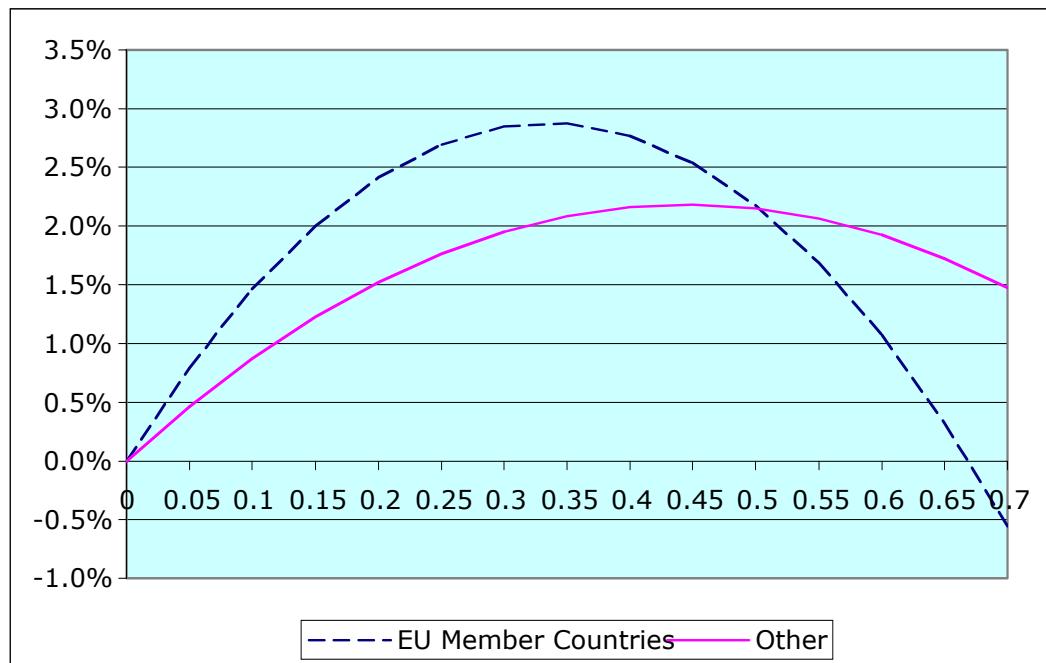
Column (4) investigates the hypothesis that EU member or candidate countries will experience a different relationship between their tax rates and tax revenues due to increasing market integration. In particular, it is expected that countries experiencing greater international integration should have higher revenues at low tax rates and lower revenues at high tax rates due to the greater responsiveness of the corporate tax base. This hypothesis was investigated by including interaction terms between the tax variables and the three indicators of European integration. In the case of the EU member interaction terms, the results confirmed expectations. EU member countries experience steeper revenue curves, as illustrated in Figure 5; this implies a lower revenue-maximizing tax rate for such countries. In the case of countries applying to be EU members,

¹¹ The unemployment variable is not statistically significant in this equation, although it is statistically significantly negative in all following specifications.

¹² The raw data indicate that credit countries average corporate revenue to GDP ratios of 2.9%, mixed countries average corporate revenue to GDP ratios of 2.4%, and exemption countries average corporate revenue to GDP ratios of 1.9%.

however, these interaction term coefficients are not statistically distinguishable from zero. (Although included in these specifications, they are omitted from Table 4 to conserve space.)¹³

Figure 5: Revenue Curves for EU Members and Others, Column (4) of Table 4



Column (5) examines the hypothesis that international integration changes the relationship between tax rates and government revenues more generally. It does this by including a set of interaction terms between the term *international* and both the tax rate and the tax rate squared. *International* is a dummy variable equal to one if the country has an above-average stock of foreign direct investment (FDI) relative to GDP for this sample of countries.¹⁴ Results indicate

¹³ These specifications were also estimated excluding the (ten) recent central and eastern European accession countries. The estimated effect of European integration on the relationship between tax rates and tax revenues was quite similar.

¹⁴ This is an arbitrary measure of internationalization, as there are many ways to measure global integration. By all measures examined, OECD countries became more “international” during this time period. FDI ratios were emphasized in this analysis as they best proxy for the ability of multinational firms to respond to international tax incentives. The total stock of direct investment (both inward and outward) relative to GDP has increased dramatically over this time period for these countries, from 14% of GDP in 1980 to 57% in 2002. Both inward and outward stocks of foreign direct investment have increased relative to GDP, by about 22 percentage points in each case. These upward trends are steady although more dramatic in the 1990s. Measures of capital

that countries with a higher stock of FDI relative to GDP see larger coefficients on both tax rate variables, indicating a steeper parabolic relationship between tax rates and revenues, although the coefficient on the tax² interaction term is only statistically significant with 85% confidence, not meeting the conventional benchmark. The EU interaction terms retain their prior sign, size, and statistical significance. The specifications in Table 4 are pooled regressions; those including year fixed effects are not reported here, but the results were similar.

In a separate analysis, I also ran the specifications of Table 4 with country specific effects.¹⁵ In general, the results were qualitatively in keeping with those reported in the article, but the tax coefficients were generally smaller and less reliably statistically significant. The tax coefficients in equations (1) and (3) met the typical benchmarks, but in equations (2), (4), and (5), the relevant t-statistics were between 1.0 and 1.8. While these results are less precise, it is important to remember that the inclusion of country level fixed effects generates a situation where the tax effects are estimated *solely* based on within-country variation rather than between-country variation. In this sample, the between-country variation is both larger and the main source of the estimation of the tax effects. Given that the essential focus of this investigation is on tax competition among countries, it is likely legitimate as well as necessary to utilize variation of this type.¹⁶

A final caveat is the omission of a variable measuring the breadth of the tax base. Comparing the main revenue specification, equation (4) above, to the theoretical decomposition of the section II, note that there is no measure of the tax base breadth, or f from equations (1) and (2). In practice, this variable is very difficult to measure. Still, omission of this variable could affect the analysis. If low tax countries are also those with a more comprehensive base, then it may appear that the corporate Laffer curve is steeper than it would be if measures of the tax base breadth were included.¹⁷

account liberalization would show a similar upward trend for this sample of countries during this time period, although the rate of liberalization was faster in the 1980s than the 1990s.

¹⁵ I used random effects; results are available upon request.

¹⁶ Further, if one employs country level fixed effects, one gets far less intuitively plausible revenue curves (unlike those charted in Figures 4 and 5). In particular, the presence of a constant term makes revenues positive even at zero or very high tax rates. In addition, the slope of the resulting revenue curves is almost flat and does not match well the cross country variation that we see in revenues, variation that is not used in deriving the fixed effects results.

In addition, concerns regarding other unobserved variables driving the tax results appears theoretically unlikely. In particular, I have included all of the country-level variables that we have a theoretical basis for expecting to be correlated with tax revenues. None of these inclusions have eliminated the tax effects of the article. Thus, while it is possible that some third influence is correlated with tax rates that influences revenues as well, that explanation for these results is unlikely. (And, such concerns also affect any study that relied on a cross-section analysis.)

¹⁷ However, there is some evidence that this concern is not dominant. For example, if one measures the correlation between country effective tax rates (which can be calculated from data

V. Conclusion

This article has investigated two aspects of international corporate taxation. First, it has considered the question of how governments set corporate tax rates. There is substantial empirical support for the idea that lower tax rates are chosen when the corporate income tax base is more elastic, which is likely to be the case for smaller countries, more open countries, and countries that are either current or prospective European Union members. In particular, a ten percentage point higher outward foreign direct investment stock is associated with a 2 percentage point lower corporate income tax rate. European integration also lowers tax rates. EU members choose lower tax rates than non-members, and EU prospective members choose rates that are approximately eight percentage points lower. The large size of the prospective member effect may reflect a deliberate attempt by countries joining the EU to simultaneously create an attractive environment for inward foreign direct investment.

Other determinants of corporate tax rates generally confirm theoretical expectations. Countries with higher individual income tax rates choose higher corporate rates, perhaps due to the fact that the corporate income tax serves as a backstop for the individual income tax. Countries with a greater role for government, and thus a higher government consumption ratio, choose higher tax rates, as do countries with more leftist governments in power.

The second focus of the article is on corporate tax revenues. The analysis indicates that the relationship between corporate tax rates and corporate tax revenues is parabolic, indicating a revenue-maximizing tax rate of approximately 32% for the entire sample period. Of course, this does not imply that this is the *optimal* tax rate. Also, while this is an estimate for the sample of countries and years studied in this analysis, it need not imply the revenue maximizing tax rate for any particular country or at any particular time.

Higher corporate profits, a greater corporate share in the economy, and a worldwide system of taxing resident firms are all found to increase corporate tax revenues. In addition, there is evidence that EU members, as well as countries that are simply more open to the world economy, face steeper tradeoffs between tax rates and tax revenues, such that revenues are higher at low tax rates and lower at high tax rates. This finding is compatible with the idea that that more integrated economies should face a more elastic tax base.

The parabolic relationship between tax rates and revenues documented here is unsurprising. At high tax rates, the elasticity of reported taxable income with respect to the tax rate may exceed one, implying that an increase in the tax

available from the U.S. Bureau of Economic analysis on U.S. multinational operations abroad) and the statutory tax rates used here, the correlation is quite high, 0.76.

rate will reduce tax revenues. Further, greater international integration provides additional methods for responding to taxation.

Corporations respond to taxation in several ways. Corporations may undertake real responses that lower overall economic activity or that move economic activity to more lightly taxed destinations. Such responses imply a resulting loss of national (and world) income. In addition, corporations may utilize tax avoidance activities. For instance, multinational firms may increase the shifting of income to low tax destinations through transfer price manipulation and other techniques. Such actions need not affect real economic activity, although the reporting of that activity would change.

Note that the policy implications of these types of responsiveness differ. Both real and financial responses may have implications for the optimal corporate income tax rate. Yet financial responsiveness also implies a greater role for other policy responses such as international coordination, efforts toward harmonization, greater enforcement of transfer pricing regulations, reductions in the loopholes that permit aggressive tax planning, and greater tax evasion penalties.

Appendix A: Data Sources

The countries included in the data set are the 30 OECD countries, with the addition of the six countries that became EU member countries in May 2004 that were not already OECD members. These countries are Cyprus, Estonia, Latvia, Lithuania, Malta, and Slovenia. (Hungary, the Czech Republic, Slovakia, and Poland were already OECD member countries.) The time period covered is 1979 to 2002. Eastern European countries are only included for the later part of the sample, from the mid-1990s.

Data on central government corporate income tax revenues, corporate value added, and corporate profits come from the OECD revenue and national accounts databases.¹⁸ Corporate value added is defined as the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by the corporate sector. The corporate profit rate is calculated as corporate operating surplus relative to corporate value added. Operating surplus is defined as the surplus accruing from production before taking account of any interest, rent or similar charges payable or received on financial or tangible non-produced assets borrowed, rented, or owned by the enterprise.

Data on statutory tax rates are taken from various editions of PriceWaterhouse Coopers' *Corporate Taxes: A Worldwide Summary*. The corporate tax system is also inferred from these publications; credit=1 indicates that the country taxes worldwide income of its' corporations, allowing a foreign

¹⁸ Some missing revenue data (for non-OECD countries, e.g.) are filled in using the Office of Tax Policy Research's *World Tax Database*. The data in both sources is comparable.

tax credit for foreign income taxes paid. Mixed=1 indicates that the country follows a tax system that has aspects of a credit system but also has aspects of a territorial system. Territorial systems exempt the foreign income of resident corporations from taxation. Data on individual tax rates are taken from various editions of PriceWaterhouse Coopers' *Individual Taxes: A Worldwide Summary* as well as the Office of Tax Policy Research *World Tax Database*, accessible online.

Data on GDP, population, growth rates, government consumption, and unemployment rates are from the World Bank's *World Development Indicators* database. GDP per-capita is derived from the GDP and population data. Data on inward and outward foreign direct investment stocks is from UNCTAD's foreign investment database. Data on political variables come from the World Bank's *Database of Political Institutions*, overviewed in Beck et al (2001). Data on economic openness was provided by Dennis Quinn.

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