Department of Economics *University of Victoria*
Working Paper EWP0301 **ISSN 1485-6441**

Capital Taxation, Globalization, and International Tax Competition

Kenneth G. Stewart
Associate Professor
Department of Economics
University of Victoria
Victoria, British Columbia
Canada V8W 3P5

Michael C. Webb
Associate Professor
Department of Political Science
University of Victoria
Victoria, British Columbia
Canada V8W 3P5

January 31, 2003

Abstract

The historical evolution of the corporate tax burden in the OECD nations is studied, beginning with an assessment of alternative measures of the burden. Descriptive analysis of these time series reveals no evidence of a competitive "race to the bottom" in capital taxation, and little evidence of even a harmonization of the tax burden. These conclusions for the OECD and Europe as a whole are confirmed by cointegration analysis, which does however indicate that there may have been some modest harmonization within smaller groups of countries.

I. Introduction

The intuition is simple and, at least at the level of popular debate and policy discussion, compelling: when corporations face few barriers to locating in the lowest tax jurisdiction, countries will be forced to compete for mobile capital with artificially low tax rates. In an era of "globalization"—that is, international economic integration and an accompanying increase in capital mobility—the implication is that governments may find themselves drawn into an internecine "race the bottom" in capital taxation, undermining the financing of the welfare state and the provision of public goods generally. Further, taxes must then come to fall unduly on immobile factors, specifically labor, exacerbating labor market rigidities and unemployment.

The popular appeal of this common sense fuels not only the fears of anti-capitalist activists and the hopes of some seeking lower taxes (e.g. *Economist* [1997], Lee and McKenzie [1989]), but also policy initiatives by governments struggling with persistent budget deficits. During the 1990s, both the OECD and EU took up the issue of "harmful tax competition," concluding that international cooperation was needed to prevent the erosion of corporate tax revenues and the introduction of distortions to the international allocation of capital [OECD, 1998].

The view that, in an attempt to prevent mobile capital from fleeing, governments are led to adopt inefficiently low capital taxes and a suboptimal level of public goods provision, was first articulated in modern form by Oates [1972]. The idea was subsequently formalized in now-canonical models by Zodrow and Mieszkowski [1986] and Wilson [1986]. Propelled by widespread interest in this issue, a large theoretical literature surveyed by Wilson [1999] explores extensions to the Zodrow-Mieszkowski-Wilson framework.

These models of tax competition among sub-national government authorities had an obvious application to the international context as barriers to international capital mobility eroded during the post-1945 period, a trend that accelerated in the 1980s. Building on the work of Diamond and Mirrlees [1971], tax economists like Gordon [1992] and Razin and Sadka [1991] argued that taxes on corporations were no longer a viable option for small open economies. Even if governments continued to levy corporate income taxes, the incidence would fall on labor in the form of lower wages. The claim that economic globalization undermined the taxing capacity of national governments became a staple of the critical scholarly literature on economic globalization in the 1990s [Teeple, 1995; Scholte, 1997; Strange, 1996].

Empirically there can be little doubt that corporate investment decisions are sensitive to tax policy. The substantial body of evidence supporting this not very surprising proposition has been surveyed by Hines [1999] and Devereux and Griffith [2002]. Recent contributions include Devereux and Griffith [1998], who study the determinants of investment location, and Devereux, Lockwood, and Redoano [2002], who estimate country reaction functions and find that countries compete over corporate tax rates.

Yet the sensitivity of corporations to taxation does not by itself imply that jurisdictions will be driven into a competitive race to the bottom in capital taxation, any more than the sensitivity of homeowners to property taxes implies that local governments will be driven into a race to the bottom in property tax rates. Different jurisdictions—be they municipalities, states, provinces, or countries—offer different bundles of public services, amenities, and other characteristics such as labor market institutions, environmental standards, public capital, and so on. Consequently tax rates may differ in equilibrium. This was exactly the point of the classic analysis of Tiebout [1956] who argued that, in contrast to the externality described by Oates, tax competition among local governments would result in efficient provision of public goods and different equilibrium tax rates.

In the contemporary context of the international tax competition controversy, some authors have recently explored a number of possibilities for how nations may differ in the bundles of characteristics they offer. For example, drawing on models of trade and economic geography, Baldwin and Krugman [2000] show that agglomeration economies can result in differential rates of capital taxation.

Alternatively, working within the public finance tradition of the Zodrow-Mieszkowski-Wilson model, Wooders, Zissmos, and Dhillon [2001] show that if public goods affect productivity positively then tax competition can result in an efficient level of public goods provision, or even an inefficient "race to the top" in which inefficiently high provision of public goods is financed through excessive taxation. Political economists examining the comparative economic performance of governments in the advanced capitalist countries have argued that high taxes will not discourage investment if those taxes are matched with good government services that improve the business environment. In this view, investors will be willing to pay high taxes in return for being able to take advantage of good infrastructure—both human and physical—and social stability financed by government spending, including spending on redistributive social welfare policies. This dynamic could, according to proponents, even lead to rising tax burdens, because economic globalization "has increased the importance of economic, political, and social stability to the investment decisions of mobile asset holders." [Garrett, 1998] This can make countries with activist social democratic governments attractive sites for foreign investment (Garrett [1998, p. 12]; see also Garrett [1995]). Extending this model, Rogowski [2000] argues that if preferences regarding the extent of government intervention vary across both national polities and investors, this dynamic could lead to greater cross-national diversity in standards (with no overall trend towards lower or higher standards), as different coun-

tries specialize in providing distinctive combinations of taxes, regulations and services that appeal to investors with different preferences.

Although these analyses make use of quite different modelling frameworks, all harken back to the simple logic of Tiebout. However the Tiebout model and its extensions to the international environment rely on the assumption that taxpayers cannot avoid paying taxes to a particular jurisdiction in order to receive the benefits of public services provided by that jurisdiction. This assumption is challenged by increasing opportunities for tax avoidance afforded by economic integration and the proliferation of tax havens [Griesik, 2001; Webb, 2001].

Other studies argue that international tax competition could be having economic effects even if it does not cause downward convergence in tax revenues. Gropp and Kostial [2000], for example, find that tax rates have a systematic impact on flows of foreign direct investment, with lower tax rates being associated with larger net inflows. Anecdotal evidence from countries like Germany also suggests that high statutory tax rates can discourage inward investment [Weichenrieder, 1996]. However, as other analysts have argued, even if economic globalization is raising the costs associated with high corporate tax rates, this does not mean that governments have the domestic political freedom to cut those rates. Partisan politics and deficit pressures could interfere with any smooth adjustment to a changed international economic context [Hallerberg and Basinger, 1998; Genschel, 1999], though over an extended period continued outflows of investment presumably would shrink the tax base enough to reduce corporate tax revenues even without a formal policy change.

In this paper we step back from this large theoretical literature and attempt a purely empirical assessment of the recent history of capital taxation in the OECD nations. We begin by asking whether corporate tax burdens have systematically fallen in recent decades; our conclusion is that, judging on the basis of available measures, they have not. We then turn to whether there has been any tendency towards tax harmonization—meaning a convergence in tax rates. Based on a descriptive analysis, our conclusion is that the evidence of this for the OECD and Europe as a whole is at best weak. Finally, we perform an inferential analysis of whether tax burdens move together; that is, whether they are cointegrated—a necessary condition for convergence. This suggests some tax harmonization among smaller groups of countries, but in a way that tends to be dependent on the tax measure used.

Establishing these basic empirical facts seems more important to us at this point in the debate than distinguishing between alternative theoretical explanations for why these patterns are what they are. Indeed, the data problems are such as to make it doubtful that it is even possible to distinguish empirically between, say, Baldwin-Krugman versus Wooders-Zissmos-Dhillon. These data problems are our opening theme, to which we now turn.

II. Measuring Corporate Tax Burdens

Any attempt to evaluate hypotheses about international tax competition faces serious measurement problems. In order to assess whether governments are being forced to cut and harmonize corporate tax burdens in response to international competitive pressures, we need to measure national tax levels in a way that permits comparison across countries and over time. This problem is not new. The earliest attempt to compare tax burdens cross-nationally that we have found was published in 1924, and concluded that "such an endeavor ... is fraught with great difficulty" [Seligman, 1924, p. 142]. Seligman compared tax burdens in only four countries—the United States, the United Kingdom, France and Germany. Since that time there has been considerable convergence in the kinds of taxes imposed by industrialized countries (though not necessarily tax burdens, as we shall see) and an international institution—the OECD—has devoted a great deal of energy to compiling data in ways that facilitate comparison. Even so, the circumstances encountered by Seligman have not changed as much as one might hope. Devereux, Lockwood, and Redoano [2002] have recently remarked that, with respect to international competition in taxes on corporate income, "Part of the reason for the lack of empirical evidence to date is the difficulty in developing appropriate measures of taxation."

Any comparative study of capital taxation is necessarily limited to the OECD countries. Outside the OECD capital flight tends to be heavily determined by factors not reflected in observed data, such as political uncertainty, the risk of expropriation, enforcement of laws relating to transfer pricing, and so on. Accordingly, even in the rare cases where data is available for non-OECD countries, it tends not to reflect the factors relevant to studying tax competition. Furthermore, policy concern about tax competition has been concentrated in the OECD economies, since it is they that account for the bulk of foreign direct investment and whose governments tend to have the highest levels of corporate taxation.

Generally speaking, our approach to the problem of measurement is to consider a number of the most plausible measures rather than rely solely on one. This section considers the possibilities, concluding that four measures are useful enough to be included in the empirical analysis to follow.[1]

Statutory Corporate Income Tax Rates

Statutory corporate income tax rates have been widely used as a simple, highly visible measure of the intent of policy makers. If governments were under serious international competitive pressure to reduce the tax burden facing internationally-mobile investors, one might expect to see statutory tax rates decline through a process of competitive tax cutting. In fact, statutory corporate tax rates have fallen substantially over the past 20 years, and this is often cited in popular critiques of globalization.

However, statutory rates are of little use as a measure of international tax competition, because

their impact depends critically on the definition of the tax base to which the rates are applied, and those bases vary widely across countries and over time. Most countries that cut corporate tax rates in the 1980s and 1990s simultaneously broadened the tax base by eliminating tax incentives, with the result that revenues earned from corporate income taxes rose in many countries. Revenue neutrality or even revenue enhancement were the goals in most countries, not reducing the corporate tax burden. Indeed, the twin patterns of declining statutory tax rates accompanied by the broadening of tax bases are cited by Devereux, Griffith, and Klemm [2002] as important stylized facts of the recent history of capital taxation.

Definitions of the base to which corporate taxes are applied continues to vary widely across countries (and across industry sectors within countries). Thus, while statutory rates may be of some use in assessing how rapidly governments can respond to changing international trends [Hallerberg and Basinger, 1998], they are not a good measure of the relative burden of corporate taxation across countries.

Marginal Effective Tax Rates

Tax economists have devoted considerable effort in recent years to assessing effective rates of taxation on new investments using a methodology first developed by King and Fullerton [1984] to calculate so-called *marginal effective tax rates* (METRs). These estimates take into account some of the complexities in national tax legislation (e.g. different tax treatment for different industries and for different methods of financing new investments). Proponents argue that they are useful for assessing micro-level decisions by corporations about the location of new investment. However, METRs are not appropriate for measuring the tax burden on existing capital, and therefore are not useful for this study or for assessments of fairness and equity in the tax system more generally [OECD, 2000, Chapter 5 and pp. 70-73]. METR estimates are highly sensitive to assumptions about tax policy, economic conditions and investor behavior, and are based on neoclassical theories of investment predicated on simplifying assumptions that may not be realistic. An important problem is that they generally neglect the possibility of international tax planning (e.g. substituting debt for equity in high-tax countries) in response to the provisions of the tax code that are incorporated into the METR analysis. Furthermore, the procedure generates a large number of METRs for each country, based on industry-specific tax provisions and different assumptions about economic conditions and the financing of investments; this makes it difficult to know which METRs to compare. Finally, given the technical difficulty associated with the procedure, estimates of METRs are available only for a limited number of countries at selected points in time. These characteristics of the methodology make it inappropriate for macro-level comparisons of the tax burden in different countries and for assessments of trends in taxation over time [OECD, 2000, pp. 70-73].

A. Average Tax Rates

The problems with statutory tax rates and METRs mean that we need to focus attention on actual taxes paid, standardized across countries and over time according to some plausible criteria. Actual taxes paid reflect the overall impact of the tax system (taking account of rates, bases, and special incentives), and thus are most useful for macro-level cross-national comparisons [OECD, 2000, p. 33; Mendoza, Razin, and Tesar, 1994, pp. 299-301]. According to OECD experts, they are especially useful for assessing questions about equity and fairness in the tax system [OECD, 2000, pp. 33-4], which is the central concern of the critics of globalization. Tax rates calculated in this fashion are sometimes called *average tax rates,* and there are a variety of ways they can be calculated. Specifically, we have a number of choices to make regarding both the taxes that are included in the comparison (the numerator) and the criteria for standardization (the denominator).

Measures of the Numerator

The starting point for measuring actual taxes paid is *corporate income taxes* (CIT). These are also sometimes called profit taxes, and are listed as code 1200 in the standard OECD classification scheme. They are a direct cost of doing business, and are large enough in most countries to constitute a significant cost. Thus, while the low cost of regulatory differences can sometimes account for the absence of regulatory harmonization or competitive deregulation [Spar and Yoffie, 1999], an absence of CIT harmonization could not be explained in this fashion. While corporate income taxes certainly are not the only determinant of the location of investment, they are a significant determinant [Hines, 2000].

However, CITs are not the only taxes businesses pay, nor are they necessarily the most costly. The other key taxes paid by corporations are *employer contributions to social security* (ECSS, code 2200 in the OECD classification scheme) and *payroll taxes* (PRT, code 3000). There is some controversy about whether these should be considered taxes on employers or taxes on employees. Many economists view them as the latter, believing that the burden of ECSS and PRT are borne by employees in the form of lower nominal wages. There are three reasons to question that argument, and to include ECSS and PRT in the corporate tax burden. First, the argument that the burden is borne by employees rests on the assumption that labour markets are perfect, which is clearly unrealistic. The persistence of high unemployment in continental European countries with high ECSS and PRT burdens indicates that labour markets are not perfect and that employers cannot pass the full cost of ECSS and PRT on to employees. Second, and perhaps even more important for our analysis, businesses themselves believe that they bear the burden of ECSS and PRT, as do employees. If businesses operate on the basis of this belief, then ECSS and PRT become part of the evaluation of comparative tax burdens.

Third, there appears to be some substitutability in practice between CIT, on the one hand,

and ECSS plus PRT on the other. Countries with high CIT burdens tend to have low ECSS plus PRT burdens and vice versa. For 1995–97, there was a negative correlation (Pearson's $r = -0.336$) between the two kinds of tax revenues measured as shares of GDP. At one extreme are countries like Australia and New Zealand, which have high CITs, no ECSSs, and negligible PRTs. At the other extreme are a number of continental European countries, which tend to rely heavily on ECSSs and PRTs, and to levy relatively low CITs (e.g. Austria, France, Germany).

Our approach is to consider tax burdens measured both as CIT alone, and as the combined burden of these major taxes, which we label ALL (ALL = CIT + ECSS + PRT). We feel that there is merit to both types of measures, but that as long as labor markets are not perfectly competitive, ALL is a better measure of the tax burdens that matter for corporate location decisions.[2]

Measures of the Denominator

Regardless of whether one uses CIT or ALL, some way is needed to standardize the measures across countries and over time. Again, there are a number of possible choices.

Corporate Profits For CIT, the ideal measure would be actual corporate profits. The problem is that no such measure exists in a form that can be used for cross-national comparisons.

Operating Surplus A number of analysts have used a measure called *operating surplus* (OS) reported in OECD national accounts data [Mendoza, Razin, and Tesar, 1994; Swank, 1998; Steinmo and Swank, 2002; Garrett, 1998; Garrett and Mitchell, 2001]. There are a number of problems with this measure that undermine its utility for this purpose. First, the aggregate operating surplus statistic represents all sectors of the economy, including government enterprizes and unincorporated enterprizes which are not subject to corporate taxation. This problem could be addressed by using the OECD's measure of *operating surplus for corporations and quasi-corporate enterprizes* (OSC, which is used by Mendoza et al.). The OECD calls this the "implicit tax rate approach" [OECD, 2000, p. 10]. However, this statistic is available for only a limited number of countries, and usually only for recent years. Second, both OS and OSC are gross of interest expenses, rent, royalties, and other amounts that are normally deductable in the calculation of taxable income and profits [OECD, 2000, p. 37]. This could seriously distort the calculation of the average tax rate, particularly during periods of high interest rates when operating surplus would greatly exceed actual profits. According to OECD experts, this problem "renders implicit corporate tax rates of questionable relevance" [OECD, 2000, pp. 10 (quote), 35]. The OECD is currently engaged in project to use firm-level data to adjust operating surplus data to more accurately reflect real profits, but this faces many challenges [Carey and Tchilinguirian, 2000].

Entrepreneurial Income An alternative measure of corporate profits that is available in OECD national accounts data is *entrepreneurial income* (EI). According to national accounts statisticians, this statistic "is close to the concept of profit and loss as understood in business accounting" [ISWGNA, 1993, p. 164]. It begins with the operating surplus for corporations and quasi-corporate enterprises, adds property income receivable on assets owned by the enterprises, and deducts interest and rent payments made by the enterprise. It thus corrects for the second problem identified in reference to the operating surplus measure. The key problem with this measure is that it is available only for a limited number of countries: for only seven of the OECD countries have we been able to obtain this variable back to 1965 or earlier—roughly the minimal sample size that would be needed for credible time series analysis. A second potential problem is that it may be calculated on a different basis by different countries, as measures of EI/GDP vary more widely than one would expect among countries with relatively similar economic structures. Thus, we do not have a great deal of confidence that EI is an accurate measure for standardizing corporate tax burdens across countries and over time.

Both OSC and EI suffer from three other problems. First, they are measures of the net income of the corporate sector, including both profitable corporations and loss-making corporations. The losses of some corporations therefore offsets the profit made by those corporations that actually pay taxes, thereby exaggerating the tax rate on profitable corporations [OECD, 2000, pp. 10, 37]. The general effect here is to exaggerate the impact of business cycles on the measure of the tax burden, and to produce a counter-intuitive relationship between economic conditions and tax rates. While one would normally expect tax burdens to rise during times of economic growth, when profits and tax revenues are higher, these measures produce the highest tax rates during economic recessions, because the denominator (OSC or EI) shrinks more than the numerator (tax revenues). The effective corporate tax rate can appear to be higher than the statutory rate (a logical impossibility) when the taxes paid by those corporations that are profitable are large in relation to the net profits of profitable and loss-making corporations combined [OECD, 2000, pp. 66-67]. These considerations were evident in our own exploratory work with EI, which yielded time series for average tax rates having implausible outliers.

Second, both OSC and EI are based on the profits that corporations declare in the countries in question. Reported profits underestimate real profits because of the use by corporations of tax havens and other mechanisms of international tax avoidance. Furthermore, given rapid growth in the use of tax havens and in the use of specialist tax advisors, it is likely that the underestimation of real profits due to this factor has increased over time [OECD, 2000, p. 71; Carey and Tchilinguirian, 2000, p. 25]. Third, neither OSC nor EI are useful for standardizing measures of ALL, since there is no reason to expect that there would be any relationship between these profit measures and ECSS

or PRT. The latter vary in line with the number of employees and their wages, not corporate profits. In fact, the calculation of OSC (and therefore also EI) involves the subtraction of ECSS and PRT from gross operating revenues.

These problems with the available measures of corporate profits mean that we need to find other variables to standardize tax burdens across countries and over time.

GDP While not perfect, standardizing tax burdens in relation to *gross domestic product* (GDP) is a very useful measure. Countries with high tax-to-GDP ratios undoubtedly have higher tax burdens than countries with low tax-to-GDP ratios, even though GDP does not come directly into the calculation of corporate taxes. The measure is available for all countries over the entire period, unlike the least-inaccurate measures of profits (i.e. EI). It also avoids the problem of underreporting profits; increased international tax avoidance would correctly indicate a declining corporate tax burden using this measure, while underreporting of profits could be associated with stable or even rising tax burdens using either OSC or EI as the denominator.

The key problem with using GDP as the denominator is that the relationship between corporate taxes and GDP depends on both the tax rate and the level of pre-tax corporate profits. Thus a decline in the CIT/GDP ratio could result from a decline in the tax rate, a decline in corporate profitability, or some combination of the two [OECD, 2000, pp. 8–9, 30]. OECD experts argue that this undermines the validity of CIT/GDP comparisons [OECD, 2000, Chapter 3]. Indeed, the failure to consider business cycle effects helps to account for the widespread findings of falling corporate tax rates in the early 1990s by critics of economic globalization (see, for example, Teeple [1995]). The end-point of the time period for many of these analyses was the early 1990s, when most OECD countries were experiencing slow growth or recession. By the same logic, recent claims that strong corporate income tax revenues in the late 1990s show that tax competition is a myth [Crook, 2001; Weiss, 1999] are weakened by their failure to acknowledge the historically high levels of corporate profits in those years.

However, in the absence of better measures, we believe that tax/GDP ratios are a useful indicator of real tax burdens, as long as the span of the sample is such that conclusions about long run trends will not be driven by the short run influence of the business cycle on the sample end points. This is one reason why we feel it is important to begin with a descriptive analysis of our average tax rates before proceeding to inferential analysis.

Total Government Revenues The other useful statistic for standardizing tax burdens across countries and over time is *total government revenues* (GTR). This is particularly useful for examining the globalization hypothesis, because the essence of this hypothesis is that governments are being forced to shift the tax burden away from corporations and onto less mobile tax bases (e.g. labour income, consumption). Indeed, this is commonly alleged by fiscal officials in OECD and EU reports

on the problem of tax competition [Carey and Tchilinguirian, 2000]. Using GTR as the denominator is perhaps the best way to measure the constraints facing government policy, because it allows us to directly measure the impact of alleged international constraints on governments' freedom of action. Using GTR as the denominator does raise a problem similar to that associated with using GDP, which is that the share of CIT in GTR depends on the level of corporate profits as well as the tax rate. Accordingly, as with GDP, it is useful to begin with a descriptive analysis of the data in order to verify that findings are not being driven by anomalous sample endpoints.

Conclusions

These considerations leave us with four average tax rates which, using obvious acronyms, we denote by CITGDP, CITGTR, ALLGDP, and ALLGTR. Constructing these with available data, ALLGTR and ALLGDP are available over 1965–1999 for all countries, with the exception Austria which begins in 1967. We have been able to obtain CITGTR and CITGDP over 1950–1999 for the majority of countries; the exceptions are Australia (1965), Belgium (1953), Italy (1951), Japan (1952), New Zealand (1965), Norway (1951), and Spain (1954).

The measures using CIT will appeal most to those who believe that employees bear the lion's share of the burden of certain other taxes nominally paid by corporations—ECSS and PRT. Conversely, the measures using ALL will appeal more to those who share business's view that a large part of the burden of paying these taxes falls on corporations. CITGTR and ALLGTR are the most useful measures for assessing the direct impact of international competitive pressures on government policy, though CITGDP and ALLGDP are also useful as measures of the alleged impact of international competitive pressures on national tax systems.

While none of these measures is perfect, they are the best available for the purposes of this research. The problems with them that we have acknowledged mean that it would be rash to attribute very much significance to conclusions specific to any one measure. Instead the findings that will be of interest will be ones that are robust across several tax rates. As we will see, the most robust such finding is that there is little evidence of a competitive race to the bottom in capital taxation; even any tendency towards a convergence of rates is remarkably weak.

III. Has There Been a Systematic Decline in Tax Rates?

In light of these issues of definition and measurement, it is useful to begin with a descriptive inspection of the data. The time series for the levels of our four tax rates are studied in Figures 1–8.

The odd-numbered Figures 1, 3, 5, and 7 show time plots of the individual country tax rate series for the 19 OECD economies, each figure corresponding to a different tax measure. Because of the difficulty of distinguishing any one series when this number of series are plotted, they have been

grouped somewhat arbitrarily in three panels as Scandinavia, the rest of Europe, and non-Europe. For a given tax rate, the panels of each figure use common units on the vertical axis, for ease of comparison across panels.

The even-numbered Figures 2, 4, 6, and 8 show these tax rates averaged across certain country groups: in panel (a) all OECD countries, and all OECD countries omitting Japan and Norway; and in panel (b) Europe, and Europe omitting Norway. The averages are recomputed with Japan and Norway omitted because, as the odd-numbered figures make clear, for some tax measures these countries are outliers for substantial portions of the sample period. It is useful to ensure that our findings are not sensitive to their inclusion.

Inspecting the odd-numbered figures, one dominant conclusion emerges: there has been no general tendency towards falling tax rates among the OECD countries. This result is robust to the tax measure used, and holds regardless of whether one considers the entire sample or focuses on the period since 1980, commonly thought to be the period of intensive globalization.

Certainly one can find a few instances of sustained declines for some countries in some periods. Corporate income taxes as a proportion of total government tax revenues (CITGTR shown in Figure 3) declined fairly steadily until the mid-1980s in Australia, Canada, New Zealand, and the United States, as this rate approached levels more typical of those prevailing in Europe. But since that time these rates have remained stable or increased modestly in these countries. Especially after 1980 it is very difficult to find examples of sustained declines in tax rates. This is important because many studies of economic globalization (e.g. Held et al. [1999]; Scholte [2000]) see it as a phenomenon that became important in the 1980s and accelerated in the 1990s.

These conclusions are confirmed by examining the evolution of tax rates averaged across countries, as presented in the even-numbered figures. On average across the OECD countries (panel (a) of Figures 2, 4, 6, and 8) most aggregate tax rates have remained stable or increased, especially in recent years. A possible exception is CITGTR, which declined fairly steadily in the early part of the sample, reaching its lowest value in 1983. However this rate has been stable since the mid-1970s, increasing markedly in the '90s, so that by 1996 the average rate was little different from what it was 30 years earlier. This approximate U-shaped pattern is even more extreme if the average is calculated omitting Japan and Norway. It also shows up in the average values of CITGDP and CITGTR for Europe (panel (b) of Figures 2 and 4), which show sustained declines throughout the 1950s and '60s. However to the extent that this constituted any "race to the bottom" it is very old news indeed: any decline in average rates in Europe was complete by 1980—perhaps even by the mid-'60s. Since that time these rates have tended to remain stable or increase, so that by the late '90s the average rate of CITGDP in Europe was higher than it was in the early '50s.

It might be thought that any race to the bottom in tax rates would be more evident if we limit ourselves to the European countries, which could be conjectured to be more subject to tax

competition. However a comparison of panels (a) and (b) of the even-number figures shows that this is not the case: the evolution of average tax rates in Europe has not been greatly different from that for the OECD as a whole.

In conclusion, a simple descriptive inspection of the data on average tax rates fails to support the popular assertion of a competitive race to the bottom in capital taxation among the developed nations. On the contrary, in the period since 1980—often suggested as an intensified period of globalization—to the extent that there is any trend at all in tax rates, it would appear to be upward. This conclusion is robust to alternative measures of average tax rates, whether all OECD countries or just the nations of Europe are considered, and the omission of the outlying series for Japan or Norway.

IV. Are Tax Rates Converging?

Although countries may not be engaged in a competitive race to the bottom in capital taxation, tax competition may nevertheless be leading to a harmonization of rates. Is there any evidence that countries are moving toward a common tax regime?

There are two ways of studying convergence: descriptively and inferentially. In this section we take the descriptive approach by considering the coefficient of variation (CV).[3] In the next section we turn to an inferential test of whether tax rates move together, a necessary condition for convergence.

The CV at time t is the ratio of the standard deviation of country tax rates to their average,

$$\sigma_t = \text{coefficient of variation} = \frac{s_t}{\bar{\tau}_t}. \tag{1}$$

Dividing by the mean adjusts the standard deviation for changes in the magnitude of the data over time, an adjustment that uses the same units of measure in the numerator and denominator. These sample means are just the values that we have examined in Figures 2, 4, 6, and 8. Since, as we have seen, there is little trend in these averages, this scaling is minor. Although elementary, we state this definition explicitly because it differs from the "index of σ-convergence" used by Boyle and McCarthy [1999, equation (1)], which they define in terms of the variance rather than the standard deviation.

The CVs for each of our four tax measures are plotted in Figures 9–12. As with our examination of the levels of average tax rates, in each case σ_t is calculated both for the OECD (panel (a)) and for Europe (panel (b)). In each case the sensitivity of σ_t to the omission of Japan and Norway is indicated.

Inspection of these time plots yields the following observations. Although there is some evidence of convergence in some tax measures—manifested as a steady decline in σ_t—this evidence is very mixed. It is sensitive both to the tax measure used and the country group examined. Consider the aggregate tax rate CITGTR shown in Figure 10. Across all countries (panel (a)) σ_t exhibits

a significant decline in the 1990s to a level well below historical values. But this turns out to be dependent on the inclusion of the outlying series for Japan and Norway. Recomputed to omit these countries, the variability of the tax burden in the mid-'90s turns out to be no different from what it was in the early '80s. Considering just Europe (panel (b)), the variability of this tax rate has declined in the '90s, but at the end of the sample was still greater than it was in the mid-'60s. Similar qualifications apply to the interpretation of Figure 9 for CITGDP. Indeed, if any one generalization is possible from the tax measures based on corporate income taxes—Figures 9–10—it is perhaps that any convergence of rates took place in the early part of the sample and had run its course by the early 1980s, if not earlier.

ALLGTR

It would seem that only one tax measure yields a series for σ_t that can be taken at all seriously as suggestive of convergence. The CV of ALLGTR, shown in Figure 12, has declined significantly since the early 1980s. In the case of Europe this decline is part of a longer trend dating from at least the mid-'60s.

Even so, these declines are less than compelling evidence of a systematic tendency towards convergence, for they cannot necessarily be distinguished from zero-drift unit root processes. Augmented Dickey-Fuller tests fail to reject the hypothesis of a unit root in these σ_t series, indicating that they are best described as I(1). This finding is robust to alternative implementations of the ADF test, including alternative augmenting lag lengths and the inclusion of a trend term. Computing the means of the first differences, standard t tests suggest that, although the drifts of these I(1) processes are negative, they may well not be significant. For the OECD the t statistic for the drift is $t = -1.298$; for Europe the evidence of a nonzero drift is slightly stronger, as Figure 12b suggests it to be, but is still only $t = -1.775$.

In this light, it would be premature to interpret the declines in the CV of ALLGTR as clear evidence of a systematic movement towards a common tax regime. Indeed, in the broader context of all four measures of capital taxation, the surprise in examining the coefficient of variation is just how weak is the evidence favoring convergence. If it were genuinely the case that international tax competition has forced a convergence of tax regimes in a manner that is as important and pervasive as the globalization literature suggests, it should show up much more clearly in the data than it does.

Conclusions

In conclusion, not only do capital tax rates not exhibit any systematic decline—the finding of the first part of our analysis—but even any trend toward harmonization is remarkably unpervasive. To the extent that this has occurred it was, according to most of our measures, a phenomenon that was largely complete by 1980, rather than accelerating at that time. In light of the enormous growth

and prosperity among the OECD economies in the last two decades, to the extent that there may have been any more recent tendency towards a further convergence of tax rates, it is difficult to see this as a matter of compelling policy concern.

A problem with the coefficient of variation as a "test" of convergence is that it is based on a choice of certain country groupings, in our case the OECD or Europe. It can always be argued that convergence is present among some countries, but is just not revealed by the particular groupings that have been chosen. For example, in this spirit Baldwin and Krugman [2000] inspect average tax rates for some European countries and observe that if one averages across the "core" of Germany, Benelux, France, and Italy versus the "periphery" of Spain, Portugal, Ireland, and Greece, then it appears that the core and periphery have converged.

Of course the problem with recomputing the CV among alternative permutations of countries (besides the degrees-of-freedom problem that would arise with smaller groups) is the data mining problem: by examining enough permutations it will always be possible to construct some CV series that appears to indicate convergence. We therefore turn to inferential methodology in which potentially converging country groups arise endogenously from the analysis.

V. Do Tax Rates Move Together in the Long Run?

Given the mixed evidence on convergence, it is useful to consider a weaker question: do tax rates move together in the long run?

On a priori grounds it would seem quite likely that the answer to this question is Yes. It is entirely plausible that tax rates, although no doubt able to diverge for limited periods, should ultimately be drawn back into some sort of conformity with the rates prevailing elsewhere in the developed world. Indeed, one interpretation of the globalization hypothesis is that it is not possible for one country to "go it alone" indefinitely; countries are not free to pursue tax policies that are radically inconsistent with those of other countries for indefinite periods of time. If this hypothesis is correct, the data should contain evidence that tax rates tend to move together in the long run.

Posing the question in this form is of interest because it corresponds to the time series econometricians' concept of *cointegration.* That is, one interpretation of the globalization hypothesis is that tax rates are cointegrated. We test this below. Somewhat surprisingly, our finding is that there is only modest evidence supporting even this very weak version of the globalization hypothesis.

Univariate Analysis

For cointegration methodology to be appropriate it is necessary that our tax rates follow integrated processes. That most macroeconomic time series are integrated is now well enough established that unit root tests to confirm this might be regarded as superfluous. However since tax rates are bounded in the range 0–1, treating them as I(1) is not acceptable as a maintained hypothesis.[4] Instead we

must ask whether the data support modelling tax rates in this way.

Table I reports augmented Dickey-Fuller unit root tests for our average tax rates. In view of the apparent absence of drift in these series, our ADF regressions include an intercept but no trend. It is often the case that autocorrelation in annual data is adequately treated with just a few augmenting lags, and this was confirmed for our series: examining the usual lag length criteria, two augmenting lags seemed adequate.

On the whole the frequency of rejection of the unit root hypothesis is low, suggesting that these series can be modelled as integrated processes. This is particularly true for the variables ALLGTR and ALLGDP: out of a total of 38 ADF statistics only three are significant at 10%, of which two are significant at 5%. This is about the same incidence of rejection that would be observed in artificially simulated unit root series.

Recall that the sample period for ALLGTR and ALLGDP is 1965–1999. By contrast, CITGTR and CITGDP are observed over 1950–1999 for most countries. The longer sample period will make it more difficult to treat bounded variables as non-mean reverting, and indeed this is reflected in the higher incidence of unit root rejections: out of 38 ADF statistics, nine reject at 10%, of which three reject at 5%, of which one rejects at 1%. Even so, perhaps the surprise in these results is that by far the majority of these series pass the unit root test. Since the fairly low incidence of unit root rejections may be surprising in view of the bounded nature of the variables, we double-check the possibility that some series may be stationary as part of our cointegration analysis; we comment further on this below. For the moment we proceed in the next section with reporting cointegration results for all variables.

The only noteworthy regularity among the ADF statistics is the rejection of unit root behavior for all four U.K. tax rates, suggesting that one may want to interpret the cointegration tests for this country with some caution.

A. Are Tax Rates Cointegrated?

The dominant methodology for studying cointegration is due to Johansen, which tests the cointegrating rank r of an error correction model. In a bivariate setting the possibilities are:

$r = 0$	absence of cointegration;
$r = 1$	cointegration;
$r = 2$	full cointegrating rank: variables are stationary and therefore cannot be cointegrated.

The hypothesis that there is no long run tendency for two tax rates to move together is the hypothesis that $r = 0$; our primary interest is in testing this against the alternative that $r = 1$. This is done with the maximum eigenvalue statistic, which is reported in Tables II–V.[5] For $n = 19$ countries there are $n(n-1)/2 = 171$ pairs, and so this is the number of statistics reported for each of our four tax rates.

The most striking feature of Tables II–V is that by far the majority of bivariate pairings are insignificant: the null of an absence of cointegration is not rejected. Equally surprising is the absence of strong evidence of cointegration between countries that one might expect to be linked. One example is Germany and Austria. Another is Canada and the United States, which are significant only for ALLGDP. Similarly, Australia and New Zealand are significant only for CITGTR. The Scandinavian countries show little association among themselves, although they are sometimes strongly linked to other northern European countries. Perhaps not surprisingly, Japan shows little association with other countries: in particular, it is significantly related to the United States only for ALLGTR.

In fact only one country pair is significant across all four tax rates: the Netherlands and the United Kingdom. This makes some sense in light of similarities between the two economies: both have high levels of inward and outward foreign direct investment, and the governments of both have consciously attempted to create attractive investment climates for overseas businesses seeking access to the EU market.

Several country pairs are significant for three of the four rates: Ireland-U.K., France-U.K., Denmark-U.K., Norway-U.K., Sweden-U.K., Belgium-Germany, Switzerland-Germany, Spain-Switzerland, U.S.-New Zealand, and U.S.-Austria. Again, some of these pairings make sense in terms of the countries' locations in the international economy and in relation to each other (e.g. U.K.-Ireland, U.K.-various northern European countries, Germany-Belgium), but others do not (e.g. U.S.-Austria, Spain-Switzerland).

Taken at face value, the frequency of the rejections is high enough that they cannot be dismissed simply as random outcomes. Rejection frequencies for Tables II–V are summarized in Table VI, and are higher than would likely be generated by non-cointegrated series. Consider a Monte Carlo experiment in which many independent I(1) series are generated. At a 10% significance level, 171 cointegration tests will generate 17.1 rejections on average, with a variance of 171(0.1)(0.9)=15.39. A two-standard deviation confidence interval for the number of rejections is therefore (9.25,24.95). Table VI reports rejections at this significance level of 31, 43, 26, and 40 for the four tax rates, all outside these confidence bounds.

It is possible, however, to question the plausibility of some of these rejections. One respect in which it is difficult to take the bivariate results at face value is that some suggest that many countries tie their tax policies to those of minor nations. If one were to take the results for ALLGTR literally, for example, one would believe that many nations coordinate their tax policies with Belgium; CITGTR suggests that the pivotal nations are Sweden or Canada. Findings like these may be driven by the univariate properties of the series: conceivably they could be the spurious outcome of univariate stationarity associated with the bounded nature of the variables. Recall that the ADF tests of Table I rejected unit root behavior for Belgium for ALLGTR, and for Sweden and Canada for CITGTR. If other tax rates are near-stationary then linear combinations will tend to appear stationary; the

presence of a unit root in the linear combination will be rejected, and the variables will be found to be cointegrated.

To examine this possibility, and as a double-check on the univariate ADF tests of Table I, Table VII summarizes test results for cointegrating ranks of $r = 1$ versus $r = 2$ for all country pairs. The alternative hypothesis of full rank can only hold if the series are stationary. (In the interests of space the test statistic values are not presented since the tables would parallel Tables II–V.) The rejection frequencies are very low: at most no more than would be found in randomly generated series under the null. This suggests that, to the extent that the bivariate tests of Tables II–V overstate the evidence favoring cointegration, it can nevertheless probably not be dismissed entirely.

Multivariate Cointegration

The evidence of some bivariate cointegration only occasionally extends to larger groups of countries.

Note first that there are many examples in which countries A and B are each cointegrated with country C, but not with each other—a logically inconsistent finding.

Table VIII summarizes the groups of three or more countries that are mutually bivariately cointegrated in Tables II–V. Such groups are specific to the choice of tax rate: none is robust across several rates. There are four instances in which as many as four countries are mutually bivariately cointegrated: Finland-Netherlands-UK-US in the case of ALLGTR, Belgium-Ireland-Sweden-UK in the case of ALLGDP, and Denmark-Netherlands-Sweden-UK in the case of CITGTR, and France-Germany-Netherlands-Switzerland in the case of CITGDP; the others are three-country groupings.

Are any of these country groups driven by a single stochastic trend? The results of multivariate Johansen maximum eigenvalue tests on the cointegrating rank are reported in Table VIII, based on a 10% significance level. Out of seventeen country groups there are seven that appear to be driven by a single common trend, including two of the four-country groups. As well, five of the seventeen show full-rank systems, a stronger indication of stationarity than was perhaps evident in the univariate or bivariate results. These findings are, of course, conditional on the chosen significance level. At a higher level of significance, say 5% or 1%, some of the full-rank systems would become less-than-full-rank.

It is important to bear in mind that there may be an element of data mining in these results. Beginning with 171 bivariate pairings across four tax rates, it may be that seventeen apparently significant multivariate groupings could arise purely as a matter of chance. It is unclear, for example, why the tax policies of Belgium, Canada, and Australia should be coordinated. At the same time, some groupings are quite plausible, including the two four-country ones.

Focusing on the seven groups that are driven by a single stochastic trend, is there any evidence that the tax rates of these countries are not just moving together in the long run, but are actually converging?

Convergence Revisited

Cointegration is a necessary but not sufficient condition for convergence. A tighter necessary condition is that pairwise deviations between countries cointegrate. This is the basis for what is now the dominant inferential convergence testing methodology, due to Bernard and Durlauf [1995]. However it is important to note that the Bernard-Durlauf criterion is still only a necessary but not sufficient condition; convergence requires as well that the pairwise deviations have mean zero, something that can only be tested by estimating univariate time series models for each.[6]

Technically, the Bernard-Durlauf methodology involves testing not just whether series are cointegrated—the subject of the previous section—but whether cointegrating country pairs are related by the cointegrating vector $[1; -1]$. Imposing this cointegrating vector means studying the pairwise deviations in the variables; the necessary condition for convergence is that these pairwise deviations are jointly driven by a single stochastic trend.

Table IX summarizes the results of this analysis, basing decisions on the maximum eigenvalue statistic using a 10% significance level. It reveals that five of the seven country groups are driven by a single stochastic trend. Not surprisingly, this consists primarily of European countries, although some groups include Australia or the United States.

For these country groups, then, the Bernard-Durlauf necessary condition for convergence is satisfied, suggesting that tax harmonization may be taking place among some small groups of countries. As with our other findings, this conclusion is conditional on the choice of tax measure: none of these country groups is robust across alternative tax rates.

VI. Conclusions

Does the increasing integration of the world economy constrain government policy-making in a way that favors capital over labor, as anti-globalization forces allege?

If so, it's awfully difficult to find it in the data. Simple descriptive inspection of the available historical time series for the post-war period fail to reveal anything even remotely resembling a "race to the bottom" in the tax burden imposed on corporations. Indeed, to the extent that there is any trend over the last two decades it would appear to be upward. Descriptive analysis also finds little consistent evidence of a harmonization of the corporate tax burden in the OECD or Europe.

These descriptive findings are confirmed by cointegration analysis, which finds only modest evidence that corporate tax burdens move together in the long run across countries. This suggests that there is relatively little to prevent most governments from going it alone in the formulation of autonomous tax policy, at least within the historical norms that have operated within the OECD—quite in contrast to the assertions of anti-globalization rhetoric and the fears of some governments.

Finally, following Bernard and Durlauf [1995], cointegration analysis offers a tight necessary

condition for convergence that only holds for a few small groups of (mainly European) countries. On the whole this serves to confirm our descriptive finding of an absence of tax harmonization among the OECD or European nations as a whole, but qualifies it by recognizing that harmonization may be taking place within smaller groups of countries. Which countries these are depends on which tax measure is used. This serves to highlight one key message of our analysis: conclusions about tax policy are highly sensitive to the choice of tax measure. There is little to be learned with any confidence from empirical analyses that fail to explore the robustness of findings to alternative measures.

Our finding of (at most) minimal convergence is consistent with a variety of arguments about the persistence of diversity cited in the introduction, but our analysis does not allow us to assess the empirical merits of these arguments. The lack of convergence is consistent with Tiebout models and with the idea that domestic politics and spending pressures offset international competitive pressure to cut corporate taxes, as well as with the view that capital mobility has been exaggerated. It is also possible that governments that fail to reduce the corporate tax burden are paying an increasing price in terms of foregone investment [Gropp and Kostial, 2000]. But if the competitive disadvantage caused by high tax rates was serious, one might expect this result to have shown up by now, after at least twenty years of economic globalization.

As with any empirical study, one can always question the adequacy of the both the data and the methodology. With respect to the former, we have emphasized the limitations of available measures of the corporate tax burden. With respect to the latter, inferential econometric techniques—cointegration or otherwise—are always best applied within a broader descriptive understanding of the data, and this is our reason for placing some emphasis on this. Whatever the limitations of this study may be, it does tend to place the burden of proof on those who advance international tax competition as a matter of urgent policy concern.

Notes

[1]For another detailed discussion of alternative measures of capital taxation see Devereux, Griffith, and Klemm [2001].

[2]An alternative measure of the numerator developed by Mendoza, Razin and Tesar [1994] and widely used in other studies [Steinmo and Swank, 2002; Garrett and Mitchell, 2001] adds together CIT, property taxes, taxes on financial transactions, and a portion of personal income tax revenues estimated to reflect the share of capital income (in contrast to labor income) in the total income of individual taxpayers. However this is not a useful measure of the tax burden on mobile corporations, since it includes taxes paid by individuals and because property taxes include those paid by homeowners (and, in any case, "real property is a potentially important tax base with a high revenue-raising potential since it is among the least mobile of all potential tax bases." [OECD, 2001, p. 33]

[3]The methodology of studying convergence has been the subject of much research over the last two decades in the literature on the growth of living standards. An important distinction in that literature is between σ- and β-convergence, terms due to Sala-i-Martin [1996]. In that terminology, we are here studying σ-convergence—the narrowing of the dispersion of a distribution over time; β-convergence refers instead to mobility within a distribution, something that is not of interest in the present context. In using the coefficient of variation to study σ-convergence we are employing what Friedman [1992], citing Hotelling before him, calls the "real test" for convergence.

[4]Since tax rates are bounded they cannot logically be integrated *in the population;* an integrated variable has infinite variance and so can wander arbitrarily far from any starting point. Despite this, we can nevertheless adopt as a modelling strategy that these series can be treated as I(1) *in the observed sample,* and that is our approach here. An alternative would be to model tax rates as fractionally integrated, which permits mean reverting behavior despite being nonstationary with an infinite variance. However the methodology of testing for fractional cointegration is still in its infancy, particularly in contexts in which the fractional order of integration is unknown a priori, as would be true of tax rates. As Robinson and Yajima [2002, p. 219] have remarked, "... Some empirical study of fractional cointegration has already been carried out ... However, rigorously justified procedures are currently in short supply ...". Furthermore there is some doubt that typical macroeconomic time series like ours are long enough to provide adequately precise estimates of the fractional order of integration, as Granger [1999] has argued.

[5]These tests are based on a certain specification for the underlying error correction model (ECM). Consistent with our ADF tests, we treat the series as univariate I(1) *without* drift. The implication of this is that the ECM should have no intercepts in the equations of the ECM, and no time trend in the cointegrating error. This corresponds to Option 2 of the EViews cointegration routine, identified by Franses [2001] as one of two "realistic special cases"—the other being the one corresponding to the series being univariate I(1) *with* drift.

[6]Applications of the methodology, including the original Bernard-Durlauf work, typically concern themselves only with testing the necessary condition, and not with sufficiency.

References

Baldwin, R., and P. Krugman, "Agglomeration, Integration, and Tax Harmonization," CEPR Discussion Paper no. 2630 (2000).

Bernard, A.B., and S.N. Durlauf, "Convergence in International Output," *Journal of Applied Econometrics* X (1995), 97–108.

Boyle, G.E., and T.G. McCarthy, "Simple Measures of Convergence in Per Capita GDP: A Note on Some Further International Evidence," *Applied Economics Letters* VI (1999), 343–347.

Carey, D., and H. Tchilingurian, "Average Effective Tax Rates on Capital, Labor and Consumption," Economics Department Working Papers No. 258 (Paris: OECD, 2000).

Crook, C., "Globalisation and its Critics: A Survey of Globalisation," *Economist* 29 September 2001.

Devereux, M.P., and R. Griffith, "Taxes and the Location of Production: Evidence from a Panel of US Multinationals," *Journal of Public Economics* LXIIX (1998), 335–367.

Devereux, M.P., and R. Griffith, "The Impact of Corporate Taxation on the Location of Capital: A Review," *Swedish Economic Policy Review, forthcoming* (2002).

Devereux, M.P., Griffith, R., and A. Klemm, "Have Taxes on Mobile Capital Declined?" Working paper, Institute for Fiscal Studies (2001).

Devereux, M.P., Griffith, R., and A. Klemm, "Corporate Income Tax Reforms and International Tax Competition," *Economic Policy* 35 (2002), *forthcoming.*

Devereux, M.P., Lockwood, B., and M. Redoano, "Do Countries Compete over Corporate Tax Rates?" working paper, University of Warwick Department of Economics (2002).

Diamond, P., and J. Mirrlees, "Optimal Taxation and Public Production, II: Tax Rules," *American Economic Review* LXI (1971), 261-278.

Economist, "The Disappearing Taxpayer," *Economist,* 31 May 1997.

Franses, P.H., "How to Deal with Intercept and Trend in Practical Cointegration Analysis?" *Applied Economics* XXXIII (2001), 577–579.

Frenkel, J., Razin, A., and E. Sadka, *International Taxation in an Integrated World* (Cambridge, MA: MIT Press, 1991).

Friedman, M., "Do Old Fallacies Ever Die?" *Journal of Economic Literature* XXX (1992), 2129–2132.

Garrett, G., "Capital Mobility, Trade, and the Domestic Politics of Economic Policy," *International Organization* IL (1995), 657–687.

Garrett, G., *Partisan Politics in the Global Economy* (Cambridge, UK: Cambridge University Press, 1998).

Garrett, G., and D. Mitchell, "Globalization, Government Spending and Taxation in the OECD," *European Journal of Political Research* 39 (2001), 145–177.

Genschel, P., "Tax Competition and the Welfare State," unpublished paper, Max Planck Institute for the Study of Societies, Cologne, Germany (1999).

Gordon, R.H., "Can Capital Income Taxes Survive in Open Economies?" *The Journal of Finance* XLVII (1992), 1159–1180.

Granger, C.W.J., "Aspects of Research Strategies for Times Series Analysis," presentation to the conference on *New Developments in Time Series Analysis,* New Haven, Connecticut, October 1999.

Gresik, T.A., "The Taxing Task of Taxing Transnationals," *Journal of Economic Literature* XXXIX (2001), 800–838.

Gropp, R., and K. Kostial, "The Disappearing Tax Base: Is Foreign Direct Investment (FDI) Eroding Corporate Income Taxes?" IMF Working Paper WP/00/173 (2000).

Hallerberg, M., and S. Basinger, "Internationalization and Changes in Tax Policy in OECD Countries: The Importance of Domestic Veto Players," *Comparative Political Studies* XXXI (1998), 321–352.

Held, D., McGrew, A., Goldblatt, D., and J. Perraton, *Global Transformations: Politics, Economics, and Culture* (Palo Alto, CA: Stanford University Press, 1999).

Hines, J.R., Jr., "Lessons from Behavioral Responses to International Taxation," *National Tax Journal* LII (1999), 305–322.

Hines, J.R., Jr., "International Taxation," *NBER Reporter* (2000), 10–14.

ISWGNA [Inter-Secretariat Working Group on National Account], *System of National Accounts 1993* (Brussels, New York, Paris, Washington D.C.: Eurostat, IMF, OECD, UN, World Bank, 1993).

King, M.A., and D. Fullerton, *The Taxation of Income from Capital* (Chicago, IL: University of Chicago Press, 1984).

Lee, D.R., and R.B. McKenzie, "The International Political Economy of Declining Tax Rates," *National Tax Journal* ILII (1989), 79–83.

Mendoza, E.G., Razin, A., and L.L. Tesar, "Effective Tax Rates in Macroeconomics: Cross-Country Estimates of Tax Rates on Factor Incomes and Consumption," *Journal of Monetary Economics* XXXIV (1994), 297–323.

Oates, W.E., *Fiscal Federalism* (New York, NY: Harcourt-Brace-Jovanovich, 1972)

OECD *Harmful Tax Competition: An Emerging Global Issue* (Paris: OECD, 1998).

OECD, "Tax Burdens: Alternative Measures," *Tax Policy Studies* No. 2 (Paris: OECD, 2000).

OECD, "Tax and the Economy: A Comparative Assessment of OECD Countries," *Tax Policy Studies* No. 6 (Paris: OECD, 2001).

Razin, A., and E. Sadka, "International Tax Competition and Gains from Tax Harmonization," *Economic Letters* XXXVII (1991), 69–76.

Robinson, P.M., and Y. Yajima, "Determination of Cointegrating Rank in Fractional Systems," *Journal of Econometrics* CVI (2002), 217–241.

Rogowski, R., "Globalization and Governance: Implications of Tiebout Models for a World of Mobile Factors," paper presented at the 2000 Annual Meeting of the American Political Science Association, Washington, D.C.

Sala-i-Martin, X., "Regional Cohesion: Evidence and Theories of Regional Growth and Convergence," *European Economic Review* XL (1996), 1325–1352.

Scholte, J.A., *Globalization: A Critical Introduction* (New York, NY: St. Martin's Press, 2000).

Scholte, J.A., "Global Capitalism and the State," *International Affairs* LXXIII (1997), 427-452.

Seligman, E.R.A., "Comparative Tax Burdens in the Twentieth Century," *Political Science Quarterly* XXXIX (1924), 106–146.

Spar, D., and D. Yoffie, "Multinational Enterprises and the Prospects for Justice" *Journal of International Affairs* LII (1999), 557–581.

Steinmo, S., "The End of Redistribution? International Pressures and Domestic Tax Policy Choices," *Challenge* (November-December 1994), 9–18.

Steinmo, S., and D. Swank, "The New Political Economy of Taxation in Advanced Capitalist Democracies," *American Journal of Political Science* ILVI (2002), 642–655.

Strange, S., *The Retreat of the State: The Diffusion of Power in the World Economy* (Cambridge, UK: Cambridge University Press, 1996).

Swank, D., "Funding the Welfare State: Globalization and the Taxation of Business in Advanced Market Economies," *Political Studies* ILVI (1998), 671–692.

Tiebout, C.M., "A Pure Theory of Local Expenditures," *Journal of Political Economy* LXIV (1956), 416–424.

Tanzi, V., *Taxation in an Integrating World* (Washington, D.C.: Brookings Institution, 1995).

Teeple, G., *Globalization and the Decline of Social Reform* (Toronto: Garamond Press, 1995).

Webb, M.C., "Reconciling Practice and Structure: US Regulation of Transfer Pricing by Transnational Firms," in T.J. Sinclair and K.P. Thomas, eds. *Structure and Agency in International Capital Mobility* (New York, NY: Palgrave, 2001), 129–152.

Weiss, L., "Globalization and National Governance: Antinomy or Interdependence?" *Review of International Studies* XXV (Special Issue) (1999), 59–88.

Weichenrieder, A., "Fighting International Tax Avoidance: The Case of Germany," *Fiscal Studies* XVII (1996), 37–39.

Wilson, J.D., "A Theory of Interregional Tax Competition," *Journal of Urban Economics* XVIV (1986), 296–315.

Wilson, J.D., "Theories of Tax Competition" *National Tax Journal* LII (1999), 269–304.

Wooders, M.H., Zissimos, B., and A. Dhillon, "Tax Competition Reconsidered," working paper, University of Warwick Department of Economics (2001).

Zodrow, G.R., and P. Mieszkowski, "Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods," *Journal of Urban Economics* XVIV (1986), 356–370.

Table I: Augmented Dickey-Fuller Tests

	CITGDP	CITGTR	ALLGDP	ALLGTR
Australia	-0.590	-1.073	-0.479	-0.899
Austria	-1.586	-1.519	-0.570	-1.057
Belgium	-1.158	-2.343	-2.435	-3.436**
Canada	-2.395	-2.716*	-0.319	-1.713
Denmark	-1.173	-2.650*	-1.731	-2.193
Finland	-1.989	-2.059	0.361	0.421
France	-2.721*	-2.424	-1.703	-1.965
Germany	-1.259	-1.257	-2.431	-2.070
Ireland	-0.566	-1.047	-1.196	-0.163
Italy	-1.111	-1.426	-1.965	-2.240
Japan	-1.862	-1.994	-1.865	-2.203
Netherlands	-3.136	-3.135**	-2.028	-1.964
New Zealand	-2.179	-2.757*	-1.890	-2.366
Norway	-1.772	-2.169	-1.806	-1.777
Spain	-2.129	-2.126	-1.171	-0.531
Sweden	-2.354	-3.936***	-1.856	-1.820
Switzerland	-3.351**	-1.892	-1.585	-2.171
UK	-3.281**	-3.092**	-3.256**	-2.698*
US	-1.975	-2.001	-1.333	-2.091

Notes: All statistics are obtained from ADF regressions having an intercept but no trend, using an augmenting lag length of two. Rejections of the unit root hypothesis are indicated by *(10%), **(5%), and ***(1%). The series ALLGTR and ALLGDP are for 1965–1999, except Austria which begins in 1967; MacKinnon critical values for the full sample size are -2.616 (10%), -2.956 (5%), -3.650 (1%). The series CITGTR and CITGDP are for 1950–1999 except Australia (1965), Belgium (1953), Italy (1951), Japan (1952), New Zealand (1965), Norway (1951), and Spain (1954); MacKinnon critical values for the full sample size are -2.560 (10%), -2.924 (5%), -3.574 (1%).

Table II: Johansen Maximum Eigenvalue Tests for Cointegration: CITGDP

	Europe									Scandinavia				Pacific			North America	
	UK	NL	Belgium	France	SZ	Germany	Austria	Italy	Spain	Denmark	Norway	Sweden	Finland	AL	NZ	Japan	US	Canada
Ireland	14.63*	14.50*	12.84	13.49	14.07*	5.56	3.06	8.59	5.40	6.19	3.64	10.08	10.97	6.13	7.50	5.93	7.76	13.24
UK		14.18*	11.47	18.31**	17.18**	13.54	13.21	10.11	7.38	18.83**	14.12	20.77***	12.84	9.39	7.93	6.69	12.21	14.70*
Netherlands			7.38	17.77**	17.21**	15.82**	10.24	10.35	10.06	21.59***	6.53	14.05	16.29**	4.62	7.75	5.87	12.66	13.26
Belgium				10.19	15.64*	21.95***	5.21	8.71	4.24	4.77	5.39	8.04	7.61	9.55	10.29	8.03	7.76	7.52
France					22.30***	15.33*	10.66	10.34	13.04	10.13	9.03	10.51	13.92*	7.76	8.23	6.22	10.28	14.68*
Switzerland						16.11**	13.37	14.46*	14.23*	14.58	12.28	11.52	15.80**	9.89	8.44	10.55	17.69**	15.74**
Germany							3.56	9.66	6.97	8.64	5.53	9.18	6.79	5.87	9.13	8.22	7.42	8.77
Austria								6.20	7.17	3.90	6.68	9.57	10.55	12.61‘	8.98	8.73	16.56**	10.26
Italy									6.45	12.17	12.07	6.76	7.07	10.80	11.53	13.02	6.62	12.15
Spain										11.10	9.41	16.37**	5.01	10.48	13.45	9.03	12.61	5.85
Denmark											7.61	11.13	8.30	10.09	7.86	4.89	10.01	9.89
Norway												7.44	7.07	4.73	6.75	10.54	11.34	8.15
Sweden													13.97*	11.53	8.33	6.21	11.27	11.84
Finland														9.64	11.25	9.04	9.84	7.33
Australia															11.65	11.75	10.36	7.73
New Zealand																6.47	16.95**	10.82
Japan																	7.92	24.51***
US																		6.28

Notes: CITGDP is observed over the sample period 1950–1999, except for Australia (1965), Belgium (1953), Italy (1951), Japan (1952), New Zealand (1965), Norway (1951), and Spain (1954). Rejections of the null hypothesis of an absence of cointegration are indicated by *(10%), **(5%), and ***(1%), based on Osterwald-Lenum critical values of 13.75 (10%), 15.67 (5%), 20.20 (1%).

Table III: Johansen Maximum Eigenvalue Tests for Cointegration: CITGTR

	Europe									Scandinavia				Pacific			North America	
	UK	NL	Belgium	France	SZ	Germany	Austria	Italy	Spain	Denmark	Norway	Sweden	Finland	AL	NZ	Japan	US	Canada
Ireland	1.36	12.65	11.96	12.96	6.43	8.14	3.59	6.86	5.92	9.11	6.40	17.92**	8.04	4.03	11.36	11.50	7.26	17.48**
UK		16.05**	10.49	17.78**	17.09**	13.06	12.77	10.58	9.24	17.24**	15.63*	18.33**	12.03	7.09	10.97	12.45	10.40	14.94*
Netherlands			10.70	13.53	17.60**	14.00*	11.60	7.89	12.16	16.86**	8.70	18.95**	12.76	7.09	9.93	12.63	10.31	12.65
Belgium				7.18	6.39	15.93**	6.62	7.55	10.55	6.73	6.78	9.63	7.15	13.17	17.25**	12.75	9.60	11.35
France					8.95	11.71	10.79	12.79	9.92	8.83	7.98	30.45***	9.36	7.18	11.65	14.17*	11.73	22.89***
Switzerland						7.69	7.43	9.58	13.85*	10.86	9.56	21.09***	7.89	5.82	11.39	8.37	10.14	17.20**
Germany							6.75	11.29	6.67	11.62	7.66	20.50***	7.83	6.57	13.67	10.69	7.02	10.63
Austria								6.05	10.76	9.23	8.28	18.12**	10.41	12.76	11.86	12.40	17.58**	15.89**
Italy									5.58	6.67	8.91	7.66	5.38	11.90	11.50	7.14	8.92	20.09**
Spain										9.79	8.85	16.68**	6.78	7.78	21.00***	11.46	29.78***	7.28
Denmark											15.87**	20.46***	10.95	15.60*	14.04	9.44	9.40	10.43
Norway												9.50	8.63	6.66	10.70	6.12	11.66	10.53
Sweden													18.85**	11.25	15.37*	12.26	14.65*	21.77***
Finland														11.55	15.06*	16.48**	13.62	10.76
Australia															18.82**	4.83	18.56**	13.18
New Zealand																10.81	20.20***	18.98**
Japan																	6.00	16.31**
US																		8.62

Notes: CITGDP is observed over the sample period 1950–1999, except for Australia (1965), Belgium (1953), Italy (1951), Japan (1952), New Zealand (1965), Norway (1951), and Spain (1954). Rejections of the null hypothesis of an absence of cointegration are indicated by *(10%), **(5%), and ***(1%), based on Osterwald-Lenum critical values of 13.75 (10%), 15.67 (5%), 20.20 (1%).

Table IV: Johansen Maximum Eigenvalue Tests for Cointegration: ALLGDP

	Europe									Scandinavia				Pacific			North America	
	UK	NL	Belgium	France	SZ	Germany	Austria	Italy	Spain	Denmark	Norway	Sweden	Finland	AL	NZ	Japan	US	Canada
Ireland	18.94**	7.10	14.92*	6.79	8.98	11.91	6.86	6.97	10.83	12.13	5.27	14.24*	6.15	7.43	6.27	15.11*	5.45	5.19
UK		15.00*	15.48*	15.99**	13.23	16.43**	14.11*	12.81	13.59	20.27***	14.17*	13.85*	13.85*	16.17**	12.26	11.11	13.60	12.37
Netherlands			9.48	5.89	9.77	9.63	8.52	5.95	9.81	10.12	7.66	7.24	13.69	11.71	11.49	9.57	16.89**	10.61
Belgium				10.24	8.69	10.58	12.28	10.25	15.13*	12.38	16.62**	29.69***	8.61	9.46	11.34	9.02	12.63	8.99
France					8.19	19.25**	11.38	20.91***	10.41	10.94	6.30	8.25	4.30	7.83	9.54	9.12	4.36	4.38
Switzerland						13.89*	8.91	7.41	10.22	7.94	8.01	8.66	8.58	9.69	8.43	9.43	10.64	7.22
Germany							5.12	19.84***	11.58	10.57	8.45	8.58	10.16	14.11*	8.75	9.45	11.47	9.35
Austria								7.84	5.36	10.61	7.88	6.74	4.73	5.71	4.88	6.89	6.68	7.66
Italy									10.01	11.21	4.69	8.13	5.31	7.18	5.58	6.37	5.79	5.85
Spain										8.14	5.07	5.77	5.70	4.17	3.16	7.27	7.41	9.98
Denmark											13.49	8.45	5.63	12.72	8.76	8.19	5.47	6.45
Norway												11.11	5.19	9.65	10.77	12.24	7.09	7.07
Sweden													5.76	6.06	6.70	9.23	7.04	5.45
Finland														14.23*	6.49	11.10	9.39	14.85*
Australia															8.70	8.84	8.33	10.71
New Zealand																7.73	7.96	7.73
Japan																	11.42	7.01
US																		14.47*

Notes: For all countries ALLGDP is observed over the sample period 1965–1999, except Austria which begins in 1967. Rejections of the null hypothesis of an absence of cointegration are indicated by *(10%), **(5%), and ***(1%), based on Osterwald-Lenum critical values of 13.75 (10%), 15.67 (5%), 20.20 (1%).

Table V: Johansen Maximum Eigenvalue Tests for Cointegration: ALLGTR

	Europe									Scandinavia				Pacific			North America	
	UK	NL	Belgium	France	SZ	Germany	Austria	Italy	Spain	Denmark	Norway	Sweden	Finland	AL	NZ	Japan	US	Canada
Ireland	14.66*	10.01	13.81*	6.60	7.81	7.91	8.20	5.62	3.37	10.02	4.18	6.23	4.75	4.35	9.02	7.34	11.56	5.29
UK		14.74*	12.61	11.30	11.93	11.51	13.50	10.80	15.73**	13.49	9.11	10.43	14.07*	14.29*	9.03	8.87	17.25**	8.08
Netherlands			13.39	11.17	8.14	5.82	8.76	6.14	6.95	8.68	4.72	7.34	16.62**	7.13	11.07	8.76	16.94**	7.98
Belgium				10.92	14.70*	18.51**	15.74**	16.24**	20.74***	11.34	21.05***	24.42***	14.43*	17.29**	18.77**	16.13**	12.69	17.50**
France					20.43***	7.57	5.72	11.18	18.19**	15.96**	8.25	6.82	8.58	11.98	21.82***	8.38	12.56	8.36
Switzerland						14.17*	9.18	11.36	19.53**	7.20	9.73	12.31	8.03	11.40	13.05	9.24	11.97	10.41
Germany							3.61	11.15	12.42	6.13	7.67	6.86	9.38	6.14	7.28	7.28	9.79	7.03
Austria								8.04	4.81	7.62	5.38	9.64	9.90	4.78	5.59	7.84	18.42**	9.35
Italy									9.60	8.67	10.02	6.77	6.08	8.03	12.78	6.78	14.16*	8.03
Spain										12.19	17.81**	7.97	5.81	15.73**	20.17**	10.42	11.86	8.27
Denmark											14.02*	6.93	6.76	16.44**	14.24*	6.41	10.03	5.28
Norway												10.74	3.83	6.55	8.62	12.43	8.29	4.25
Sweden													6.71	5.96	8.15	8.09	10.28	8.54
Finland														6.44	9.10	6.16	17.54**	12.40
Australia															12.05	8.88	13.84*	15.35*
New Zealand																9.89	15.99**	7.38
Japan																	17.20**	10.80
US																		12.64

Notes: For all countries ALLGTR is observed over the sample period 1965–1999, except Austria which begins in 1967. Rejections of the null hypothesis of an absence of cointegration are indicated by *(10%), **(5%), and ***(1%), based on Osterwald-Lenum critical values of 13.75 (10%), 15.67 (5%), 20.20 (1%).

Table VI: Cumulative Rejection Frequencies for the Null of an Absence of Cointegration

Tax rate	Significance level	Rejections	Cumulative rejections	Rejection frequency
CITGDP	1%	5		2.9%
	5%	14	19	11.1%
	10%	12	31	18.1%
CITGTR	1%	9		5.3%
	5%	25	34	19.9%
	10%	9	43	25.1%
ALLGDP	1%	3		1.8%
	5%	8	11	6.4%
	10%	15	26	15.2%
ALLGTR	1%	5		2.9%
	5%	22	27	15.8%
	10%	13	40	23.4%

Table VII: Cumulative Rejection Frequencies for the Null of Less Than Full Rank

Tax rate	Significance level	Rejections	Cumulative rejections	Rejection frequency
CITGDP	1%	0		
	5%	2	2	1.2%
	10%	4	6	5.3%
CITGTR	1%	1		0.6%
	5%	9	10	5.8%
	10%	8	18	10.5%
ALLGDP	1%	0		
	5%	2	2	1.2%
	10%	6	8	4.7%
ALLGTR	1%	0		
	5%	1	1	0.6%
	10%	2	3	1.8%

Table VIII: Multivariate Cointegration Within Country Groups

Tax rate	Country groups	Number of countries n	Cointegrating rank r	Stochastic trends $n-r$
CITGDP	France-Germany-Netherlands-Switzerland	4	3	1
	Ireland-Netherlands-UK	3	0	3
	Netherlands-Sweden-UK	3	1	2
CITGTR	Denmark-Netherlands-Sweden-UK	4	2	2
	Denmark-Norway-UK	3	2	1
ALLGDP	Belgium-Ireland-Sweden-UK	4	4	0
	France-Germany-Italy	3	3	0
	France-Germany-UK	3	3	0
ALLGTR	Finland-Netherlands-UK-US	4	3	1
	Belgium-Australia-Canada	3	2	1
	Belgium-Australia-Spain	3	2	1
	Belgium-Germany-Switzerland	3	1	2
	Belgium-New Zealand-Spain	3	3	0
	Belgium-Norway-Spain	3	2	1
	Belgium-Spain-Switzerland	3	1	2
	France-New Zealand-Spain	3	3	0
	France-Spain-Switzerland	3	2	1

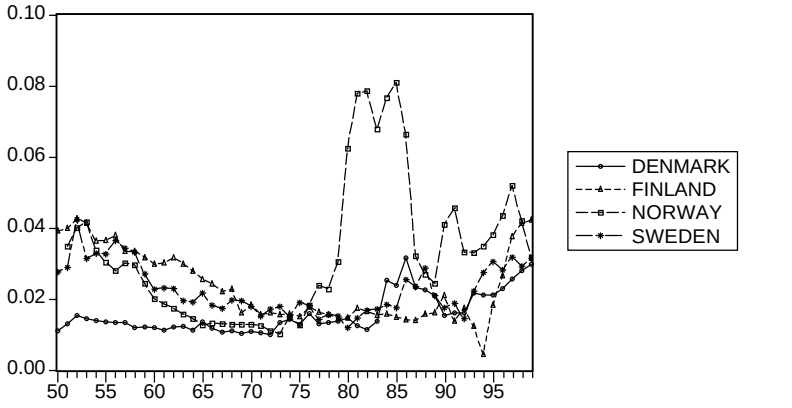
Note: Test decisions are based on the maximum eigenvalue statistic using a 10% significance level.

Table IX: Convergence Within Cointegrating Country Groups

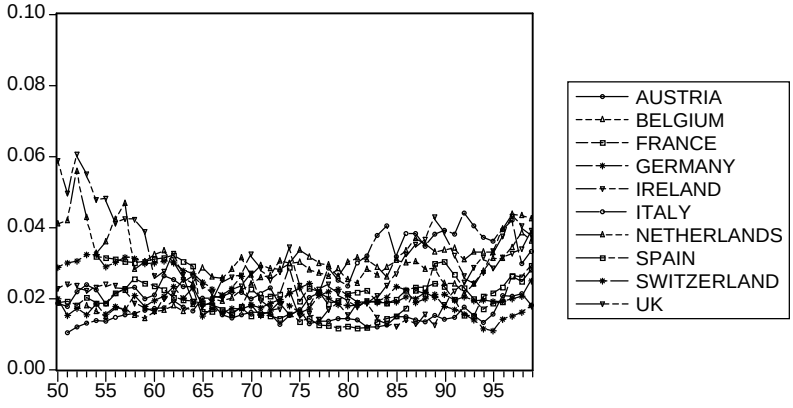
Tax rate	Country groups	Number of country deviations	Cointegrating rank	Stochastic trends
CITGDP	France-Germany-Netherlands-Switzerland	3	2	1
CITGTR	Denmark-Norway-UK	2	0	2
ALLGTR	Finland-Netherlands-UK-US	3	2	1
	Belgium-Australia-Canada	2	0	2
	Belgium-Australia-Spain	2	1	1
	Belgium-Norway-Spain	2	1	1
	France-Spain-Switzerland	2	1	1

Note: Test decisions are based on the maximum eigenvalue statistic using a 10% significance level.

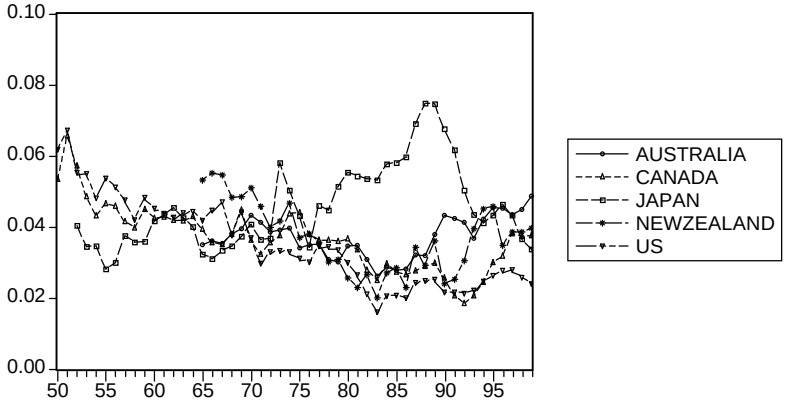
Figure 1: Tax rates measured by CITGDP



(a) Scandinavia

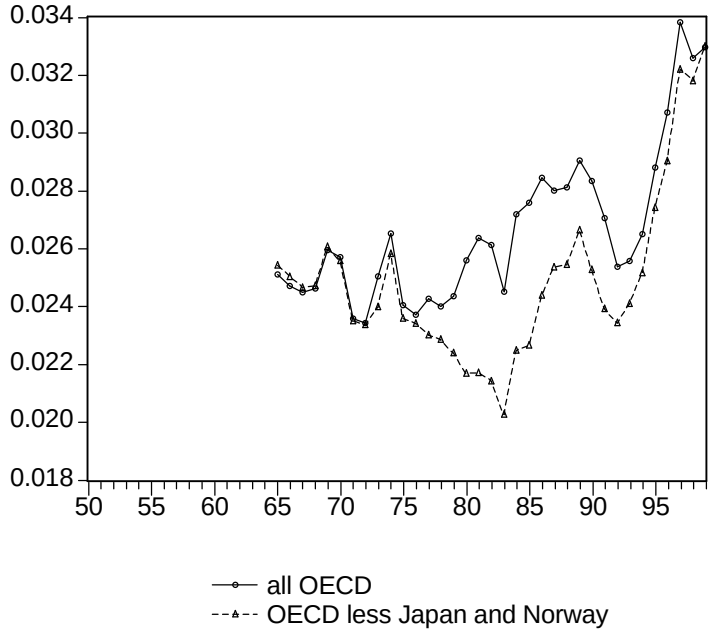


(b) Rest of Europe

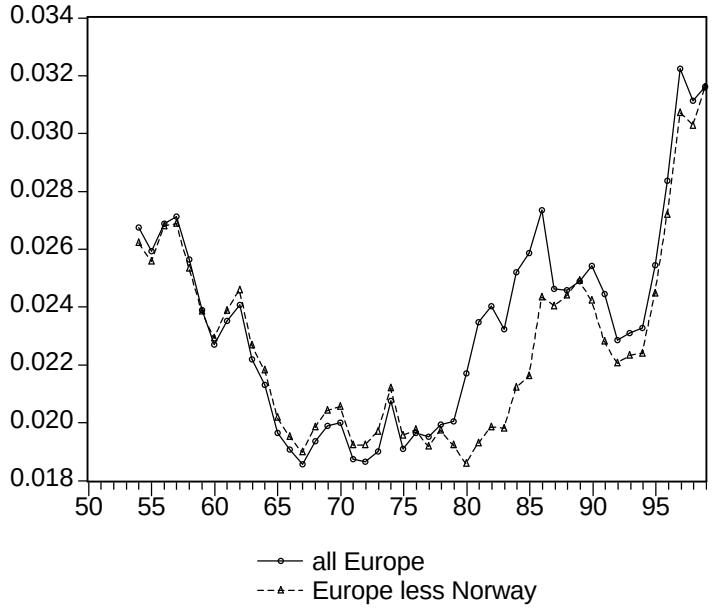


(c) Non-Europe

Figure 2: CITGDP averaged across countries

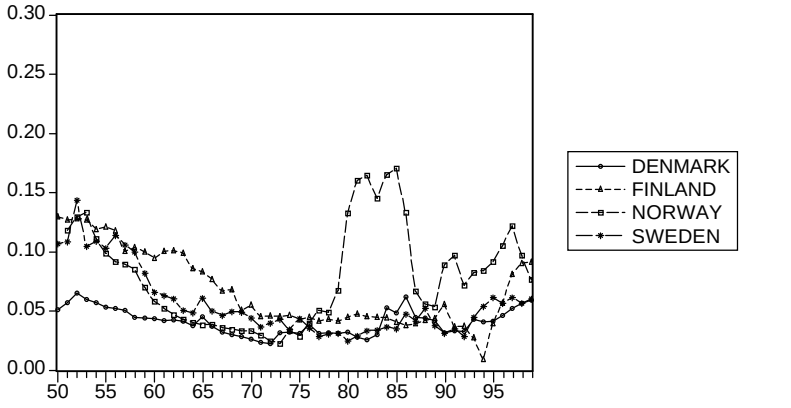


(a) OECD

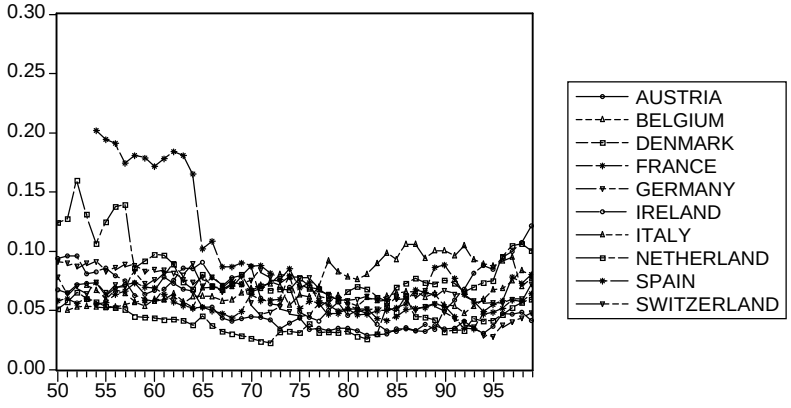


(b) Europe

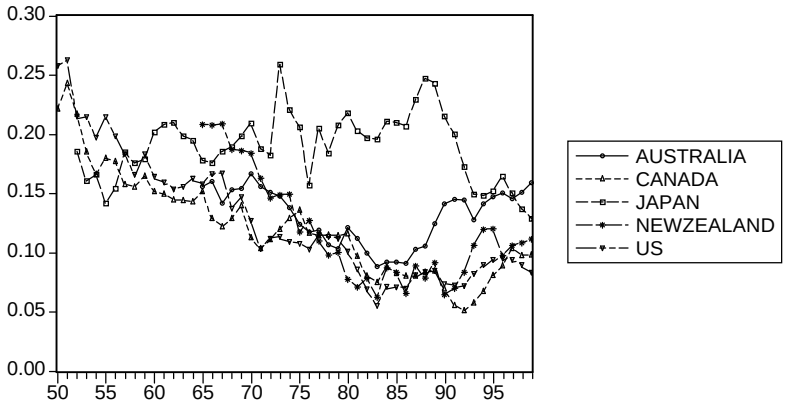
Figure 3: Tax rates measured by CITGTR



(a) Scandinavia

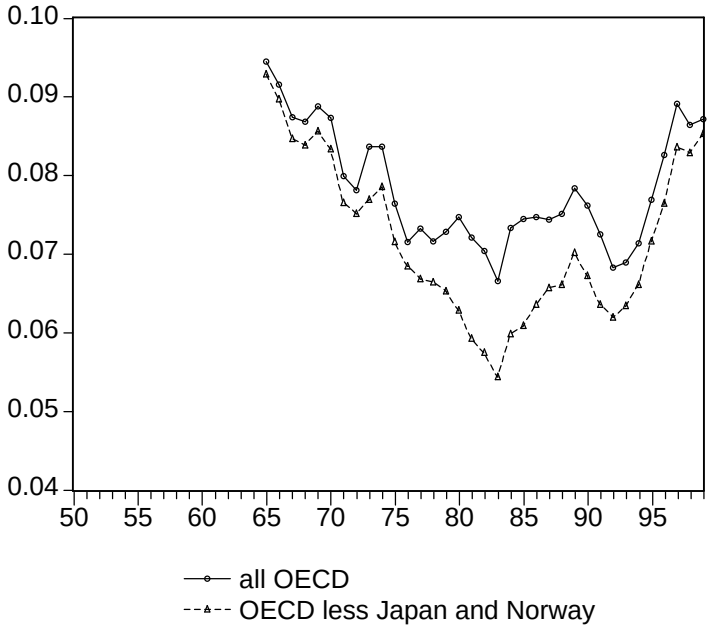


(b) Rest of Europe

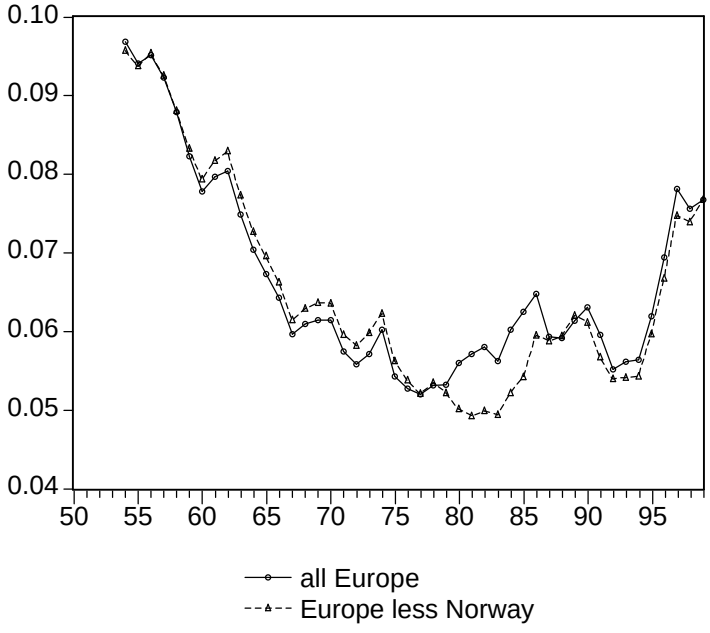


(c) Non-Europe

Figure 4: CITGTR averaged across countries

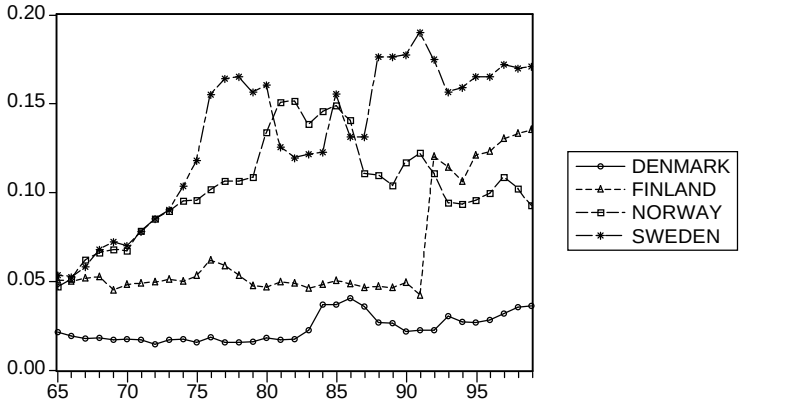


(a) OECD

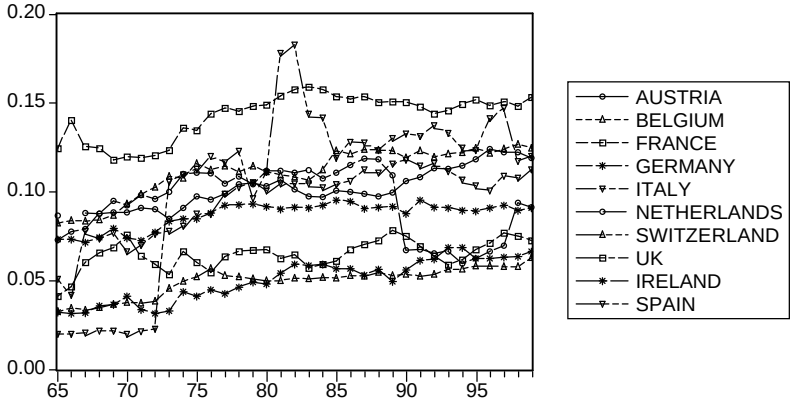


(b) Europe

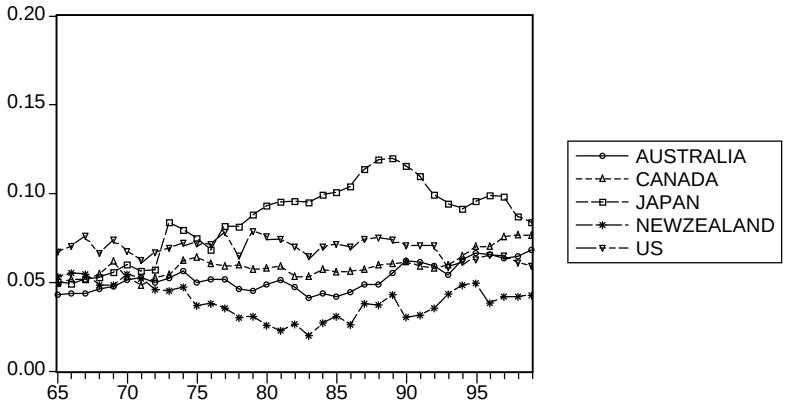
Figure 5: Tax rates measured by ALLGDP



(a) Scandinavia

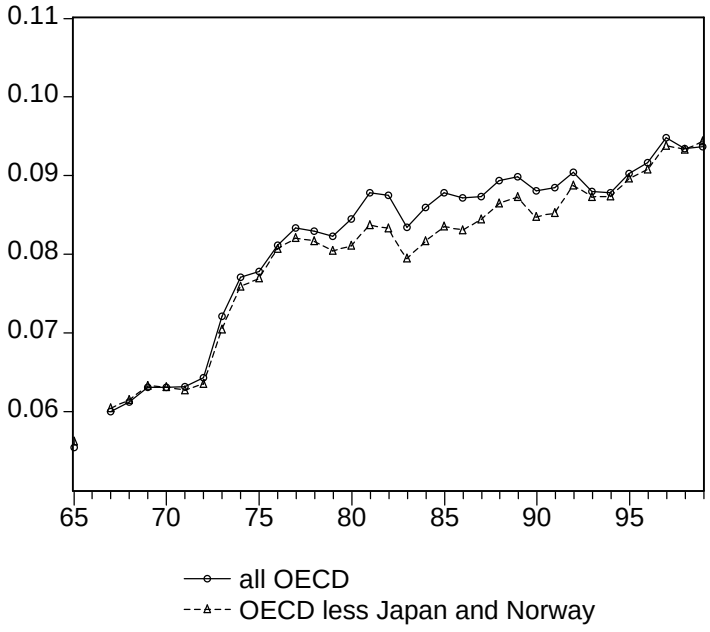


(b) Rest of Europe

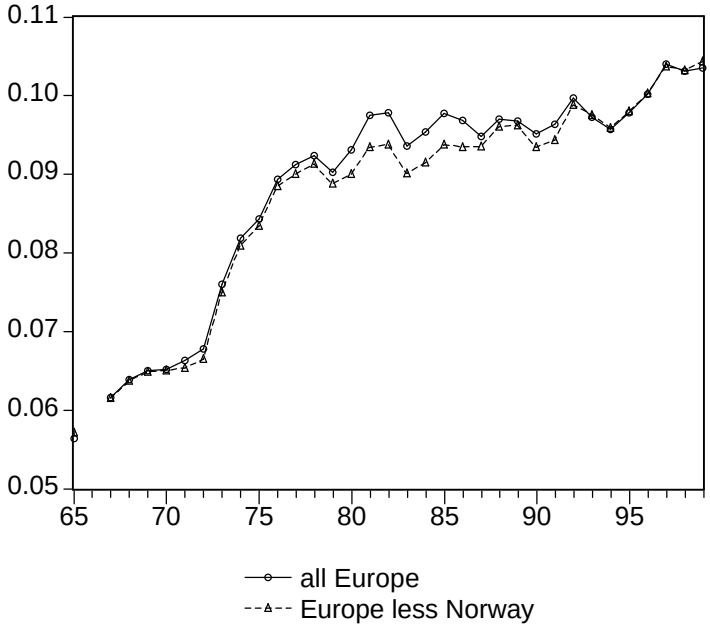


(c) Non-Europe

Figure 6: ALLGDP averaged across countries

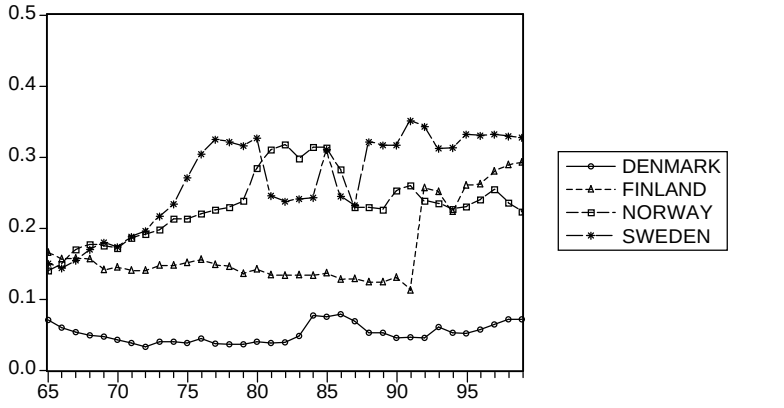


(a) all OECD

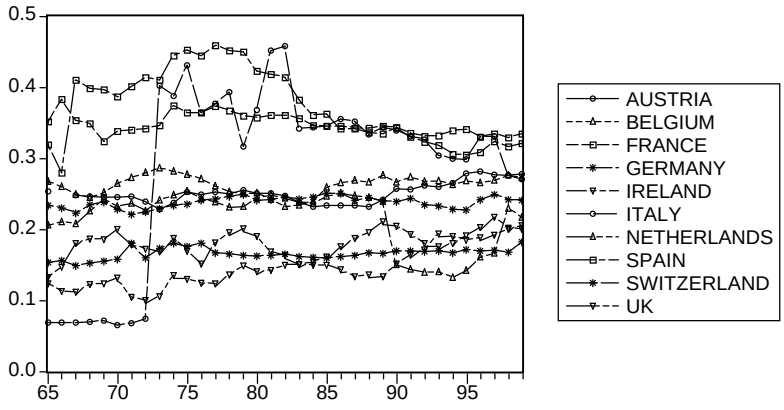


(b) Europe

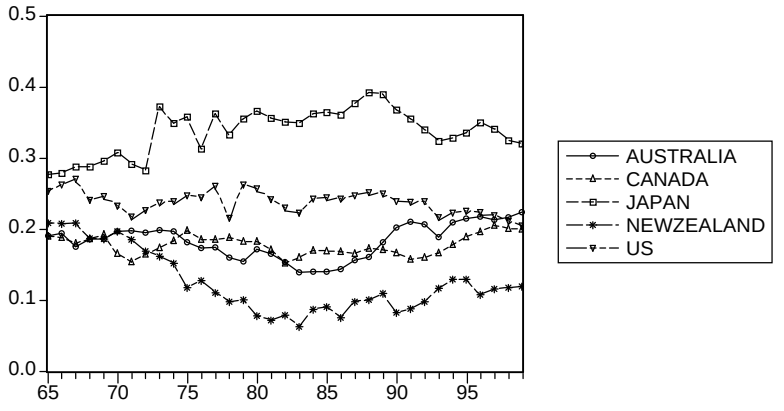
Figure 7: Tax rates measured by ALLGTR



(a) Scandinavia

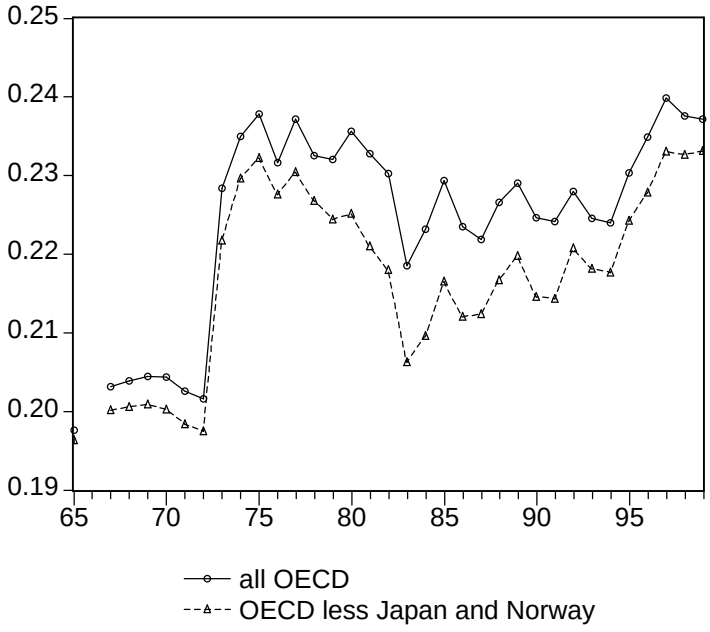


(b) Rest of Europe

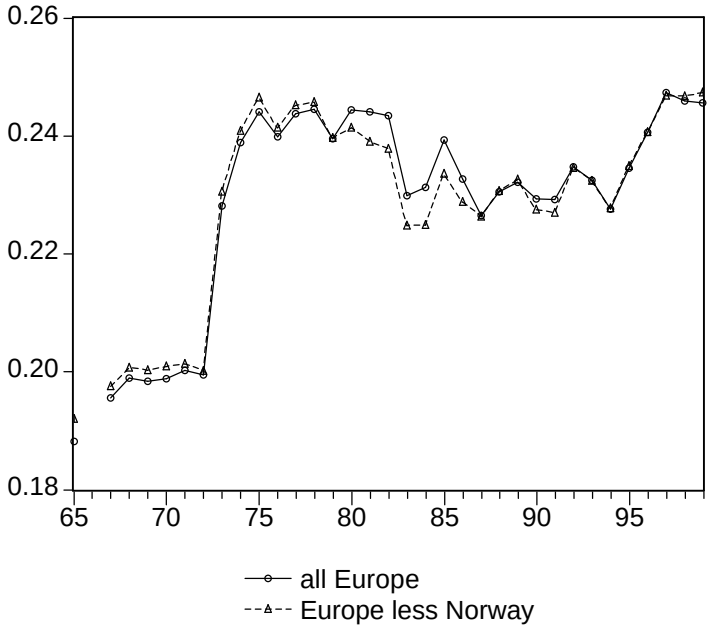


(c) Non-Europe

Figure 8: ALLGTR averaged across countries

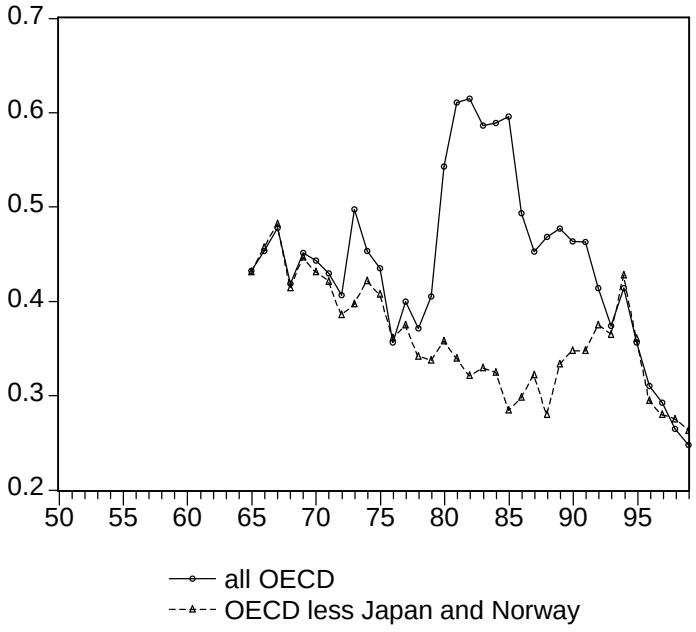


(a) OECD

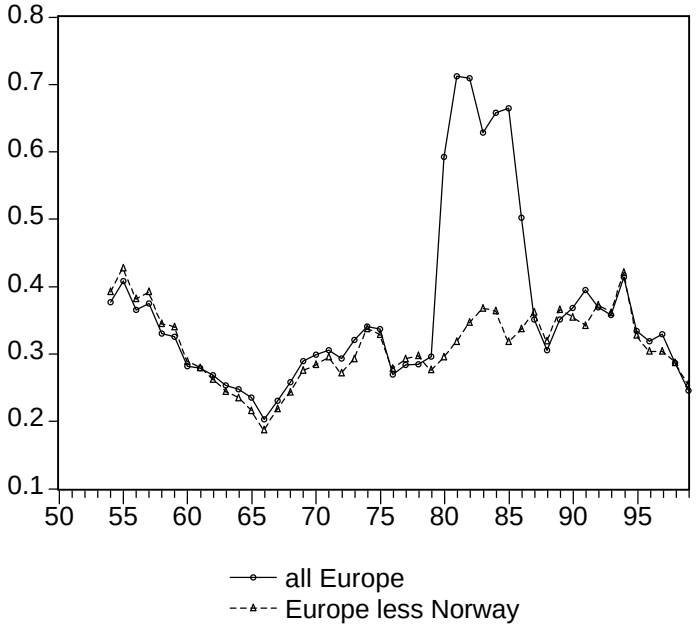


(b) Europe

Figure 9: CITGDP - coefficient of variation

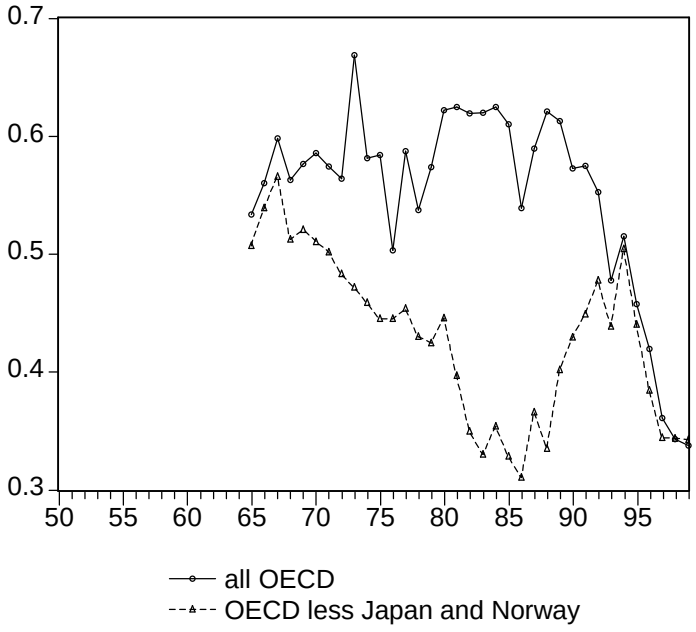


(a) OECD

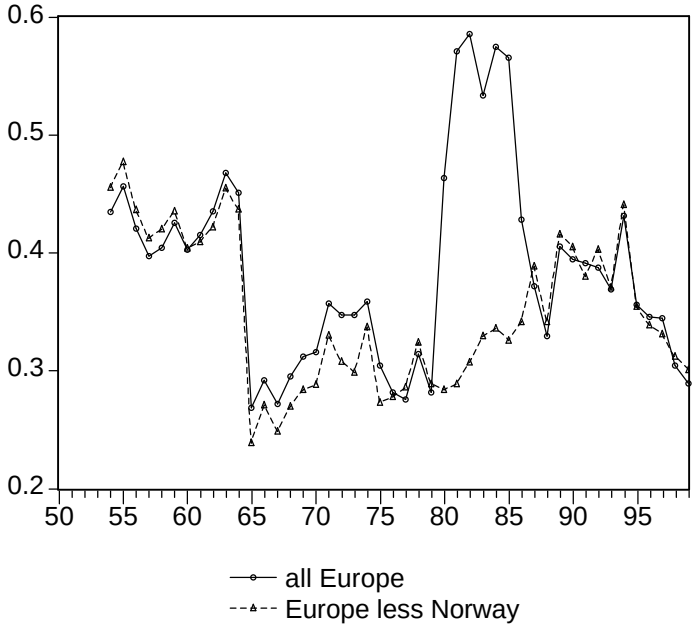


(b) Europe

Figure 10: CITGTR - coefficient of variation

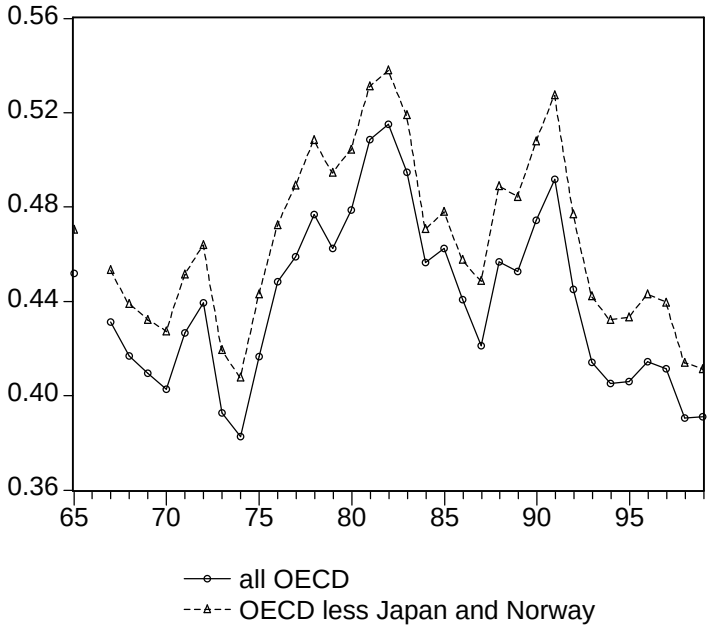


(a) OECD

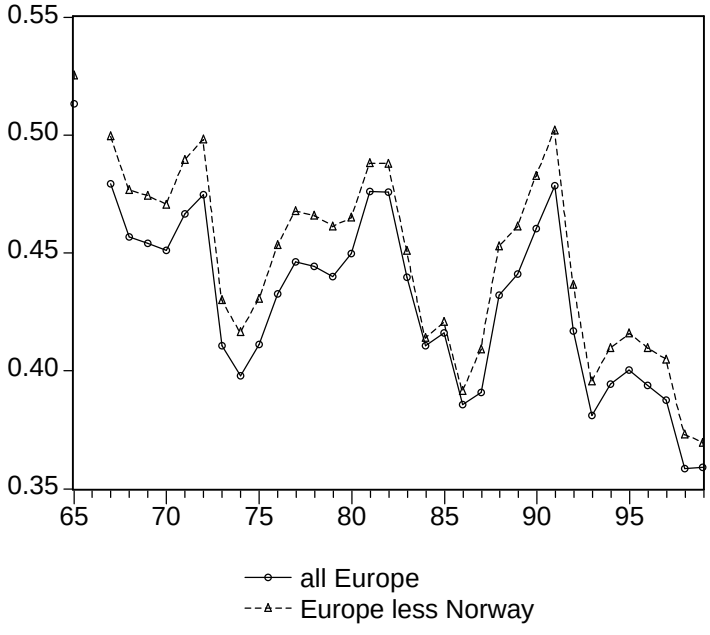


(b) Europe

Figure 11: ALLGDP - coefficient of variation

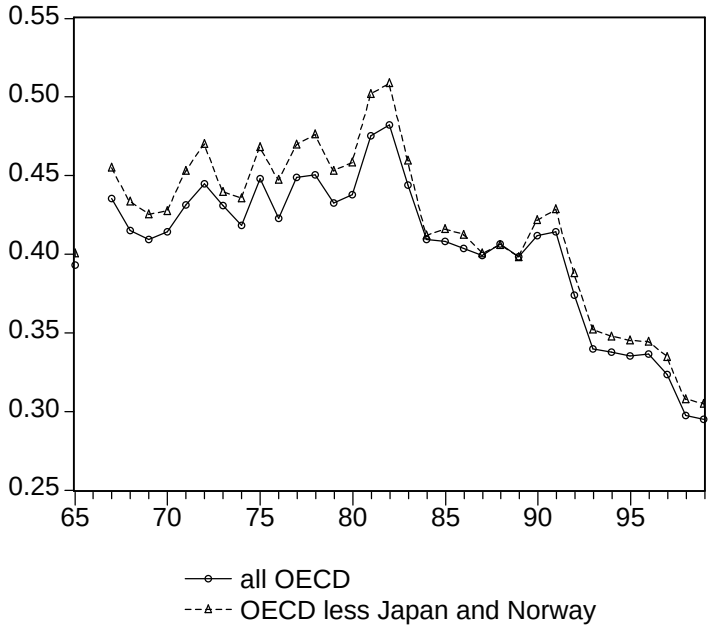


(a) OECD

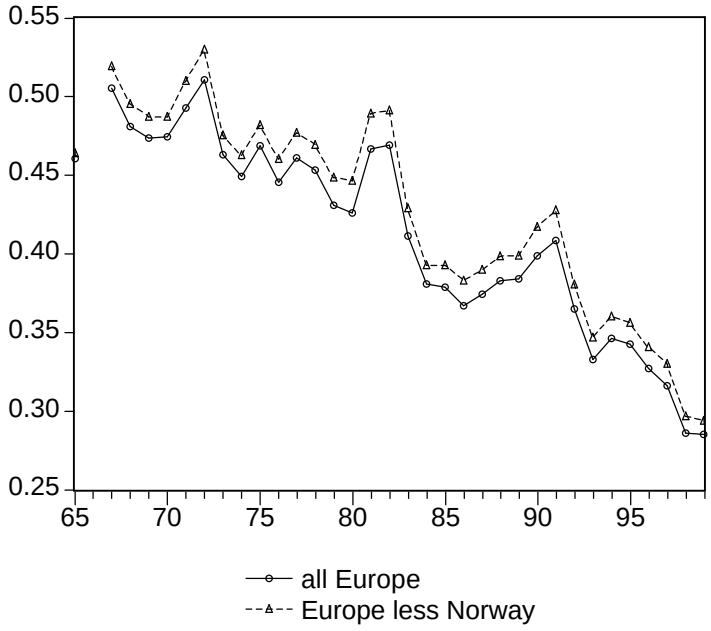


(b) Europe

Figure 12: ALLGTR - coefficient of variation



(a) OECD



(b) Europe