ARE CORPORATE TAX RATES, OR COUNTRIES, CONVERGING?

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First find your facts.
Select your facts. (What to include, what to omit)
Arrange your facts.
Consider missing facts.
Explain your facts. How much, and what, will you explain, and why?

A.S. Byatt, *The Biographer's Tale*

1. Introduction

Many empirical examinations of tax competition have considered certain patterns—facts, if you will--about corporate taxation, in particular convergence and/or a decline toward zero, as evidence of tax competition. However, this conclusion is not convincing in the absence of some notion of what the pattern of corporate rates over time would have been in the *absence* of international competitive pressures. A convergence of corporate tax rates might indicate that the domestic determinants of corporate tax rates, other than competitive pressures, have converged. In other words, convergence may be due to the fact that countries, or at least those aspects of countries that influence the setting of corporate tax rates, have grown more alike. Similarly, a decline of corporate tax rates may mean that they are no longer a desirable part of tax systems from a purely domestic standpoint.

In this paper I investigate the pattern of corporate taxation across countries in several years, beginning in an era supposedly before the advent of intense fiscal competition, and ending in 1995, supposedly well into the competitive era. I separately investigate a set of domestic influences on corporate tax rates that are arguably distinct from competitive pressures, and a set of indicators of competitive pressures.

This research is offered in the spirit of a larger research agenda, the aim of which is to clarify what empirical patterns are, and are not, evidence of tax competition, harmful or benign. It is also related to the ongoing policy debate about what variations in tax regimes are appropriate expressions of sovereignty and perhaps desirable symptoms of efficiency, due for example to differences in services provided by government, demand for government activities and the desired progressivity of the tax burden.

2. The Domestic Role of the Corporation Income Tax

The modern normative theory of taxation, also known as the theory of optimal taxation, has largely ignored the corporation income tax. Undoubtedly one reason for this is that the corporation tax is difficult to model in a straightforward way, especially compared to a commodity tax or linear income tax. It is a tax on the income of one sector of the economy that is distinguished not by the type of good produced but by the firm's legal form of organization. It is a tax on income net of the payment to one class of capital providers—lenders—where the conceptual distinction between this class and the other class—equity holders—can be made only by introducing uncertainty.

In the absence of rigorous normative models, most arguments about the appropriate role of the corporation income tax have been informal. In what follows I review these arguments, and discuss what they imply about the variation of corporate taxation across countries and across time. In so doing, I distinguish the implications for two different aspects of the corporation income tax—the statutory rate and an average rate.

2.1 Tax mix

I begin with the most informal argument of all. There is a folk theorem among tax policy makers that goes as follows: all taxes have weaknesses, and the marginal social cost of the weaknesses increase with the tax system's reliance on any given tax. Therefore, revenues should be collected from a variety of taxes rather than a small number.

There are certainly rigorous theorems from optimal taxation that sound like this folk theorem. The optimal commodity tax literature comes to mind, with its prescription to make use of all available taxes. But such theorems don't apply to the case at hand,

because we know that for a small, open economy (under certain conditions) a source-based tax on mobile factors is dominated by taxes on immobile factors: everyone may be made worse off under the former system. The folk theorem presumably applies only to the real world in which administrative and enforcement issues dominate.

An empirical implication of the tax mix folk theorem is that as government spending (relative to GDP) and therefore revenue needs increase, across countries or across time, so will the rate and revenues raised from the corporation income tax. To put the issue more starkly, the absence of any relationship between revenue needs and corporate taxation suggests that the taxation of corporations is determined by something other than collecting revenues.

2.2 Backstop to the income tax

Depending on how capital gains are taxed, an income tax without a corporation income tax can be avoided through retaining earnings within a corporation, and delivering profits to shareholders in a variety of tax-preferred ways. This motivation suggests that a corporate income tax is more likely to be observed in cases of preferential capital gains taxes. More generally, a corporate tax may serve as a backstop to the reclassification of labor income as business income in search of a lower effective tax rate. The empirical importance and policy implications of this kind of income shifting re explored in Gordon and Slemrod (2000) and Gordon and MacKie-Mason (1995), respectively. It suggests that, ceteris paribus, the statutory corporate tax rate will be higher in countries in which the top individual tax rate is high.

2.3 Withholding tax on corporate-source

Even in the absence of preferential capital gains taxes, it has been suggested that from an administrative standpoint it is more efficient to collect tax at the corporate level rather than at the level of the suppliers of capital to the corporation. From this perspective the corporation income tax is a withholding tax on corporate-source income. If this is the motivation, one would expect to see some form of corporate and personal tax integration, so that the total tax on corporate-source income would be tailored to the appropriate personal tax rate of the shareholder. One would also expect to see more extensive corporate income taxation in countries where there are relatively large administrative difficulties of raising taxes from individuals or small, unincorporated

businesses. The problem with empirical investigation of this issue is that indicators of the administrative difficulty, such as the level of illiteracy in a country, are highly correlated with other measures of economic development. This makes it difficult to separately identify the administrative motivation for corporate taxation from other reasons that a country's tax structure might change as it develops.

2.4 Tax on economic profits

If economic, or pure, profits could be isolated, this would be an efficient base for taxation. (Mintz, 1995) By definition, taxes on rents secure revenues for public purposes without disturbing private economic decisions. Notably, several recent proposals for reformed corporate taxation, including cash flow taxes are aimed at taxing only the "rent" element of corporate profits. If successful, they collect revenue but levy a zero tax at the margin on new investment. The income from extracting natural resources is likely to have a large rent component, so corporate taxation of businesses in the extraction business may be relatively efficient. This suggests examining the influence of rent-intensive activities on corporate taxation. As a crude but widely available measure of this, in the empirical analysis that follows, I control for the per capita value of oil and natural gas reserves in a country.

2.5 Benefits tax

It has been argued that, to the extent that particular government activities result in identifiable cost-reducing benefits, businesses can and should be charged for them. User charges, where feasible, are a direct way to charge for these benefits. If they are not feasible, then one might consider taxes that approximate user charges, although there is no clear argument about why these taxes should be applied only to corporate businesses, or why the base for assessing these charges should be income. Moreover, as Bird (1996) argues, corporations may benefit generally from government actions through maintaining the basic legal and institutional framework, providing physical infrastructure, and educating the labor force. As for specific government programs, there is no clear rationale for limiting the tax to corporations or basing it on income.[1] Nevertheless, it is

[1] There is also an argument, favored by many legal tax experts, that the corporation income tax is justified as a charge for bestowing certain legal characteristics, such as limited liability, perpetual life, and easy transfer of ownership. It is difficult to see that this is the motivation for the general corporate taxes of the scale observed.

worthwhile to pursue whether variations in corporate taxes can be explained by variations in the amount of cost-reducing services offered by government. Below I use the extent of electrification to try to capture this idea. Any such measure suffers from the problem alluded to above--that it will be highly correlated with the degree of development.

2.6 Political bias/attempt at progressivity

Although to economists the link between the corporate tax and tax progressivity is not straightforward, and in particular depends on incidence assumptions, to many voters the corporation tax is a linchpin of any progressive tax system. To the extent this is true, it may be higher in countries in which egalitarian sentiment is more likely to prevail. This is difficult to investigate, however, because although measures of political or ideological characterizations are available for developed countries, they are not available more widely.

3. International Pressures and Tax Competition

3.1 The competitive model

In a partially or completely open economy, other considerations become relevant to the setting of the corporation income tax, and can lead to striking policy prescriptions. Consider, as a benchmark, the conclusion of Gordon (1986) that a small, open economy should levy no distorting source-based taxes. The intuition behind this result is straightforward. In a small, open economy all taxes are borne by immobile factors (labor and landowners, for the sake of this argument), because mobile factors can always earn the world rate of return for their resources. Thus, the incidence of a source-based tax on capital would be identical to a tax levied on labor. A source-based tax on capital will, though, reduce the capital stock in a way that the labor tax would not, so that the latter way of raising revenue dominates.

From this perspective, the fact that corporation income taxes raise hundreds of billions of dollars worldwide suggests either a failure of competition or a failure of the predictive power of this stylized model that ignores many of the complexities of real economies. Nevertheless, an underlying theme of much of the tax competition discussion is that over time the world is moving toward the prediction of this model. Thus, we might expect that to see less reliance over time on source-based taxes on mobile factors,

such as the corporation income tax. For such an exercise, it is worthwhile to consider what important aspects of the real world are not captured by the stylized model.

3.2 Reasons for the failure of the competitive model

3.2.1 Large country

Countries that are large relative to the world market might be able to exploit this market power through the taxation of foreign capital income, which can be implemented via a corporation income tax. Thus, it is of interest to see if the move away from corporation taxes has been stronger among smaller economies.

3.2.2 Incompletely open capital markets

Capital markets have not always been completely open in all countries. To the extent they are not, a country can escape the iron law that because it is unable to impose a tax burden on its residents' capital income then source-based taxes on mobile factors are dominated by other taxes. It is the sense that capital (and goods) markets have become more open over the last decades, and this is fueling the "race to the bottom" of capital taxes, that motivates this paper (and this conference!).

Appropriate measures of capital market openness, or liberalization, are not easy to come by. More available are measures of trade openness and liberalization. In the empirical analysis below, I investigate two such measures. One is trade volume (exports plus imports) relative to GDP. This, of course, reflects not only policy but also characteristics of a country such as its geographic isolation. I also examine the measure of policy openness constructed by Sachs and Warner (1995), which is a qualitative zero-one index. It is, as all such measures are, somewhat arbitrary; on the plus side, it is available for many countries over the period 1950 to 1992. Quinn and Inclan (1997) have developed an index of financial liberalization, which is presumably more directly related to the question at hand, but the index is publicly available for only a few years, and is not explored in this draft.

3.2.3 Tax on foreign-owned rents

The argument made above about the attractiveness of taxing rents in a domestic context applies in spades to foreign investors. In this setting the taxation of rents may be not only non-distorting, but the burden may fall on non-residents, which is presumably ideal from the point of view of domestic policy makers seeking to maximize the welfare

of their citizen-voters. Moreover, there is a compelling argument that by their nature foreign direct investments must have some firm-specific assets that generate rents for them; otherwise, domestic companies would have a natural advantage. According to this view, the mere existence of foreign direct investment may be taken to imply that the profits accruing to such operations must contain a rent element. (Bird, 1986; Sorensen, 1995). Furthermore, as Bird (1996) emphasizes, if the host country doesn't tax the profits earned by foreign investors, the home country likely will.

Coming up with an empirical proxy for this is problematic. The stock and flow of inward foreign direct investment is available for many countries, but this is certainly endogenous to the level of corporate taxation imposed. To the extent that the foreign-owned rents are concentrated in natural resource extraction, the oil and natural gas may pick up some of this effect.

3.2.4 Soak up foreign tax credits

To the extent that a country has incoming foreign direct investment from countries that operate a worldwide tax system with a foreign tax credit, and to the extent that the investing companies are in a deficit-credit situation, increases in the source country's tax rate may simply transfer revenue from the residence country's treasury to the source country's treasury. In this case, a source-based tax may not only be much better than alternative ways to raise revenue, it may be a cost-less tax.

The tax system of the United States, being a large supplier of foreign investment that operates a worldwide system, has drawn special attention. In fact, Gordon (1992) has argued that the post-war era can be divided into two eras. In the first, which ended in the mid-1980's, the U.S. dominated the world economic scene, and essentially acted as if it were a Stackelberg leader. It set its corporate tax rate high, knowing that it would be in the interest of foreign governments to match its rate. As the U.S. economic dominance declined in the 1980's, at some point the Stackelberg equilibrium became a non-cooperative Nash equilibrium, and the pressure for lower corporate tax rates increased.

This motivation for a source-based tax should be larger, the greater the fraction of expected FDI from countries with worldwide tax systems, and the higher are those countries' tax rates. Getting a quantitative measure of this is very difficult. A reasonable substitute, and one that speaks to the Gordon (1992) argument, is the U.S. statutory rate

interacted with a measure of how much inward foreign direct investment comes from the U.S. to the country in question. This is problematic, though, because the flow of foreign direct investment arguably depends on the source country's corporate tax structure.

3.3 Previous empirical literature relating taxes to globalization

A series of empirical papers in the political science literature have addressed the relationship of globalization to tax policy. Garrett (1996, 1998a, 1998b) concludes that the liberalization of international capital flows is largely unrelated to total revenues or personal income, consumption, corporate, or social security taxes as shares of GDP in developed capitalist democracies.[2] Hallerberg and Basinger (1998) find that 1986 to 1990 changes in corporate and personal tax rates are, at best, only indirectly related to liberalization of capital markets. To the extent that any relationship between liberalization and corporate taxation has been claimed, it is a *positive* one. Quinn (1997) finds substantively small and positive relationships between liberalization of capital flows and corporate taxes (measured as a percentage of GDP and as a share of tax revenues) at both high and low levels of economic development.[3] Similarly, Swank (1998a) finds that corporate income taxes are positively associated with rises in capital mobility and liberalization, although the increases in business taxes associated with rises in capital mobility are small.

Steinmo and Swank (2001) examine the tax policy effects of three dimensions of international capital mobility: flows of foreign direct investment, flows of financial capital, and the liberalization of restrictions on capital and financial flows. Analyzing data from 1981-1995 for developed democracies in a pooled time-series framework, they find no evidence that widespread reductions in statutory corporate tax rates are associated directly with and systematically with rises in transnational capital or trade flows. However, reductions in corporate tax rates--but not average effective rates on capital income--are significantly associated with liberalization of restrictions on capital and

[2] The explanation provided in Garrett (1998a, 1998b) is that public infrastructure and other public goods provided by a moderately large public economy is attractive to international capital. High labor costs caused by high labor taxes may be as inimical to FDI as are corporate income taxes. Furthermore, international capital markets may react poorly to deficits caused by lower taxes.

[3] Note that the Quinn (1997) measures of corporate taxes are not rates but rather products of rates and the extent of corporate income subject to tax. To the degree that low rates attract more taxable income, the behavior of the corporate rate and corporate revenues can be quite different.

financial flows. They conclude that while policy makers did not systematically lower marginal tax rates in direct response to exogenous expansion of international economic activity, tax policy reforms were closely coordinated with broader programs of financial liberalization.

Thus, there is no consensus in the political science literature that openness, liberalization, or globalization have led to reduced taxation of capital income, including use of the corporate income tax, although lower corporate taxes were sometimes pursued as a policy package with financial liberalization. The question has been less studied by economists. A noteworthy exception is Rodrik (1997), who examines the impact of relaxing capital restrictions and finds that increasing trade openness and, at high levels of openness, capital control liberalization are associated with declines in effective tax rates on capital. He also finds that increasing trade openness is associated with increases in taxes on labor, echoing the claim made by the European Commission that one result of tax competition fostered by openness is a shift toward taxes on labor, which it argues exacerbates the European unemployment problem.

Grubert (2001) examines the changes in the effective tax rates on U.S foreign direct investment, as well as the statutory rate, in 60 countries between 1984 and 1992. For both effective and statutory tax rates, he finds sizable regression toward the mean. The tax rates (effective or statutory) of the EEC countries did not decline more than other countries, which he finds surprising in view of the fact that European economic integration might have been expected to increase tax competition. Of particular interest is the finding that effective tax rates fell relatively more in small, open, and poor economies, patterns which he interprets to be consistent with an international competition motivation for corporate tax reductions. He does not, though, report any analysis of whether small, open, and poor countries also had relatively large declines in their statutory tax rates.

It is not unfair to summarize the literature by saying that the political scientists who have studied this question find no evidence that globalization has led to corporate tax decreases, while the (two) economists have found such evidence. None of the research, though, systematically inquires about whether domestic influences may explain some of the patterns of corporate taxation, to examine whether convergence of domestic

determinants might explain some of what has been occurring. What follows begins this examination.

4. An Empirical Model of the Determination of Corporate Tax Structure

4.1 Data issues

There is no straightforward way to capture to summarize a country's corporate tax system. These systems vary along a large number of dimensions. For example, some countries have multiple-rate systems, where the non-standard rates may apply to certain sectors of the economy, defined by geography or industry. There may also be differentiation based on whether earnings are retained or paid out. Countries also vary with regard to whether they have an integration scheme, and what type of scheme is employed. Many countries have graduated corporate tax rate structures.

Although it is the most visible attribute of a corporate income tax structure, the statutory rate (or rates) is only one determinant of its revenue collection capacity and its economic impact. The statutory rate may be especially important in determining the incentives that arise in shifting income between one jurisdiction and another. With respect to its impact on the incentive to invest, though, it is well known that the statutory rate is a woefully inadequate measure. It entirely misses the role of the base of the corporation income tax, including the depreciation schedules, inventory allowance system, inflation adjustment, if any, deductibility of categories of business expenses, availability of credits for investment, and the existence of tax holidays. A large literature has investigated the correct methodology to take account of all these aspects in a way that summarizes the tax disincentive to invest, using a concept known as the marginal effective tax rate on investment. (OECD, 1991) Although this approach is unquestionably a conceptual advance, even in its most worked-out form the procedure relies on a set of fairly arbitrary assumptions and does not account for certain features of some countries' tax systems. Some of these left-out features may be trivial, but others may be quantitatively very important. For example, these measures do not account for how vigorously a particular tax system is enforced. Faced with these difficulties--and the reality that careful measures of the marginal effective tax rate are not available for a wide range of countries over many years--some researchers have resorted to analyzing

measures of average effective tax rates, defined as corporate tax collections divided by some measure of economic (not taxable) income of corporations, by sales or assets of corporations, or by overall national income.

In what follows I focus on two measures of corporation income taxes--a statutory rate and the ratio of corporation income tax revenues to GDP. In constructing each of these measures, certain definitional issues had to be faced. The choices made are detailed in the Data Appendix, and are just touched on here. Both the statutory rates and total tax collections refer to central government only. The statutory rates do not account for special rates granted for categories of profits, either by region of the country or the sector of the investment. Because the denominator of the average tax rate measure is not a measure of corporate profits, this variable is a product of an effective rate of tax on income and the base to which it is applied. In other words, this measure will be higher the more successful the country is at attracting and retaining profitable corporations. In the extreme, if the elasticity of the taxable base exceeds one, this measure could be inversely related to the tax rate imposed on the base.

4.2 Levels and trends in corporate income taxation

Table 1 presents the mean and standard deviation of the statutory and average tax rates, defines as described above. It does so for each pair of five-year intervals between 1975 and 1995. For each interval, the calculation is carried out only for those countries for which data is available for the beginning and ending year. This procedure reveals a decline in the mean statutory rate beginning in the 1985-1990 period that continued into the 1990-195 interval. Between 1985 and 1995, the means statutory corporate tax rate fell from 40.0 percent to 32.7 percent. The dispersion of corporate rates also fell, but only between 1990 and 1995. The data for the average tax rates begin five years earlier, in 1975. Over the entire period, both the mean and standard deviation of the average rate also fell. However, in contrast to the statutory rate, virtually all of the decline occurred between 1990 and 1995. In summary, both the statutory and average rates fell in mean and standard deviation, but for the former the decline began about 1985, and for the average rate, it began in about 1990.

These trends are broadly consistent with the patterns found by others using different data. Altshuler, Grubert, and Newlon (2001) presents the mean and standard

deviations of average effective tax rates[4] for U.S. manufacturing subsidiaries in fifty-eight countries. The mean rose slightly between 1980 and 1984, fell from .339 to .306 in 1988, and then fell sharply to .245 in 1990, and to .234 in 1992. The standard deviation rose between 1980 and 1988, only to fall back to its 1980 level in 1990 and 1992. Grubert (2001) reports similar trends for the average effective tax rates between 1984 and 1992, and also reports that the mean statutory tax rate fell from .412 to .334 over this period, and the standard deviation fell from .146 to .121. According to Steinmo and Swank (1999), the average top statutory corporation income tax rate in developed capitalist countries fell from 45 to 35 percent between 1981 and 1995.

4.3 Cross-sectional analysis

I first examine cross-country data at five-year intervals, beginning in 1975 through 1995, for as many countries as the available data will allow. The results of these ordinary least-squares regression analyses are presented, year by year beginning with 1995 and proceeding in reverse chronological order, in Tables 2 through 6.

4.3.1 Domestic variables only

I begin with a discussion of the regressions featuring the domestic explanatory variables only, shown in column (1) for the statutory rate and column (4) for the average rate, except in Table 6 (for 1975), when only average rate data is available. For the statutory rate, the only consistent explanatory variable is the top individual income tax rate, which is significantly associated in each year. (The individual rate is not available for 1975). Moreover, the size of the estimated coefficient increases consistently over this period. These findings are consistent with the notion that the corporate rate is a backstop for the individual rate, although they could also be explained by an unmeasured third factor that affects both the top individual rate and the corporate statutory rate.

A further test of the backstop hypothesis comes from the terms where the top individual rate is interacted with dummy variables for the extent of taxation of capital gains at the personal level. Presumably, the backstop role is more important when there is low or no taxation of capital gains. This variable is available for only 1990 and 1995. In 1990, this interaction term works out exactly as the backstop theory suggests. When

[4] The average effective tax rate is calculated by dividing the total income taxes paid by U.S. controlled foreign corporations in the manufacturing sector by their total earning and profits.

there is no capital gains taxation, the impact of the top individual rate is 0.12 higher than if there is full taxation. No such effect appears in 1995, however.

What variables *don't* seem to be associated with the corporate statutory tax rate is also of interest. Perhaps the most striking variable in this category is the expenditure-to-GDP ratio. In no year is it significantly positively associated with the corporate statutory rate. Furthermore, the point estimate declines over time. In 1980, the estimated coefficient is 0.242, and is just short of reaching significance at the 95% level. But in 1985, the coefficient is 0.079, it is 0.039 in 1990, and by 1995 it is –0.016. This pattern is consistent with the idea that the process of setting the corporate tax rate has over time become more insulated from the need to raise revenues. This conclusion must be tempered, though, because there is a very high correlation among this variable and the extent of electrification. The latter two are clearly indices of development, which is widely known to be positively correlated with the extent of government, through what has become known as Wagner's Law. The electrification variable was included in part to pick up evidence that the corporate tax is partly serving as a benefit tax. The regressions provide no evidence of this, however.

The average tax rate is apparently subject to quite different influences. Unlike the statutory rate, it is not closely associated with the top individual tax rate. Like for the top individual rate, though, the association with revenue needs as measured by the expenditure-GDP ratio, declines over time. Surprisingly, the electrification variable is actually negative in 1975, 1980, and 1985, although this effect does not appear in 1990 or 1995.

4.3.2 International variables only

The results for regressions that contain only international variables are shown in columns (2) and (5) of Tables 2 through 5, and in column (2) only of Table 6. These variables are unsuccessful in explaining the cross-sectional pattern of statutory corporate tax rates, with one puzzling exception. The Sachs-Warner openness indicator is at least marginally significant in both 1990 and 1995. What is puzzling is that the estimated coefficients attract different signs in the two years: positive in 1990 and negative in 1995. The 1995 result is consistent with the view that open economies are subject to more pressure to lower the corporate rate; clearly, the 1990 result is not consistent with that

view. I am not ready to interpret the change in results between 1990 and 1995 as evidence of a shift in the pressures coming from open global markets. Notably, there is no evidence that smaller countries are driven to reduce their statutory corporation income tax rates.

I can report more success in explaining the average tax rate with the set of international explanatory variables. In every year, the average tax rate is positively associated with the trade-to-GDP ratio, and the relationship is statistically significant in every year except 1990. Moreover, in every year (except 1995), the population variable is at least marginally positively associated with the average tax rate. The openness indicator is negatively associated with the average tax rate in each year until 1990. At first blush, the relative plethora of significant coefficients seems to be consistent with the idea that international considerations are dominant factors in the amount of corporate taxes collected. The pattern of signs, though, cries out for a coherent story. The best I can offer is that, holding the openness policy variables constant, the trade and population variables measure the attractiveness of the country as a recipient of investment. So, while a policy of openness may help to drive down the rate of taxation per unit of investment, bigger, more globalized economies attract a higher base for corporate taxation, and therefore can collect more revenue from taxing corporate income.

4.3.3 Both domestic and international variables

When the domestic and international variables are combined, the top individual tax rate stands out as the strongest factor that is associated with the statutory corporate tax rate. In 1990 this effect is magnified in countries with no capital gains taxation. Neither the tax mix nor the benefit tax arguments are helpful in explaining the cross-country variation in corporate statutory tax rates. In years other than 1990, countries with more open trade policies do have lower statutory corporate rates, but over the period this effect is getting less strong rather than stronger. Bigger, more trade-intensive economies seem to be better able to collect revenue from corporations, but this pattern is not very robust and shows up, I suspect, because there variables measure how attractive as a site for investment a country is.

4.4 Difference analysis

The results of a cross-sectional analysis will be biased to the extent that unmeasured determinants of corporate tax policy are correlated with the variables that are measured and included as explanatory variables. A natural way to minimize this problem is to investigate whether *changes* in corporate tax systems are associated with *changes* in the measured determinants of the policies. The methodological cost of this procedure is that it sacrifices the explanatory power of important influences on corporate tax setting that do not vary over time.

Table 7 reports on the results of regressing the difference between the 1995 and 1985 values of the corporate tax variables as a function of the 1995-1985 difference in the explanatory variables plus a constant. In some respects, the results are noticeably different from what the cross-section regressions reveal. What is consistent is that the expenditure needs of a country are not a dominant factor in either the statutory or average tax rate. Also similarly, there is no clear association between the openness measure and the corporate tax rates. What is different is that the indicator of benefit taxes, the extent of electrification, now has a positive association with the measures of corporate taxation, one that is significant for the statutory rate and close to so for the average rate. This suggests that there may be some aspect of benefit taxation in corporate rate setting. The top individual rate is still positively associated with the statutory rate, although it is no longer statistically significant. Strikingly, the individual rate is *negatively* associated with the average corporate tax rate.

Table 8 reports the results of redoing the difference analysis with one change: adding as an explanatory variable the 1985 value of the dependent variable. The results indicate a very strong regression toward the mean, as found in Grubert (2001). For both the statutory and average corporate rates, the 1985 value is negative and highly statistically significant. For the most part, adding this variable does not change the sign pattern of the other estimated coefficients, but it does tend to rob them of statistical significance. The one exception to this is that, for the average tax rate regression in column (6), the expenditure/GDP ratio now attracts a barely significant negative sign.

Finally, Table 9 adds as explanatory variables the 1985 values of GDP per capita, population, and openness as explanatory variables. None of these variables is associated

with the change in corporate taxation over the subsequent ten years. This analysis therefore does not corroborate the findings of Grubert (2001), who found that the decline between 1984 and 1992 in the average effective tax rate on U.S. businesses was larger for countries with a population of less than 15 million, that had an open trade regime, and that had GDP per capita of less than $4,000.

5. Conclusions and Issues for Future Research

There is substantial corroborating evidence that the statutory rate and effective tax rate imposed on corporation income--as well as the dispersion of these rates--began to decline around 1985, and that this decline continued for at least a decade. The question posed in this paper is to what extent that the decline was the result of increasing downward pressure exerted by international considerations, and to what extent the domestic pressures on corporation income tax rates both declined and became less disperse over this period.

What facts have I explained? First of all, there is striking evidence that the corporate tax rate structure is insulated from a country's revenue needs. Across countries, there is no association of the expenditure-GDP ratio with the corporate statutory or average rate. If it is not driven by revenue needs, what is it driven by? The results are suggestive, but not definitive, that the domestic role of the corporate tax as a backstop is important. Across countries, there is indeed a strong and growing association between the top individual rate and the top statutory corporate rate, and for 1990 (but not 1995) this effect is stronger when countries do not attempt to tax capital gains at the personal level. This association may not be causal, though, and may instead be arising because unmeasured factors that vary across countries affect both the top individual and top corporate rates in the same direction. This suspicion is reinforced by the failure of 1985 to 1995 *changes* in the top individual rate to be associated with the *changes* in the top corporate rate.

I have been unable to find much direct evidence that international competitive pressures exert a large effect on statutory corporate tax rates, especially across countries at a given point in time. Larger, more trade-intensive countries do collect more corporate

tax, but I suspect that this is because these countries are more attractive venues for investment.

Between 1985 and 1995 there is a very strong tendency for both statutory and corporate rates to regress toward the mean, even holding constant the changes over this period in the indicators of domestic and foreign influences on the corporation income tax. This could indicate the presence of international competitive pressures, unmeasured by me, that are compressing rates. It could also, I must add, indicate the presence of error in the measurement of the corporate tax rate variables. I return to this issue at the end of the paper.

There are certainly other possible explanations for the changes over time in corporate tax systems. One is the hypothesis discussed in Gordon (1992), that the United States exerts inordinate influence on world tax rates, and the drop in its corporate tax rate from .46 to .34 between 1986 and 1988 induced other countries to follow. This hypothesis was investigated by Whalley (1990), who considered two alternative hypotheses: (i) the U.S. initiated tax reform and other countries accommodated their tax systems to the U.S. changes, and (ii) common intellectual issues were at work in many countries, and direct interactions were relatively small. He concluded that neither hypothesis is able to account for the similarities in the tax changes of seven countries other than the U.S. In fact, a number of countries had started tax reforms prior to the 1986 tax act, and they subsequently influenced U.S. tax reform. On the other hand, there is evidence that the U.S. tax change of 1986 triggered foreign tax changes in the corporate tax systems at least among countries with major investment links with the United States, and especially Canada and Japan.

The quotation at the beginning of this paper refers to facts. If only all the numbers used in these analyses were, indeed, facts. This is unfortunately not true, especially with regard to one of the key tax rate variables I am trying to understand. Earlier I discussed the kinds of fairly arbitrary choices that must be made in choosing one summary measure of the statutory corporation income tax rate. The analysis has also ignored the extent to which integration of the corporation and individual income tax systems mitigates the total effective tax rate imposed by a country. The data also have a fairly limited coverage of the smallest countries ("dots") that are often tax havens. To be

sure, all of the empirical conclusions presented in this paper are therefore subject to a caveat regarding the quality of the data. The quality of future empirical investigation will be greatly served by a concerted effort at data collection and verification.

Data Appendix

TAXES

corprate. Statutory corporate income tax rates. These tax rates are taken from several issues of PriceWaterhouseCooper's *Corporate Tax: A Worldwide Summary*. They correspond to the marginal corporate income tax rate at the top bracket for central government only.

Avgtax Central government corporate tax revenue divided by gross domestic product. Corporate tax revenues are taken from several issues of the IMF's *Government Finance Statistics Yearbook* (item 1.2). GDP is taken from the World Bank's World Development Indicator 2000 CD-Rom.

indrate Statutory individual income tax rates. These tax rates are taken from several issues of PriceWaterhouseCooper's *Individual Tax: A Worldwide Summary*. They correspond to the marginal individual income tax rate at the top bracket for central government only.

world Territorial or worldwide tax system indicator. The indicator equals 1 if the corresponding country adopts a worldwide tax system, and 0 otherwise.

*ind*fullcap* Statutory individual tax rate interacted with an indicator for full capital gains taxation (=1 if there is full capital gains taxation, and 0 otherwise). These are taken from PriceWaterhouseCooper's *Individual Tax: A Worldwide Summary*.

*ind*nocap* Statutory individual tax rate interact with an indicator for no capital gains taxation (=1 if there is no capital gains taxation, and 0 otherwise). These are taken from PriceWaterhouseCooper's *Individual Tax: A Worldwide Summary*.

DOMESTIC VARIABLES

exp_gdp Central government expenditure as a fraction of gross domestic product. Government expenditures are taken from several issues of the IMF's *Government Finance Statistics Yearbook* (item II). GDP is taken from the World Bank's World Development Indicator 2000 CD-Rom.

ln_elec Natural log of per-capita electricity usage (in kilo-Watts per year). These are taken from the World Bank's World Development Indicator 2000 CD-Rom.

oil3 World petroleum price multipled by production of crude oil, NGPL, other liquids, and refinery, divided by population (dollars*thousands of barrels per day/millions of people). Petroleum price and amount are taken from the Department of Energy, U.S. Government. (http://www.eia.doe.gov/emeu/iea/tableg2.html). Population is taken from the World Bank's World Development Indicator 2000 CD-Rom.

INTERNATIONAL VARIABLES

ln_pop Natural log of population (in millions). These are taken from the World Bank's World Development Indicator 2000 CD-Rom.

trade (Exports + Imports)/GDP. These are taken from the World Bank's World Development Indicator 2000 CD-Rom.

openness Sachs-Warner openness indicator. These are taken from Harvard's Center for International Development website (http://www.cid.harvard.edu/). The indicator equals 1 if the corresponding country has open trade, and equals 0 otherwise. The data coverage is from 1950 to 1992. In the analyses in this paper, the 1992 values are used in 1995.

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Table 1

Mean and Standard Deviation of Corporate Statutory and Average Tax Rates, Pairs of Years from 1975 to 1995

Pairs of Years	Corporate Tax Rate		Average Tax Rate	
	Mean	Standard Deviation	Mean	Standard Deviation
1975 – 1980			0.02752	0.02795
			0.02890	0.02987
1975 – 1985			0.02752	0.02795
			0.02918	0.02835
1975 – 1990			0.02783	0.02843
			0.03078	0.03101
1975 – 1995			0.02974	0.03064
			0.02537	0.01447
1980 – 1985	0.39349	0.10838	0.02692	0.02943
	0.39529	0.10812	0.02847	0.02919
1980 – 1990	0.39697	0.10879	0.02724	0.02984
	0.36260	0.11406	0.02921	0.03019
1980 – 1995	0.39619	0.10940	0.02329	0.02387
	0.32748	0.08385	0.02342	0.01579
1985 – 1990	0.40175	0.10495	0.02713	0.02820
	0.36591	0.11416	0.02839	0.02869
1985 – 1995	0.39962	0.10563	0.02648	0.02853
	0.32708	0.08374	0.02250	0.01515
1990 – 1995	0.36500	0.11377	0.02726	0.03064
	0.32664	0.08760	0.02272	0.01534

Source: Author's calculations, based on variables described in Data Appendix. Note that each pair is based on a different set of country-year observations.

Table 2

Regression Analysis of Corporate Statutory and Average Tax Rates, 1995

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	-0.016		0.033	0.019		-0.01
	(0.19)		(0.31)	(0.76)		(0.44)
ln_elec	-0.014		-0.007	(0.13)		-0.002
	(1.83)		(0.65)	0.011		(0.67)
indrate	0.473		0.329	0.011		0.005
	(6.40)**		(3.31)**	(0.54)		(0.27)
ind * full cap	-0.01		-0.033	0.005		0.037
	(0.19)		(0.46)	(0.37)		(2.30)*
ind * no cap	0.04		0.028	-0.009		-0.003
	(0.71)		(0.42)	(0.57)		(0.18)
oil	3.827		2.868	0.256		0.582
	(1.79)		(1.26)	(0.44)		(1.31)
ln_pop		0.005	0.005		0.002	0.002
		(0.73)	(0.52)		(1.09)	(0.85)
openness		-0.039	-0.045		0.002	0.01
		(1.92)	(1.41)		(0.41)	(1.47)
trade		0.012	0.013		0.017	0.012
		(0.57)	(0.57)		(2.42)*	(1.62)
world		0.017	0.012		-0.001	0.005
		(0.75)	(0.38)		(0.18)	(0.73)
constant	0.253	0.259	0.184	0.013	-0.019	-0.012
	(4.51)**	(2.04)*	(1.11)	(0.81)	(0.59)	(0.32)
Observations	64	64	51	58	47	45
R^2	0.46	0.08	0.41	0.05	0.13	0.31

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 3

Regression Analysis of Corporate Statutory and Average Tax Rates, 1990

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	0.039		0.066	0.034		0.033
	(0.40)		(0.60)	(0.96)		(0.80)
ln_elec	-0.003		0.003	-0.004		-0.002
	(0.30)		(0.32)	(1.00)		(0.57)
indrate	0.42		0.395	-0.004		-0.014
	(5.33)**		(4.74)**	(0.15)		(0.49)
ind * full cap	0.025		0.02	0.005		-0.007
	(0.52)		(0.35)	(0.27)		(0.38)
ind * no cap	0.147		0.154	0.008		0.01
	(2.78)**		(2.73)**	(0.40)		(0.47)
oil	5.141		5.231	0.867		0.804
	(1.23)		(1.23)	(0.60)		(0.54)
ln_pop		0.002	0.014		0.005	0.005
		(0.31)	(1.73)		(1.81)	(1.64)
openness		-0.072	-0.029		-0.006	-0.008
		(3.09)**	(1.04)		(0.70)	(0.74)
trade		0.002	0.004		0.024	0.025
		(0.08)	(0.18)		(1.84)	(1.56)
world		-0.01	-0.009		-0.006	-0.009
		(0.40)	(0.31)		(0.78)	(0.79)
constant	0.175	0.392	-0.081	0.044	-0.057	-0.042
	(2.33)*	(2.91)**	(0.470)	(-1.730)	(1.180)	(0.690)
Observations	54	64	51	48	47	45
R^2	0.520	0.180	0.570	0.050	0.120	0.170

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 4

Regression Analysis of Corporate Statutory and Average Tax Rates, 1985

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	0.079		0.038	0.05		0.046
	(0.70)		(0.33)	(1.34)		(1.02)
ln_elec	0.001		0.022	-0.008		-0.01
	(0.14)		(1.84)	(2.39)*		(2.49)*
indrate	0.309		0.29	-0.003		-0.035
	(4.05)**		(3.56)**	(0.14)		(1.49)
oil	1.048		-5.332	6.844		12.765
	(0.31)		(0.45)	(3.03)**		(3.47)**
ln_pop		0.005	0.006		0.01	0.008
		(0.63)	(0.55)		(3.33)**	(2.13)*
openness		-0.007	-0.051		-0.012	-0.003
		(0.28)	(1.64)		(1.58)	(0.27)
trade		0.016	0.013		0.045	0.034
		(0.51)	(0.45)		(2.82)**	(1.56)
constant	0.202	0.313	0.008	0.07	-0.16	-0.046
	(2.49)*	(2.10)*	(0.04)	(2.92)**	(2.90)**	(0.62)
Observations	57	63	50	47	62	43
R^2	0.30	0.01	0.34	0.29	0.17	0.4

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 5

Regression Analysis of Corporate Statutory and Average Tax Rates, 1980

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	0.242		0.244	0.08		0.081
	(1.55)		(1.56)	(1.51)		(1.41)
ln_elec	-0.01		0.016	-0.013		-0.016
	(0.85)		(1.14)	(3.09)**		(3.38)**
indrate	0.176		0.125	0.047		-0.007
	(2.40)*		(1.46)	(1.92)		(0.26)
oil	-1.30		6.167	38.03		66.065
	(0.24)		(0.23)	(5.13)**		(7.11)**
ln_pop		0.011	0.015		0.009	0.004
		(1.24)	(1.22)		(1.87)	(0.73)
openness		-0.038	-0.087		-0.021	0.005
		(1.54)	(2.43)*		(1.81)	(0.39)
trade		0.02	0.017		0.07	0.035
		(0.79)	(0.65)		(2.88)**	(1.22)
constant	0.301	0.235	-0.054	0.063	-0.146	0.037
	(3.56)**	(1.56)	(0.23)	(2.19)*	(1.72)	(0.38)
Observations	54	62	47	45	56	41
R^2	0.23	0.06	0.28	0.47	0.14	0.67

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 6

Regression Analysis of Corporate Average Tax Rates, 1975

Independent variables	(1) avgtax	(2) avgtax	(3) avgtax
exp_gdp	0.09		0.045
	(3.31)**		(1.03)
ln_elec	-0.004		-0.00009
	(1.96)		(0.03)
oil	21.355		-3.045
	(2.49)*		(0.17)
ln_pop		0.008	0.007
		(2.63)*	(1.72)
openness		-0.014	-0.013
		(2.05)*	(1.45)
trade		0.054	0.039
		(3.06)**	(1.34)
constant	0.028	-0.126	-0.108
	(1.78)	(2.28)*	(1.40)
Observations	47	47	42
R^2	0.40	0.22	0.28

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 7

Regression Analysis of the Change in Corporate Statutory and Average Tax Rates
Between 1985 and 1995

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	-0.235		-0.249	0.052		0.004
	(1.09)		(1.01)	(0.94)		(0.06)
ln_elec	0.083		0.132	-0.015		-0.026
	(2.07)*		(2.45)*	(1.40)		(2.00)
indrate	0.134		0.153	-0.028		-0.069
	(1.13)		(1.11)	(0.91)		(2.10)*
oil	-0.361		14.069	0.051		-4.126
	(0.55)		(2.22)*	(0.30)		(2.72)*
ln_pop		0.061	-0.195		-0.024	-0.117
		(0.30)	(0.75)		(0.66)	(1.88)
openness		-0.028	0.03		-0.005	0.007
		(0.76)	(0.70)		(0.60)	(0.71)
trade		0.019	0.018		0.013	0.03
		(0.21)	(0.19)		(0.64)	(1.32)
constant	-0.089	-0.085	-0.106	-0.002	-0.002	0.009
	(3.12)**	(3.35)**	(3.03)**	(0.21)	(0.26)	(1.09)
Observations	44	38	36	44	51	36
R^2	0.20	0.02	0.31	0.11	0.02	0.41

Notes: All values (except the constant) are measured as the difference between 1995 and 1985 values.
Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level

Table 8

Regression Analysis of the Change in Corporate Statutory and Average Tax Rates
Between 1985 and 1995, with 1985 Tax Rates as an Explanatory Variable

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	-0.218		-0.168	-0.032		-0.067
	(1.22)		(0.84)	(1.18)		(2.36)*
ln_elec	0.068		0.07	0.002		-0.004
	(2.02)		(1.52)	(0.46)		(0.59)
indrate	0.052		0.012	-0.002		-0.014
	(0.51)		(0.10)	(0.12)		(0.88)
oil	0.268		6.662	0.011		-0.231
	(0.48)		(1.22)	(0.14)		(0.29)
corpra85	-0.428	-0.603	-0.518			
	(4.30)**	(5.43)**	(4.01)**			
ln_pop		0.051	-0.041		-0.011	-0.053
		(0.34)	(0.19)		(0.66)	(1.79)
openness		-0.045	-0.019		0.00	0.009
		(1.65)	(0.52)		(0.03)	(1.90)
trade		0.035	0.017		0.015	0.024
		(0.54)	(0.22)		(1.55)	(2.29)*
avgtax85				-0.661	-0.74	-0.677
				(11.90)**	(13.65)**	(10.09)**
constant	0.078	0.166	0.108	0.015	0.017	0.018
	(1.71)	(3.32)**	(1.78)	(4.12)**	(5.40)**	(4.45)**
Observations	44	38	36	44	51	36
R^2	0.46	0.48	0.57	0.81	0.81	0.88

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.

Table 9

Regression Analysis of the Change in Corporate Statutory and Average Tax Rates Between 1985 and 1995, with 1985 Values of Tax Rates, GDP per Capita, Population, and Openness as Explanatory Variables

Independent variables	(1) corprate	(2) corprate	(3) corprate	(4) avgtax	(5) avgtax	(6) avgtax
exp_gdp	-0.220		-0.242	-0.032		-0.076
	(1.21)		(1.16)	(1.22)		(2.54)*
ln_elec	0.074		0.046	0.005		-0.004
	(1.99)		(0.68)	(0.86)		(0.37)
indrate	0.036		0.033	-0.008		-0.032
	(0.33)		(0.19)	(0.51)		(1.35)
oil	0.275		8.049	0.013		-0.441
	(0.48)		(1.40)	(0.17)		(0.52)
gdppc85	0.004		-0.002	0.002		0.002
	(0.41)		(0.11)	(1.14)		(0.75)
corpra85	-0.429	-0.639	-0.562			
	(4.26)**	(5.64)**	(4.24)**			
ln_pop		-0.086	-0.340		-0.001	-0.035
		(0.36)	(1.00)		(0.06)	(0.72)
ln_pop85		0.015	0.014		0.000	0.002
		(1.94)	(1.29)		(0.17)	(1.32)
openne85		-0.022	-0.043		0.004	0.005
		(0.48)	(0.53)		(0.75)	(0.42)
openness		-0.047	-0.022		0.002	0.014
		(1.42)	(0.46)		(0.48)	(2.13)*
trade		0.055	0.085		0.013	0.024
		(0.76)	(0.90)		(1.36)	(1.80)
avgtax85				-0.659	-0.745	-0.681
				(11.91)**	(13.18)**	(9.92)**
constant	0.040	-0.043	-0.019	0.000	-0.010	-0.042
	(-0.39)	(-0.30)	(-0.07)	(-0.01)	(-0.45)	(-1.06)
Observations	44	38	36	44	51	36
R^2	0.46	0.54	0.62	0.82	0.81	0.89

Notes: Absolute value of t-statistics in parentheses.
Significant at 5% level; ** significant at 1% level.