

# **DEVELOPMENTS IN THE TAXATION OF CORPORATE PROFIT IN THE OECD SINCE 1965: RATES, BASES AND REVENUES**

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## **Abstract**

This paper describes developments in corporation taxes in the OECD over the last 40 years. It pays particular attention to the apparent divergence in the trends of the average statutory corporation tax rate and the average ratio of corporation tax revenues to GDP: the former has declined over time, while the latter has risen. It develops a simple framework for assessing the expected effect of the tax rate on tax revenues, and estimates the relationship using a panel of aggregate data for 20 OECD countries from 1965 to 2004, controlling for a measure of the tax base and other factors. There is only weak evidence of any relationship between the two. Evidence which does support a relationship is consistent with the finding of Clausing (2006) that the relationship is non-linear, and that the implied revenue-maximising tax rate is likely to be low.

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## 1. INTRODUCTION

A common belief about the development of corporation taxes in the OECD over the last two decades is that OECD countries are in a ‘race to the bottom’, generated by intense and growing competition between countries to attract either inward investment or mobile profit. This paper investigates how these taxes have developed, using data from 20 OECD countries over the last 40 years. An important distinction needs to be made between tax rates and tax revenues. Briefly, on average corporation tax rates have fallen significantly since the early 1980s – although the prospect of rates falling to zero still seems distant. However, revenues from corporation taxes have been buoyant; in fact, on average across OECD countries, revenue as a proportion of GDP is higher than at almost any time in the last 40 years.

There have been significant reductions in statutory rates over this period. However, as Figure 1 shows, the pattern of these reductions is very different over time. In 1965, the average rate for this group of countries was 40%. From the mid 1960s to the early 1980s, the average statutory rate was relatively constant, and actually increased slightly. But in a five year period between 1988 and 1993, the average rate fell from 41% to 33%. Since then, this average rate has been fairly constant for these countries; it stands now at 32%. So, while there has been a reduction in rates, the supposed “race to the bottom” in tax rates amongst these countries has not proceeded very rapidly, at least over the last decade or so.

But even the rapid decline in rates seen in the late 1980s and early 1990s has had little impact on tax revenues. Figure 2 presents the average ratio of corporation tax revenues to GDP across the same group of countries and the same time period. This began in 1965 at 2.4% - that is, on average corporation tax revenues amounted to 2.4% of GDP. This average hovered around this level for the next 30 years: it rose slightly in the first half of the 1980s to reach 2.9% by 1985, but then fell back to 2.7% by 1994. After that,

however, it has rapidly increased. It peaked at 4.1% in 2000, before falling back to 3.7% by 2004.

These two Figures do not sit easily with each other. The first shows a dramatic decline in the average tax rate over one short period. The second shows a remarkably constant series in the average revenue to GDP ratio, before it rapidly escalated in a period when there were no significant changes to the tax rates.

There are several possible explanations of these effects. One obvious candidate is an increase in profit-shifting. This could be from high tax-rate countries to low tax-rate countries, reducing tax revenues in the former, but increasing it in the latter. Given that larger countries tend to have higher rates, then this could explain an increase in the unweighted average of the ratio of corporation tax revenue to GDP across countries. Another possibility is that lower rates of corporation tax relative to personal income tax have encouraged business to take incorporated form, becoming liable to corporation tax rather than personal income taxes. Yet another possibility is that lower effective tax rates have stimulated investment and raised rates of profit; or that there have been other exogenous factors creating increases in the level of profit. In either case, revenues could rise.

This paper does not set out to distinguish between these hypotheses, but sets itself a less ambitious target; to investigate these trends in the OECD since the mid 1960s, and the cross-section variation underlying them. Section 2 presents a more detailed description of the development of corporation taxes. This section extends two earlier papers. Devereux et al (2002) presented evidence on a similar set of countries up to 2001. This paper extends that analysis by including later years, and also an earlier analysis of rates. Randolph (2005) also presented evidence of the distribution of tax rates, drawing on the earlier paper by Devereux et al (2002). Section 3 attempts a more rigorous evaluation of the relationship between tax rates and tax revenues. This section builds on recent work by Clausing (2006) by developing a framework to examine the relationship between the tax

rate and tax revenues.<sup>1</sup> It tests the hypotheses developed from this framework on the data presented by Section 2. Section 4 briefly concludes.

## **2. INTERNATIONAL TRENDS IN CORPORATE TAXATION**

Taxes on corporate income are extremely complex. Legislation can run to thousands of pages, supported by legal judgements. There is not space here to give more than a very broad picture of the development of such taxes in OECD countries. We begin in Section 2.1 by summarising some of the main features of the tax: the statutory rate, and one very simple measure of the general tax base.<sup>2</sup> We continue in Section 2.2 to combine these to present commonly-used measures of effective tax rates – both marginal and average – which depend on both the tax rate and the tax base. In Section 2.3 we summarise trends in the revenue collected from these taxes. In each case, we consider differences in corporation taxes in two dimensions: how has the tax changed over time, and how has the distribution across countries changed.

We present a systematic account of how corporation taxes have developed over time. We have not been able to accumulate all the data required for all OECD countries. However, we present evidence on corporation tax rates and revenues for 20 countries since 1965 and on measures of the tax base and effective tax rates for 19 countries since 1982.

### ***2.1 The statutory tax rate and tax base***

The most basic measure of a corporate income tax is the statutory tax rate. This measure is widely used, although even defining this rate is less straightforward than might be expected. Corporate income taxes are often applied at more than one level of government. There may also be temporary or permanent supplementary taxes, and there

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<sup>1</sup> Slemrod (2004) investigates the determinants of forms of corporation tax rates.

<sup>2</sup> We do not have space to identify and discuss special regimes – we focus only on the general position of the tax in each country.

may be special tax rules for small and medium-sized enterprises. Where possible, our definition includes local tax rates and any supplementary charges made.<sup>3</sup>

Figure 3 shows the tax rate for each of the 20 countries in three years: 1965, 1982 and 2004. This shows a picture of remarkable change. Between 1965 and 2004, 15 out of the 20 countries reduced their tax rate, 4 increased it and one had the same rate in both years. In many cases the fall has been substantial. As might be expected from Figure 1, the largest falls occurred between 1982 and 2004, when 16 countries reduced their tax rates. The change in the average in Figure 1 is not therefore due to very large falls in a few countries, but represents a common movement in most of the countries analysed here. In 1982, 16 out of the 20 countries had tax rates of 40% or more; by 2004 there were none.<sup>4</sup>

A high tax rate does not necessarily imply high tax payments, since payments depend also on the tax base. However, the tax rate may be important in its own right. In deciding where to declare income, it might be expected that multinational companies seek to use all allowances and deductions available in any jurisdiction. Having done so, tax on any excess income is levied at the statutory rate; hence the statutory rate is central in determining the location of profit, conditional on where the company's real activity takes place.

The diagrams presented here do not amount to conclusive evidence that there has been competition for taxable profit. However, further evidence is available to support the notion that, in setting their statutory rates, governments do take account of the statutory rates in other countries.<sup>5</sup> It seems plausible that this represents competition for mobile profit, although the possibility that it reflects competition for the location of real activities cannot be discounted.

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<sup>3</sup> In cases where local tax rates differ across regions, we use averages weighted by production where data are available. Otherwise the rate of regions in which most of the production takes place, or data from OECD (1991) are used. Where local taxes or surcharges can be set off against other taxes (e.g. local against federal), this is taken into account. Where tax rates change within a year we use the rate valid at the end of the calendar year. See Chennells and Griffith (1997). Data from the OTPR includes only federal rates.

<sup>4</sup> Though Japan's effective tax rate was 39.7%.

<sup>5</sup> See Devereux, Lockwood and Redoano (2004).

In all countries, the definition of the corporate tax base is extremely complex, involving a vast range of legislation covering everything from allowances for capital expenditure, to the deductibility of contributions to pension reserves, the valuation of assets, the extent to which expenses can be deducted, and so on. It is not possible to present a measure which reflects all of these factors. We follow the empirical literature in focusing only on depreciation allowances for capital expenditure. A natural measure of the value of such allowances is their present discounted value (PDV). In Figures 4 and 5 we present estimates of the PDV of allowances for investment in plant and machinery,<sup>6</sup> expressed as a percentage of the initial cost of the asset. The PDV would be zero if there are no allowances at all and it would be 100% with a cash-flow tax that permitted the cost to be deducted immediately.

Figure 4 shows the PDV for each country in 1982 and 2004, based on a single nominal discount rate for all countries and all years.<sup>7</sup> This Figure therefore reflects changes in the rates of depreciation set by governments, and abstracts from changes in the inflation rate and the real interest rate, which would affect the discount rate applied to future allowances. However, in Figure 5, we present two measures of the weighted average PDV of allowances. The first is based on the approach of Figure 4. The second is based on the assumption that the nominal discount rate applied to all allowances associated with an asset purchased in period  $t$  is based on the country-specific inflation rate in period  $t$ . Although not quite as dramatic as the changes to the statutory rate, Figure 4 does demonstrate some striking reforms. Of the 19 countries analysed, 11 cut their allowance rates for investment in plant and machinery between 1982 and 2004 - that is, they have broadened their tax bases. Most notably, the UK and Ireland decreased their allowances substantially from 100% to 73%, and to 71%, respectively. Five countries kept their allowances constant and only 3 countries - Greece, Portugal and Spain - increased allowances.

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<sup>6</sup> The PDVs of allowances for investment in industrial buildings are lower, corresponding to lower rates of allowances. However, they also fell over the period considered.

<sup>7</sup> The nominal discount rate is 13.9%, based on inflation of around 3.5% and a real discount rate of 10%.

Figure 5 presents the time series of the weighted mean with constant and actual inflation. Not surprisingly, given the evidence of Figure 4, when inflation is held constant, there was a decline in the average PDV of allowances for plant and machinery; that is, the rates of allowance have become less generous. In fact, on this basis, the weighted mean fell from 83% in 1982 to 76% in 2004. The largest part of this decline was in the late 1980s; cuts were less pronounced in the 1990s. Since then, the USA has introduced temporarily higher allowances; these have had the effect of raising the overall weighted average. An unweighted average (not shown) reveals a similar pattern up to 2001 with a fall from 81% to 76%; but since then it has fallen slightly further, to 75%.

Allowing for the effects of inflation on the nominal discount rate generates a slightly different pattern. The marked decline in the second half of the 1980s is even more pronounced. However, the stability of rates in the 1990s, combined with falling inflation, leads to some recovery of the average PDV. Overall, both measures indicate a decline over the period considered – certainly up to around 2001 - but the impact of the decline in the rates has been offset by the lower discount rates implied by lower inflation.

## *2.2 Effective tax rates*

We now turn to combining elements of the tax rate and base to present two measures of effective rates of tax. The traditional method of measuring the impact of corporate income tax on the level of capital investment is through the user cost of capital – defined as the pre-tax real required rate of return on an investment project, taking into account the financial cost of the investment as well as depreciation.<sup>8</sup> The basic idea is that a firm will invest up to the point at which the marginal product of capital is just equal to the cost of capital – so that, at the margin, the project just breaks even. As investment increases, the marginal product is assumed to decline, resulting in a unique profit-maximising level of investment. The impact of tax on the cost of capital is measured by the effective marginal tax rate (EMTR). A higher EMTR pushes up the cost of capital, and therefore reduces the

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<sup>8</sup> This approach dates back at least to Hall and Jorgensen (1967). It was further developed by King (1974), among others. The most common form of measuring the effective marginal tax rate was developed by King and Fullerton (1984).

inflow (or increases the outflow) of capital. Most studies which model the impact of corporate income tax in an open economy are based on this approach.<sup>9</sup>

More recently, attention has also focussed on the discrete choices made by multinational firms, which face a choice between alternative locations of production. For example, if an American firm wants to enter the European market, it could locate production in one of a number of different European countries. Given the structure of its costs, it will probably not locate in all countries. It should choose that location (or locations) offering the highest post-tax profit. The impact of tax on this decision can be measured by the extent to which the pre-tax profit is reduced by taxation – this is measured by an effective average tax rate (EATR). Conditional on this location choice, the scale of the investment should be determined by the cost of capital and the EMTR.

We measure the EMTR and EATR by considering the impact of tax on a hypothetical investment project. Details of the approach are in Devereux and Griffith (2003) and are not repeated here. The measures depend on economic conditions associated with each investment, notably the real post-tax required rate of return, the economic depreciation rate of the asset and the inflation rate. Throughout, we hold fixed the real post-tax required rate of return<sup>10</sup>.

The form of the investment modelled is, of necessity, limited. In common with other such measures, we ignore complications which would arise if we allowed the hypothetical investment to be risky. We consider the tax system only as it applies to a mature manufacturing firm – so the measures do not reflect the position for services or for hi-tech industries. The measures presented here also apply only to an investment in plant and machinery, financed by equity; we do not present estimates for investment in other assets (land or inventories, for example), nor for other forms of finance. We do not consider the treatment of losses or other forms of tax exhaustion. We analyse only

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<sup>9</sup> See, for example, OECD (1991).

<sup>10</sup> We assume that this is 10%, although the results are not sensitive to this assumption. We present estimates of the EATR based on an assumed pre-tax rate of return of 30%. Again, the results are not sensitive to reasonable variations in this assumption.

source-based corporate income taxes – we do not include taxes levied in the country of residence of the parent company, nor do we include any source-based taxes paid by corporations that are not based on profit. We generally exclude industry-specific measures and we do not allow for any forms of tax shifting. We have not included personal taxes levied on corporate source income. Despite all of these limitations, the measures do provide a summary of the combined effect of the tax rate and tax base, at least on a specific form of investment.

Figures 6 and 7 show the development of effective marginal tax rates (EMTR) over time, using the same format as previously. In Figure 6 we follow the approach of Figure 4, in holding inflation constant across all years and countries. In Figure 7 we mirror the approach of Figure 6 in presenting the weighted average across countries both with inflation fixed, and using the inflation rate of the period in which the investment is assumed to take place.

The development of the EMTR over time does not strongly replicate the pattern seen in the statutory tax rates. This is because investment projects at the margin are strongly affected by the value of allowances. Based on the approach in Figure 6 in 15 out of the countries the EMTR has decreased. However, in many of these cases, the falls are not very substantial.

Figure 7 shows that, given fixed inflation, the weighted mean EMTR remained fairly stable until the late 1990s; it rose a little during the early and mid 1980s, but then fell back. From the late 1990s the fall has been substantial. This reflects the movement in the weighted average allowance rates: a combination of lower statutory rates, and more generous allowances have contributed to reduce the weighted average EMTR. The same pattern holds for the weighted mean EMTR based on actual inflation rates in each country and year. However, for this measure, the drop over time has been more substantial; this reflects the evidence in Figure 5 - with a lower inflation rate, a given allowance rate is more generous, leading to a lower EMTR.

In both cases, however, the pattern since 2001 has reflected especially the position in the USA, which had more generous allowances between 2002 and 2004. In 2005, allowance rates have fallen back in the USA, and hence the EMTR for the USA, and the weighted average EMTR has risen again. The effect of the USA is diminished by considering the unweighted mean. This has fallen more steadily over the period, from 28% to 20%, but has been stable for the last few years.

Figures 8 and 9 present evidence for the EATR, following the same approach as Figures 6 and 7. Figure 8 shows that, given the fixed inflation assumption, the EATR fell in 15 countries. The pattern of reduction is closer to reflecting the pattern seen in the development of the statutory tax rate in Figures 1 and 3. The EATR for industrial buildings follows similar patterns. Figure 9 shows that, on the same basis of fixed inflation, the weighted mean EATR fell over the period from around 35% to around 27%. Based on actual inflation, the fall in the EATR was a little more striking, from 36% to 26%. These two series are closer in the case of the EATR than in the case of the EMTR, since the EATR depends rather more on the statutory tax rate and rather less on allowances and hence inflation. Nevertheless, the two approaches give a similar qualitative picture of the development of effective tax rates.

### ***2.3 Tax revenues***

A number of studies have used data on tax revenues to measure the impact of corporate income tax on incentives for investment. Often, a form of average tax rate is calculated, expressing the tax payment as a proportion of a measure of profit. However, we do not present such measures here, mainly due to concerns about whether it is possible to find a suitable measure of profit to use as the denominator.<sup>11</sup>

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<sup>11</sup> Devereux (2004) provides a discussion of alternative measures, and Devereux and Klemm (2004) demonstrate that different approaches can generate very different impressions of the severity of a tax regime.

Nevertheless, the size of revenues raised from corporate income taxes is clearly important to governments who face revenue constraints. We therefore present a description of the development of revenues from corporate income taxes. Note that these differ in scope from the measures considered above. For example, in constructing effective tax rates, we considered only source-based corporate income taxes. However, tax revenues in any country may include both source-based taxes and residence-based taxes – typically, revenue collected from profits earned abroad and repatriated.

Due to differences in country size, it is clearly not useful simply to compare corporate income tax revenues across countries. Two convenient ways of making such comparisons are to scale tax revenues in each country by GDP – as used in Figure 2 - or by total tax revenues. These measures will vary for reasons other than the corporate tax system. For example, both depend on the size of the corporate sector (e.g. the degree to which business is incorporated) and on the relative size of corporate income in GDP, which varies considerably over the economic cycle.

Figure 10 presents the time series since 1965 of tax revenues from corporate income as a proportion of GDP. We use data from OECD Revenue Statistics on tax revenues from corporate income and capital gains paid by corporations.<sup>12, 13</sup> The unweighted average is the same as presented in Figure 2. Here, however, we also include the median, and the weighted average, where the weight is GDP.

The GDP weighted mean of the ratio of taxes on corporate income to GDP varies over the economic cycle, but does not appear to follow any long-term trend. In all years it is within the interval from 2.5% to 3.5% of GDP, beginning in 1965 at 3.1% and ending in 2004 at 2.8%. By contrast, however, and as noted above, the unweighted average has clearly risen substantially, and in particular during the last 10 years. The median was relatively constant until the early-to-mid 1990s. However, it too then rose quickly before also falling back after 2000.

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<sup>12</sup> This is tax class 1200 in the OECD data.

<sup>13</sup> Data for 2004 are not yet available for Australia and Greece; for these countries we have substituted the 2003 values.

The comparison between the weighted and unweighted means clearly indicates that smaller countries – which receive a smaller weight in the weighted average – have been increasingly reliant on corporation tax revenues. Figure 11 shows corporate income tax revenue as a proportion of GDP for each country in 1965, 1982 and 2004.<sup>14</sup> The variation across countries is considerable: some of the smaller countries raised less than 2% of GDP from corporate income taxes in 1965; by contrast, Luxembourg raised over 7% in 2004. Between 1965 and 2004 most countries experienced an increase in tax revenues as a proportion of GDP. There are 4 exceptions, but only the USA experienced a drop in excess of 1 percentage point (in fact, by 2001/2 the drop since the mid 1960s was over 2 percentage points, but there has been a subsequent small recovery). Between 1982 and 2004 again 4 countries reduced this ratio; but only one of them, Japan, experienced a large reduction - of nearly 2 percentage points of GDP.

Of course, revenue is the product of taxable profit and the tax rate. Since we have already investigated the development of the tax rate, it is also useful to consider the development of taxable profit. We measure aggregate taxable profit by dividing revenue by the tax rate. Figure 12 shows how this measure has changed over the 40 year period considered. For each country, it presents the average ratio of taxable profit to GDP over the period 1965-1984 and 1985-2004.

Part of any increase in taxable profit may reflect the broadening of the tax base detailed above. Other increases could arise from a number of sources: higher rates of profit; higher investment, generating greater profit in aggregate; shifting of income from the non-corporate sector to the corporate sector; or inward shifting of profit from other countries.

In many countries, there have been substantial changes in the size of taxable profit over these two periods. The most remarkable change has been in Ireland. In the first two

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<sup>14</sup> The latter two dates were chosen to correspond to the dates available for measures based on tax rules. We also show the year 1965, because tax revenue data are available over a longer period.

decades, Ireland's taxable profit was 7% of GDP; in the second period it was 26.5%. Clearly the very low tax rate on manufacturing activity in Ireland from the early 1980s created a powerful incentive for moving real activity and profits to Ireland. But many other countries also saw a substantial rise in their taxable profit between the two periods. Taxable profit in Denmark, Finland and Greece all more than doubled, and it increased by more than 50% in Australia, Austria, France, Luxembourg, Netherlands, Norway, Spain, Sweden and the United Kingdom. This may have been affected by the broadening of the tax base, but given the analysis above, it is hard to believe that this is the only reason.

An important outlier in this series (although not the only one), is the United States, which saw an increase in the ratio of taxable profit to GDP between the two periods of only 7%. Commentators in the US<sup>15</sup> have noted that tax revenues in the US fell substantially during the first period, but have been relatively constant since, albeit moving strongly with the economic cycle.<sup>16</sup> While this is largely true, this masks the comparison with other OECD countries, as shown in Figure 13. In the mid 1960s, the US taxable profit (relative to GDP) was much higher than the OECD average. The two series rapidly reached the same level, though, and apart from some years in the 1980s where the US taxable profit was lower, they were still at a comparable level in 1988. Since then, however, taxable profit in the rest of the OECD has soared; the average ratio to taxable profit to GDP nearly doubled from 7.7% in 1988 to 14.5% in 2000, before falling back slightly.

Such differences across countries raise a number of questions. Why did taxable profit in the rest of the OECD rise so fast in the 1990s? Why did the same not happen in the United States?<sup>17</sup> In the next section, we further investigate the time-series and cross-section variation in the data to begin to explore reasons for these differing experiences.

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<sup>15</sup> See, for example, Auerbach (2004).

<sup>16</sup> Auerbach and Poterba (1987) investigated the development of tax revenues up to that point.

<sup>17</sup> One possible answer is that US multinationals are shifting income from the US to other countries with lower tax rates. This would be consistent with evidence found for German multinationals by Huizinga and Laeven (2005).

### **3. THE RELATIONSHIP BETWEEN TAX REVENUES AND TAX RATES**

In this section, we take the analysis of tax revenues one step further. We can begin to see the impact of the tax rate on a measure of taxable income in Figure 14, which plots these two variables against each other for a single year: 2004. There is clearly appears to be negative relationship between these two variables. Two countries stand out: Ireland, which has a very low tax rate, but very high revenue, and Norway, which has even higher tax revenue with a moderate tax rate. In the case of Norway, this may reflect income taxable income from North Sea oil and gas. The other countries are closer together, but they also give the clear appearance of a negative relationship. Given that there appears to be a priori evidence of a negative relationship between the tax rate and taxable income, we now turn to examining the relationship more formally, using regression analysis.

One natural approach is to attempt to explain corporation tax revenues as a proportion of GDP, using the statutory rate as one determinant amongst others. By allowing a quadratic relationship between tax revenues and the tax rate, then if both tax rate terms are significant in the regression, it is possible to infer the revenue-maximising tax rate, and possibly to trace out its development over time. This approach has been taken recently by Clausing (2006), who produced evidence of a revenue-maximising rate of only 33%.

Here we take a slightly different approach. The basic idea is that a high tax rate could deter the accumulation of taxable income. This could happen in a number of ways – lower rates of investment, more enterprises choosing not to incorporate and hence be liable for corporation tax, or shifting profit between jurisdictions. To investigate this it is useful to set out a simple framework relating the behaviour of a profit-maximising firm to aspects of taxation. The aim is to provide an empirical formulation which can be tested against the data.

Consider a firm based in a single country. It maximises post-tax profit, defined as

$$\Pi = F(K) - rK - \tau[Y - \phi] - \frac{\alpha \phi^2}{2Y} - \tau^* \phi \quad (1)$$

where

- $F(K)$  is the net revenue function, which for simplicity depends only on the capital stock,  $K$
- $r$  is the real interest rate
- $\tau$  is the statutory tax rate
- $Y$  is taxable profit before any profit is shifted, defined in more detail below
- $\phi$  is the amount of taxable profit shifted, either out of the country, or to the personal income tax
- $\frac{\alpha \phi^2}{2Y}$  represents the cost of shifting income; this depends on two factors (a) a quadratic factor which depends on the proportion of  $Y$  shifted, ie.  $(\phi/Y)^2$  and (b) a factor which represents the size of the taxable profit before shifting,  $Y$ . For simplicity, these two elements are combined into a single cost schedule.
- $\tau^* \phi$  is the tax paid on the shifted profit:  $\tau^*$  is the tax rate in another jurisdiction, or the income tax rate. We assume that  $\tau > \tau^*$ , so profit is shifted out of the corporation tax base, rather than into it.

Below, it is useful to identify two other measures of profit. Pre-tax profit is defined as  $P$ , where

$$P = F(K) - rK .$$

Taxable profit before shifting is defined as

$$Y = F(K) - ArK = P + (1 - A)rK$$

where  $A$  represents the proportion of capital expenditure offset against tax. Since we use a static model,  $A$  can be thought of as the net present value of depreciation allowances per unit of investment, as discussed in Section 2.

The firm chooses  $\phi$  and  $K$  to maximise profit. The first order conditions are

$$\begin{aligned}\frac{\partial \Pi}{\partial \phi} = 0 &\Rightarrow \tau - \frac{\alpha \phi}{Y} - \tau^* = 0 \\ &\Rightarrow \phi = \frac{\tau - \tau^*}{\alpha} Y\end{aligned}\tag{2}$$

and

$$\frac{\partial \Pi}{\partial K} = 0 \Rightarrow F' - r - \left\{ \tau - \frac{\alpha}{2} \left( \frac{\phi}{Y} \right)^2 \right\} [F' - Ar] = 0\tag{3}$$

Substituting (2) into (3) gives an expression for the marginal revenue from investment:

$$F' = \frac{(1 - A \hat{\tau})r}{1 - \hat{\tau}} = (1 + m)r\tag{4}$$

where  $m$  is a form of effective marginal tax rate,

$$m = \frac{\hat{\tau}(1 - A)}{1 - \hat{\tau}}\tag{5a}$$

and where  $\hat{\tau}$  in turn is a form of “effective” statutory rate, which takes account of optimal profit shifting:<sup>18</sup>

$$\hat{\tau} = \tau + \frac{(\tau - \tau^*)^2}{2\alpha}.\tag{5b}$$

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<sup>18</sup> Note that we do not observe this measure of  $m$  (since we do not observe  $\alpha$ ); in the empirical analysis we use the conventional measure described in Section 2.

Inverting (4) implies a profit-maximising level of the capital stock and hence the pre-tax level of profit,  $P$ , which depends on the net revenue function and the profit-shifting cost function, the two parameters of the home country tax regime, and the foreign tax rate. That is,  $P = P(m, \alpha) = P(\tau, A, \tau^*, \alpha)$ . The right hand side of (4) can be thought of as a form of the user cost of capital, incorporating the effects of profit-shifting.

Given the optimal choice of  $\phi$  and  $K$ , the tax paid in the home country is

$$\tau(Y - \phi) = \tau \left\{ 1 - \frac{\tau}{\alpha} + \frac{\tau^*}{\alpha} \right\} Y \quad (6)$$

where the term in brackets can be thought of as an adjustment to the statutory tax rate due to profit shifting.

In order to generate an expression for aggregate tax revenue, it is necessary to aggregate over firms in the country, and to make some simplifying assumptions. Suppose that there are  $N$  firms in the country. Then total tax revenue is:

$$T = \tau \sum_{n=1}^{N_i} (Y_n - \phi_n) = \tau \left\{ 1 - \frac{\tau}{\alpha} + \frac{\tau^*}{\alpha} \right\} \sum_{n=1}^{N_i} Y_n \quad (7)$$

To implement this using aggregate data, we need to make an assumption about the aggregate taxable profit in the absence of profit shifting,  $\sum_{n=1}^{N_i} Y_n$ . As an approximation, assuming a fixed capital output ratio, aggregate taxable profit is proportional to aggregate pre-tax profit,  $\sum_{n=1}^{N_i} Y_n = \lambda(1 - A) \sum_{n=1}^{N_i} P_n(m)$ . It is plausible to let aggregate pre-tax profit be proportional to the product of GDP, and possibly other control variables,  $X$ , where the

proportion depends negatively on the effective marginal tax rate,  $m$ . Combining these elements yields:

$$\sum_{n=1}^{N_i} Y_n = \lambda(1-A)(1+m)^\gamma GDP.X^\delta \quad (8)$$

Substituting this expression into (7), yields

$$T = \tau \left\{ 1 - \frac{\tau}{\alpha} + \frac{\tau^*}{\alpha} \right\} \lambda(1-A)(1+m)^\gamma GDP.X^\delta \quad (9)$$

There are two possible approaches to an empirical implementation of this expression. First, divide by GDP to generate the tax revenue to GDP ratio:

$$\frac{T}{GDP} = \tau \left\{ 1 - \frac{\tau}{\alpha} + \frac{\tau^*}{\alpha} \right\} \lambda(1-A)(1+m)^\gamma X^\delta \quad (10)$$

This gives a partial justification of the approach followed by Clausing (2006), in that the tax to GDP ratio depends on the tax rate and the tax rate squared. However, there are several important differences from the Clausing approach. First, there is a direct role for the alternative tax rate – whether that is the tax rate in some other country, or the income tax rate. Second, in this formulation, all the tax rate variables are multiplied by other factors which reflect the difference between GDP and aggregate taxable profit. Two particular variables of interest here are the measure of the tax base, reflected in  $A$ , and the effective marginal tax rate,  $m$ . We present results based loosely on this specification below.

An alternative approach is to take logs of (9). Making use of the approximation  $\ln(1+x) \cong x$  for small  $x$ , then

$$\ln(T) = \ln(\tau) - \frac{\tau}{\alpha} + \frac{\tau^*}{\alpha} - A + \gamma m + \ln(GDP) + \delta \ln(X) + \text{constant} . \quad (11)$$

Adding time effects and an error term, we can estimate the following equation, across data on country  $i$  and period  $t$ :

$$\ln(T_{it}) = a + b_1 \ln(\tau_{it}) + b_2 \tau_{it} + b_3 \tau_{it}^* + b_4 A_{it} + b_5 m_{it} + b_6 \ln(GDP_{it}) + b_7 X_{it} + D_t + e_{it}. \quad (12)$$

The framework outlined here predicts  $b_1 = b_6 = 1$ ,  $b_2 = b_3 = -1/\alpha$ ,  $b_4 = -1$  and  $b_5 < 0$ . Of course, a different specification could give different predictions. We can use (12) to determine the revenue-maximising tax rate, denoted  $\bar{\tau}$ , given estimated coefficients, denoted with a hat. Ignoring the effect via the effective marginal tax rate,

$$\frac{\partial \ln(T)}{\partial \tau} = 0 \Rightarrow \bar{\tau} = -\frac{\hat{b}_1}{\hat{b}_2}. \quad (13)$$

Note that, given the model predictions in the previous paragraph, this revenue-maximising tax rate is equal to  $\alpha$ , the parameter of the profit-shifting cost function.

This analysis is fairly general. However, there is a practical trade-off for the empirical implementation. We have 800 observations - 20 countries and 40 years - but for this complete set of observations, we only have data on tax revenue, GDP and the statutory tax rate. Given these data, we can estimate the model over the whole sample, but only by allowing GDP to be the only control variable.

For a shorter time period (and also for a slightly smaller sample of countries), we also have data available for a number of other variables. They include a measure of the tax base: the net present value of allowances available for investment in buildings,<sup>19</sup> and a measure of the effective marginal tax rate. In addition, we have data on the top income tax rate; the size of government, as measured by the ratio of public consumption to GDP;

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<sup>19</sup> The equivalent measure for investment in plant and machinery yields similar results.

openness, as measured by the ratio of total FDI inflows and outflows to GDP; and some demographics, measured by the proportion of the population living in urban areas.

In the tables below, we present results using both approaches. In both cases, the tax revenue series is highly serially correlated; we therefore use standard errors which are robust to heteroscedasticity and to serial correlation within each country.<sup>20</sup>

We also experiment with unobserved country fixed effects and time effects. In principle, we would like to control for unobserved effects. However, introducing country fixed effects removes much of the cross-section variation in the data. Any consistent difference in tax rates between countries would be captured by the fixed effect: consequently, the impact of the tax rate on revenue must be identified from periods in which the tax rate changes in each country. However, changes in the statutory rate within a country are comparatively rare. In practice, as found by Clausing (2006), there is not enough variation within country to identify an effect of the statutory rate, conditional on country fixed effects. The results presented here therefore do not include country fixed effects. We do experiment with including time effects; these are discussed below.

At the level of the firm, then in estimating (6), then  $Y$  may be endogenous: for example, an increase in investment will reduce  $Y$ , but may also have an independent effect on the amount of profit shifted. At the aggregate level, however, this is less likely to be a significant factor. In (12), we treat the parameters of the tax system as exogenous. We have experimented with treating  $\ln(\text{GDP})$  as endogenous, and instrumenting it with lagged values. However, this makes almost no difference to the results in Table 2 (probably because the lags are very highly correlated with the contemporaneous value). The results presented here treat all right-hand-side variables as exogenous.

Table 1 begins by presenting the results of estimating a simplified version of expression (10). We begin by including only the home country corporation tax rate and its square,

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<sup>20</sup> Using these standard errors has a significant impact on the results, especially in Table 2: using simple robust standard errors results in much more significant coefficients.

using data on 20 countries over 40 years 1965 to 2004. This is also the basic specification considered by Clausing (2006), and the results are very similar. Both variables are significant at the 5% level and taken together, they imply a revenue-maximising tax rate of just over 31%.

In the other columns of Table 1 we explore the implications of including other variables in (10). Columns 2 and 3 add the GDP-weighted average of the statutory corporation tax rates in the other countries, which is intended to proxy for the opportunity to shift profits to other OECD countries. In column 2, the average of other countries' tax rates is moderately significant, but not of the expected sign. One possible explanation is that this variable is close to a constant minus the home country tax rate – indeed, if an unweighted average were used, it would be exactly equal to the weighted average of all countries in each year (which does not vary across countries), less the home country tax rate divided by the number of countries. Given this, it is perhaps not surprising that the variable has a negative coefficient. To counter this effect, we include time dummies in column 3. However, in the presence of time dummies, none of the tax effects are significant.

In columns 4 and 5, we repeat this exercise using the home country top marginal income tax rate in place of the weighted average of other countries' corporation tax rates. Since we have not been able to collect data on the top income tax rate for all observations, the number of observations drops sharply to 342. Columns 4 and 5 indicate a similar effect of the home country corporation tax rate as in column 1 – an effect which is therefore robust to including time dummies. However, the income tax rate itself is not significant. Taken together, columns 2 to 5 indicate that – if firms do indeed shift their profits away from the home country corporation tax base – then we have not managed to capture the relevant tax rate at which those profits are eventually taxed. Of course, this is quite possible: to the extent to which profits are shifted to very low tax rate tax havens, then neither of the forms of “alternative” tax rates used here would be an adequate proxy.

The last two pairs of columns explore the implications of allowing for a simple measure of the home country corporation tax base, denoted  $A$ . Based on (10), we include each

measure of the tax both on its own and multiplied by A: (10) would imply that each pair of variables would have equal and opposite coefficients. Columns 6 and 7 include the weighted average of other countries' tax rates; columns 8 and 9 include the top marginal income tax rate.

Confirming the pattern in the earlier columns, in none of these specifications does the "alternative" tax rate play a significant role. However, the tax base itself is significant or marginally significant. In columns 6 and 7, the product of the tax base and the corporation tax rate squared is significant. In columns 8 and 9, the product of the tax base and the corporation tax rate is also marginally significant. In all cases, the tax rate squared is highly significant, and in the specification with the top income tax rate, the corporation tax rate is also significant.

These results suggest – as would be expected - that there is a non-linear relationship between the corporation tax rate, the corporation tax base, and corporation tax revenues. The revenue-maximising tax rates implied by columns 6 to 9 are low, ranging from 18% to 28%.

However, it is clear that the specifications shown in Table 1 do not adequately reflect the relationship in (10). To estimate (10) it would be necessary also to include a number of other factors, each of which would have to be interacted with the tax parameters. We have experimented with other simpler specifications. One approach is to multiply each form of tax rate by  $(1-A)/(1+m)$ , to allow a role for the effective marginal tax rate. This approach generates significant effects of the product of  $(1-A)/(1+m)$  and the corporation tax rate and the product of  $(1-A)/(1+m)$  and the corporation tax rate squared. The coefficients are broadly in line with those presented in Table 1. The implied revenue-maximising tax rates range from 26% to 37%.

We have also included other control variables in the specification, but not interacted with the tax rate variables. These specifications give similar results to columns (6) and (8)

when time dummies are not included. However, when time dummies are included, the tax variables generally lose significance.

Based on the framework set out above, though, a better way to incorporate control variables is to estimate equation (12). The results of this approach are set out in Table 2. This follows a similar approach to Table 1, beginning with a simple specification, and gradually adding more terms implied by the model.

Column 12 includes only the log of GDP, the log of the corporation tax rate, and the level of the corporation tax rate. The result of this simple specification is broadly similar to the equivalent model in Table 1. GDP is highly significant, and its coefficient is very close to 1. The two formulations of the tax rate are only marginally significant, although the coefficients are of the expected sign and magnitude. The implied revenue-maximising tax rate is 28%. In column 2, the measure of the tax base is added. As would be expected, this has a negative effect and is significant – in fact it remains significant in almost all of the specifications shown in the table. The coefficients on the tax rates do not change very much, but they do become more significant; the implied revenue-maximising tax rate falls to around 23%. Note that these results are sensitive to the inclusion of time dummies; if time dummies are included, the tax parameters become insignificant – and this is generally true for the specifications in Table 2.

The next three columns – columns 3 to 5 - add other variables from (12), in turn, the effective marginal tax rate,<sup>21</sup> the weighted average of other countries' tax rates, and the top marginal income tax rate. Column 6 includes the last two of these. Including these additional terms has a similar effect in all cases. The coefficients on both the log and the level of the corporation tax rate become insignificant. None of the additional terms is significant. However, the tax base consistently has a negative and significant impact. There are two possible reasons for these results. One is that there is a problem of multicollinearity: the tax rates included in these columns are correlated with each other –

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<sup>21</sup> Strictly, we include the effective marginal tax wedge: the difference between the cost of capital and the required rate of return in the absence of tax. A common definition of the effective marginal tax rate is simply this wedge expressed as a proportion of the cost of capital.

this may make the coefficients less precisely determined. Since they are less correlated with the tax base, the significance of the tax base is maintained.

Another possibility is that the more significant effects of the corporation tax rate in the earlier columns is spurious and due to omitted variables. This is tested further in the last column, 7, where additional controls are added to the basic specification in column 2. The three new control variables are logs of: public consumption as a proportion of GDP; total trade as a proportion of GDP; and one demographic measure – the proportion of the population living in an urban area. The first and third of these provide to be highly significant.

But we take these as reflecting the difference between taxable profit and GDP: there is no a priori reason to suppose that they would affect the role of either the corporation tax rate or the corporation tax base. However, they do have such an effect. Comparing columns 2 and 7, the significance of all three of the tax parameters disappears when the additional control variables are added. This creates some doubt as to whether the tax parameters have a direct effect on tax revenues. In the case of the tax base, this may not be too surprising. It is measured with considerable error; the fact that it plays a significant role in all other specifications suggests that its insignificance in the last column may be due to measurement error.

But the insignificance of the tax rate is surprising. The earlier results indicate a non-linear relationship: at low levels of the tax rate, a higher tax rate increases tax revenue, but at high levels, an increase in the tax rate reduces tax revenue as taxable profit is shifted elsewhere. But it is also possible that – conditional on other factors - there is simply no systematic effect: certainly the last column of Table 2 suggests that the tax rate simply has no effect on tax revenue. Either of these possibilities contradicts the common assumption that a higher tax rate tends to increase tax revenue.

#### 4. CONCLUSIONS

This paper has investigated the development of corporation taxes in OECD countries over the last 40 years, and identified some interesting and surprising relationships. In particular, there is a clear discrepancy on average across OECD countries between the development of corporation tax rates and the revenues raised from the tax. As set out in the Introduction, the average corporation tax rate has fallen over time; many have interpreted this as a sign of competition between countries to attract inward flows of capital and profit. Yet the reverse has happened for corporation tax revenues, which on average have risen as a proportion of GDP. These differences do not seem to be capable of being explained only by developments in the legal tax base.

There is some (weak) evidence that – due to other opportunities such as reducing investment, shifting activity out of the taxed corporate sector, or shifting profits to other countries - revenue-maximising tax rates could actually be rather low. That is, only at low rates of tax does the rate have a positive impact on tax revenues. Above moderate rates, further increases in the tax rate may actually reduce revenues.

However, another interpretation of the results presented here is that there is no systematic relationship between tax rates and revenues across OECD countries. This may reflect differences across countries; it may be the case, for example, that there is a non-linear relationship within each country, but that the relationship varies across countries, and so is not captured in a panel regression. Further work is needed to investigate these and other possibilities in more detail. More work is also needed to attempt to trace out the fundamental reasons for the lack of a straightforward relationship between rates and revenues – to determine how much of the development of revenues is due to movements of capital and profit between countries, or between the corporate and personal sectors.

There is one other implication of the observations made here. Generating measures of effective corporation tax rates is a difficult task; one common approach has been to use data on tax revenues as the numerator of a measure of an effective average tax rate. The

evidence presented here suggests that such an approach could be highly misleading. In using such a measure to interpret the impact of the tax on behaviour, it will at best contain considerable measurement error. Indeed, if there is no relationship between tax revenues and tax rates, then such an effective tax rate may contain only measurement error. Where there is a negative relationship between the tax rate and tax revenues, though, such an effective tax rate may generate a result indicating the opposite of the true effect.

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**Table 1**

Dependent variable: CT revenue / GDP

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\tau$	0.135 (0.067)	0.171 (0.055)	0.006 (0.110)	0.145 (0.039)	0.160 (0.059)	0.183 (0.115)	0.332 (0.206)	0.247 (0.103)	0.273 (0.113)
$\tau^2$	-0.215 (0.100)	-0.167 (0.118)	-0.187 (0.128)	-0.197 (0.058)	-0.214 (0.090)	-0.582 (0.175)	-0.768 (0.298)	-0.370 (0.121)	-0.491 (0.200)
$\tau^*$ (other countries)		-0.145 (0.084)	0.305 (0.288)			0.234 (0.293)	0.011 (0.304)		
$\tau^*$ (income tax rate)				-0.037 (0.040)	-0.051 (0.043)			-0.083 (0.163)	-0.040 (0.151)
$A\tau$						-0.296 (0.250)	-0.169 (0.250)	-0.416 (0.222)	-0.402 (0.205)
$A\tau''$						0.967 (0.352)	1.429 (0.675)	0.535 (0.296)	0.730 (0.383)
$A\tau^*$ (other countries)						-0.433 (0.586)	-1.232 (0.884)		
$A\tau^*$ (income tax rate)								0.231 (0.346)	0.052 (0.312)
Time dummies	no	no	yes	no	yes	no	yes	no	Yes
Observations	800	800	800	342	342	444	444	307	307
$R^2$	0.04	0.06	0.12	0.10	0.15	0.19	0.25	0.18	0.24

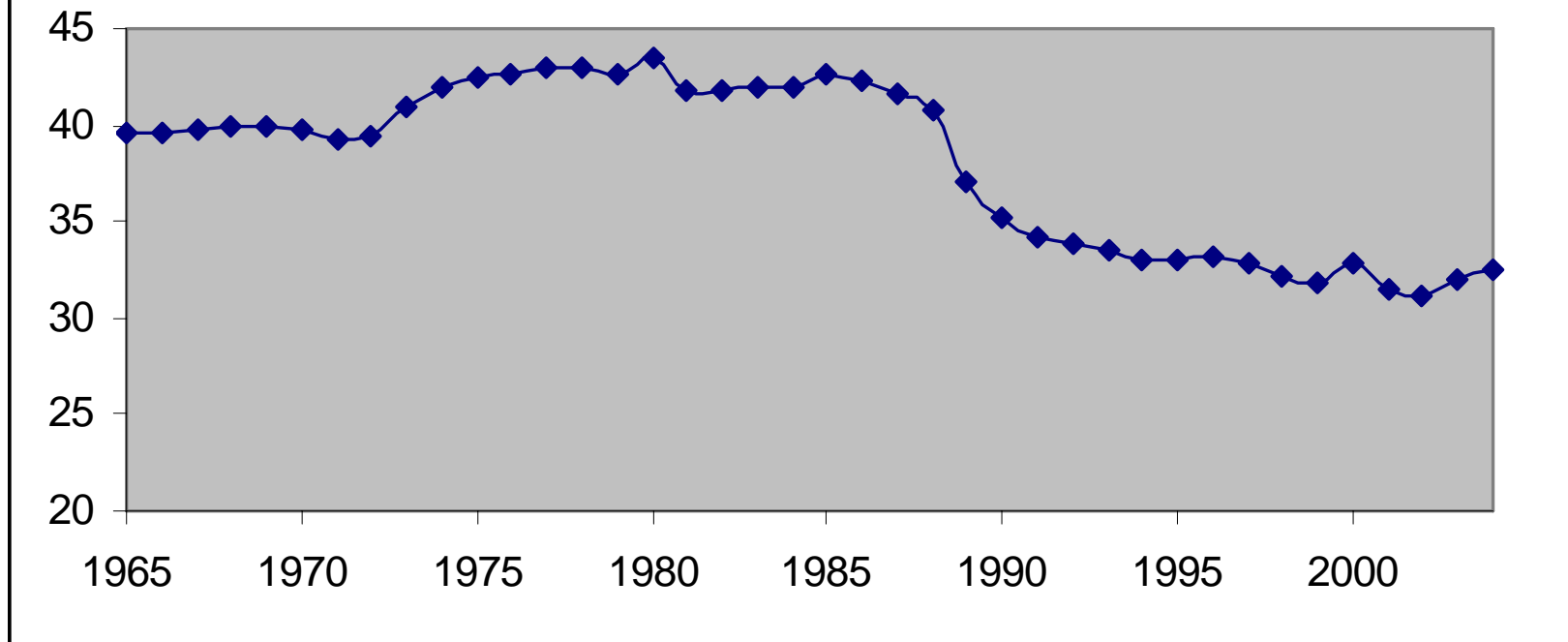
**Notes.** 1. Standard errors (in parentheses) are robust to heteroscedasticity and clustered by country to account for serial correlation.

**Table 2**Dependent variable:  $\ln(T_{it})$ 

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln(GDP_{it})$	1.009 (0.078)	0.966 (0.070)	1.065 (0.077)	1.077 (0.070)	0.966 (0.076)	1.076 (0.076)	1.026 (0.061)
$\ln(\tau_{it})$	0.803 (0.490)	0.792 (0.402)	0.442 (0.496)	0.457 (0.474)	0.725 (0.491)	0.500 (0.554)	0.377 (0.619)
$\tau_{it}$	-2.883 (1.576)	-3.389 (1.520)	-2.400 (1.810)	-2.528 (1.938)	-3.028 (1.880)	-2.756 (2.248)	-2.465 (2.348)
$A_{it}$		-1.136 (0.464)	-0.927 (0.412)	-1.009 (0.473)	-1.070 (0.449)	-1.050 (0.467)	-0.559 (0.449)
$m_{it}$			1.617 (6.120)				
$\tau_{it}^*$ (other countries)				-0.677 (1.501)		0.540 (1.645)	
$\tau_{it}^*$ (income tax rate)					0.353 (0.503)	0.294 (0.570)	
$\ln(\text{prop pop urban})$							1.107 (0.419)
$\ln(\text{pub cons/GDP})$							-0.669 (0.218)
$\ln(\text{FDI/GDP})$							0.037 (0.054)
Observations	800	444	307	307	444	307	305
R-squared	0.89	0.91	0.92	0.92	0.91	0.92	0.94

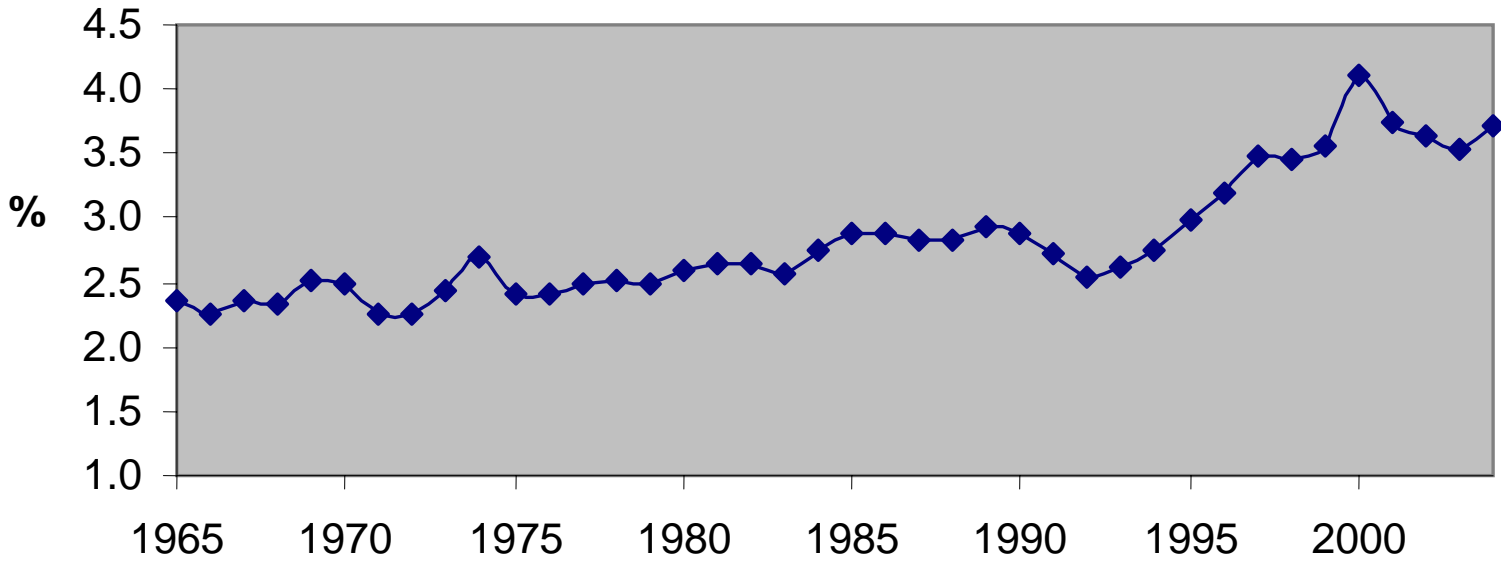
**Notes.** 1. Standard errors (in parentheses) are robust to heteroscedasticity and clustered by country to account for serial correlation.

**Figure 1. Development of Average Statutory Corporation Tax Rate in OECD countries, 1965-2004**



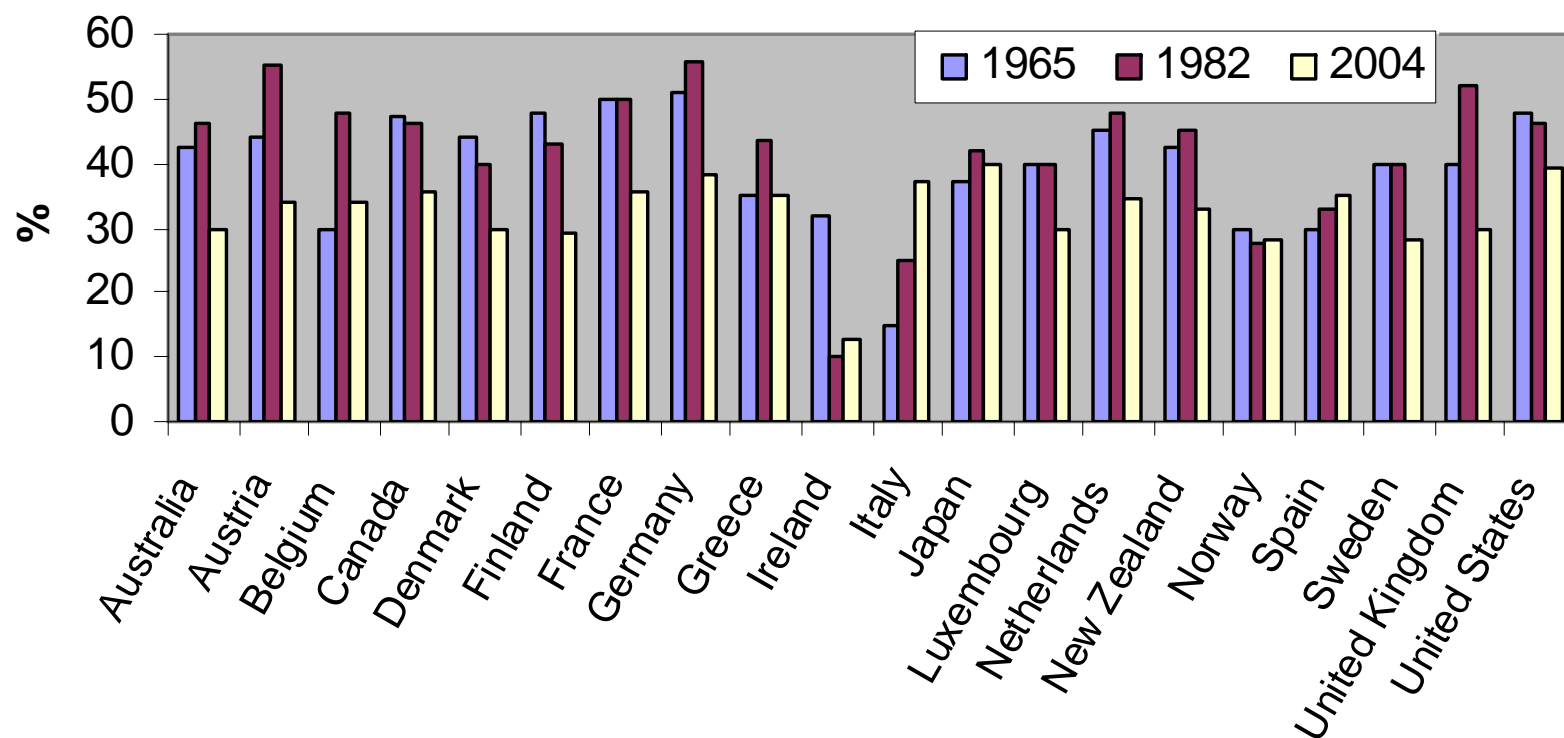
Source: Devereux et al (2002), PWC Corporate Taxes – a Worldwide Summary, and World Tax Database, Office of Tax Policy Research.

**Figure 2. Development of Average Ratio of Corporation Tax Revenues to GDP in OECD Countries, 1965-2004**



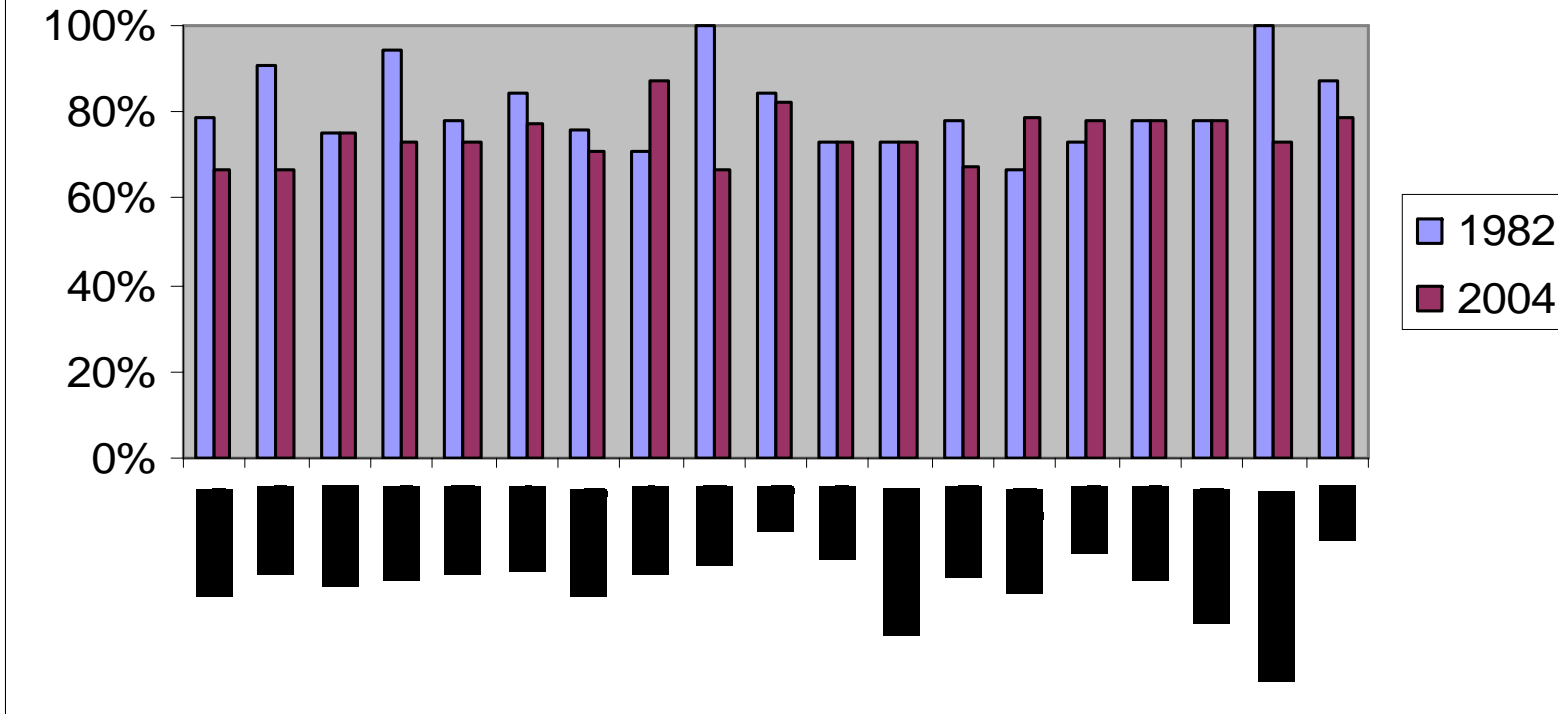
Source: OECD

**Figure 3. Statutory Rates of corporation tax**



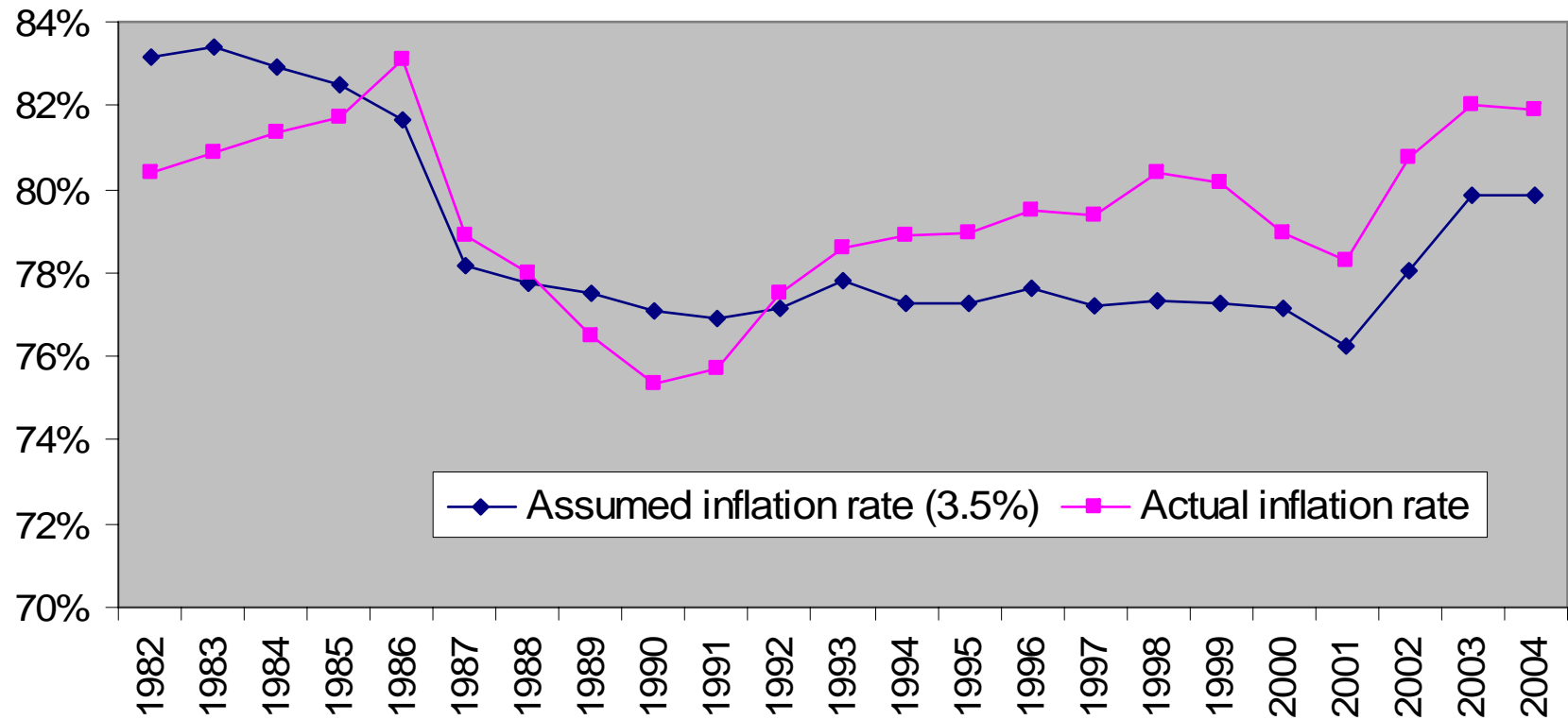
Source: Devereux et al (2002), PWC Corporate Taxes – a Worldwide Summary, and World Tax Database, Office of Tax Policy Research.  
 Notes: For countries using different tax rates, the manufacturing rate is chosen. Local taxes (or the average across regions) are included where they exist. Any supplementary taxes are included only if they apply generally, rather than only under particular circumstances.

**Figure 4. PDV of Depreciation Allowances  
1982 and 2004**



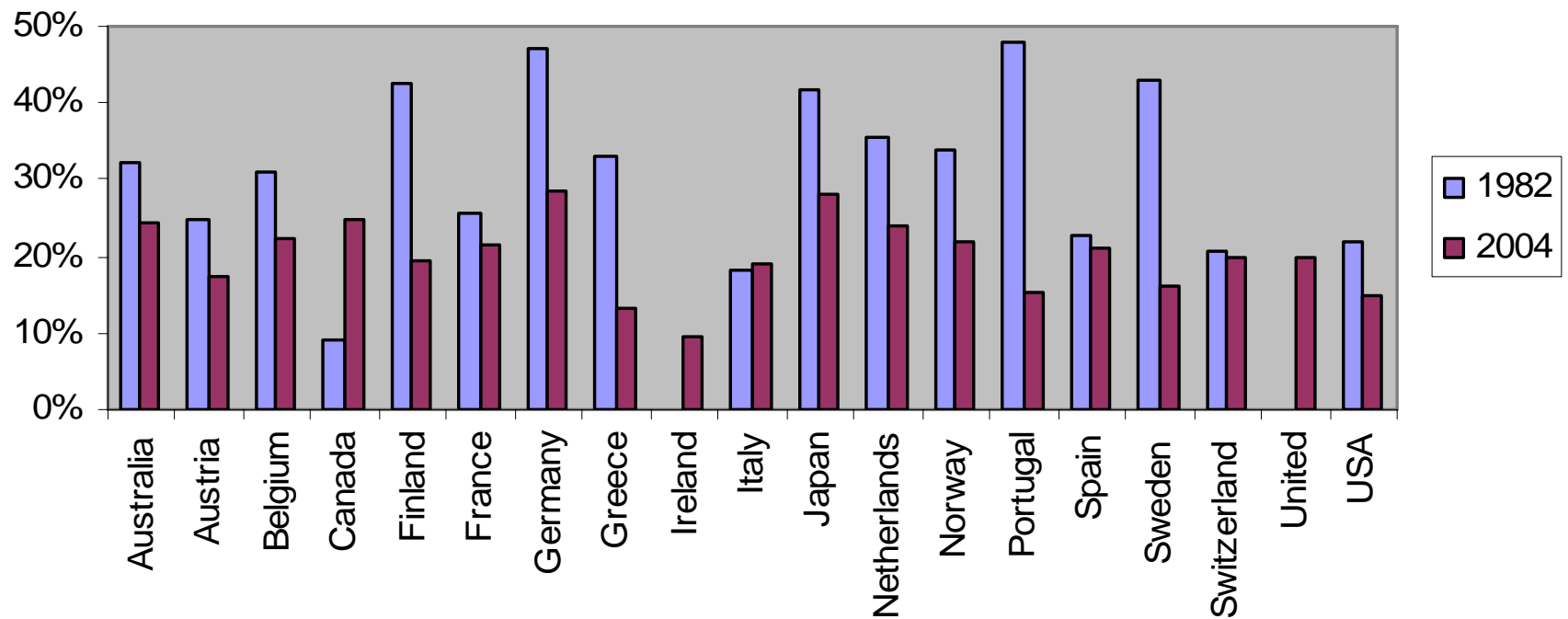
Notes :The PDV of allowances is calculated for an investment in plant and machinery. Special first year allowances are included if applicable. Where switching between straight-line and reducing balance methods is allowed, such switching is assumed at the optimal point. The assumed real discount rate is 10%, the assumed rate of inflation is 3.5%.

**Figure 5. Weighted Average PDV of Depreciation Allowances**



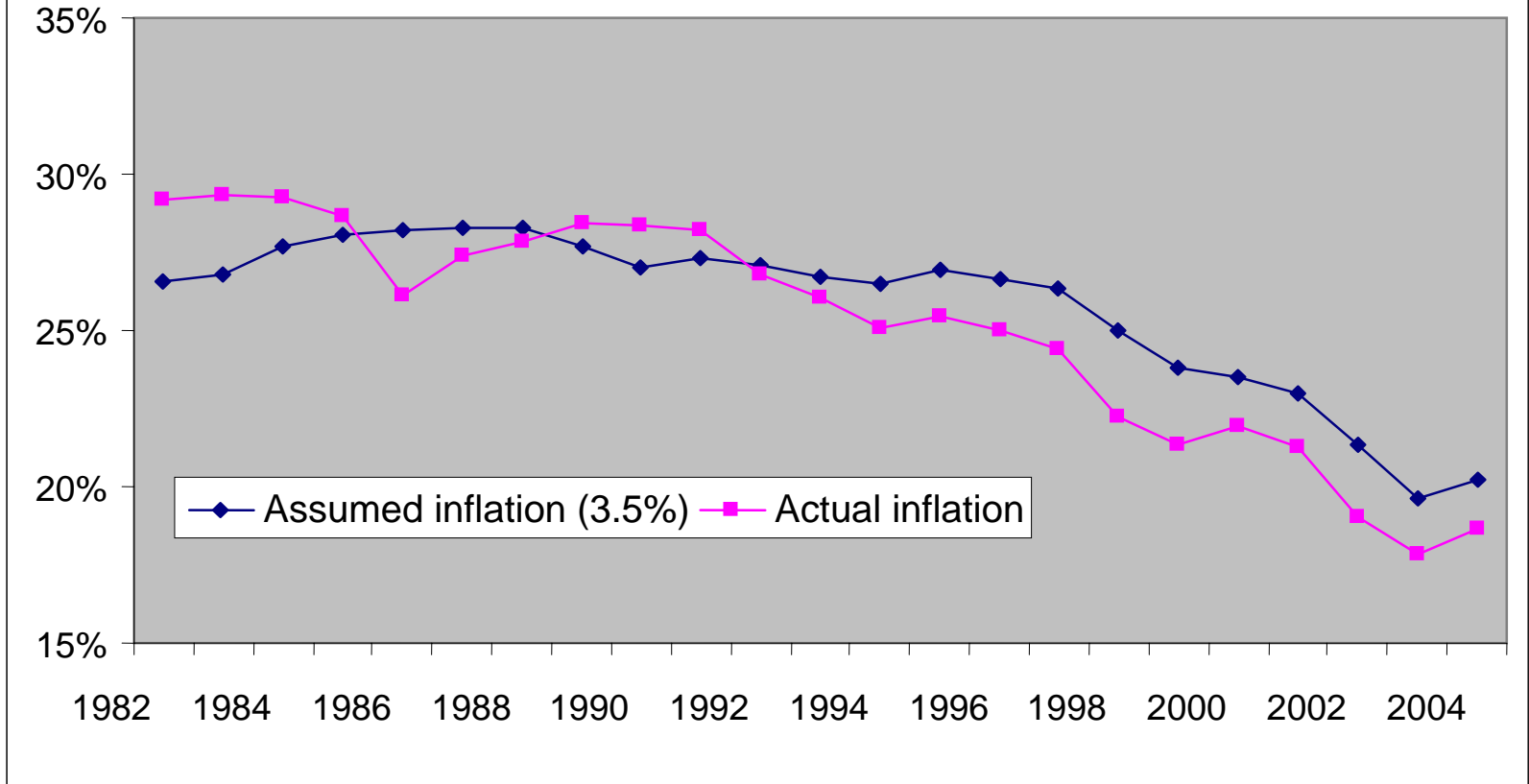
Notes: Allowances defined as in figure 3, except for the second series which is based on actual inflation rates (implying static expectations), rather than an assumed fixed rate of 3.5%. Average weighted by GDP in US\$.

**Figure 6. Effective Marginal Tax Rates  
1982 and 2004**



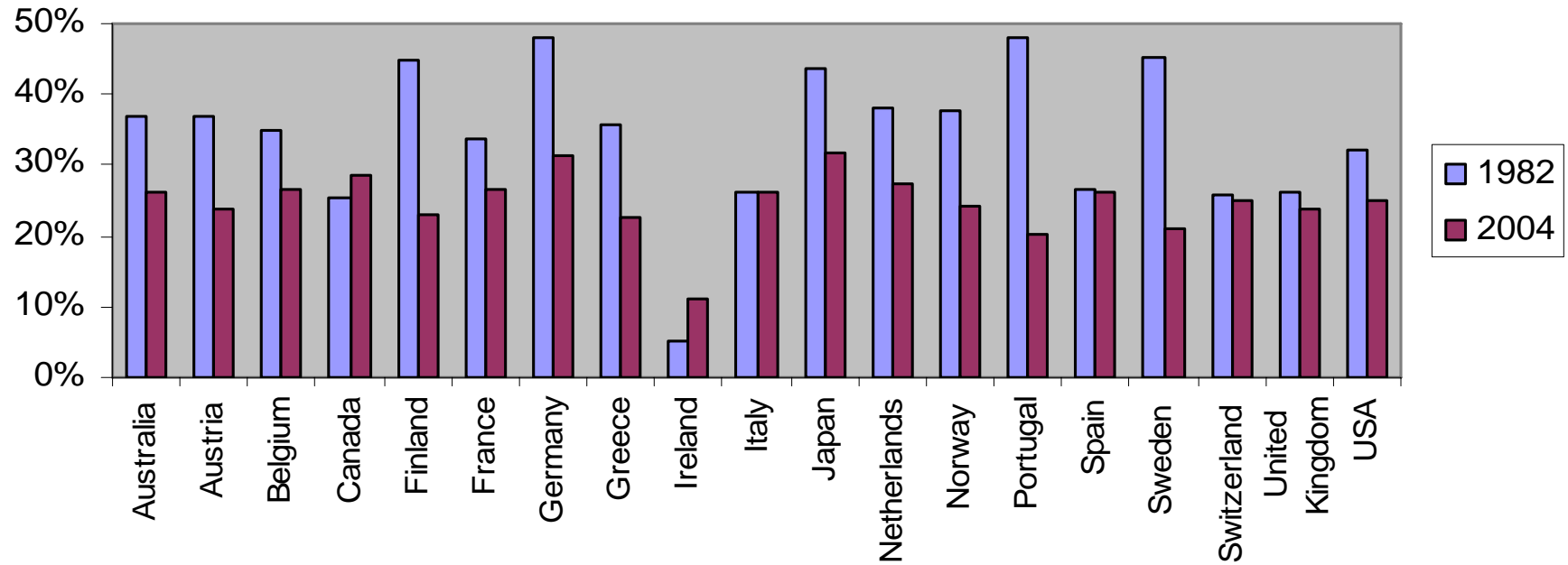
Notes: Calculations based on a hypothetical investment for one period in plant and machinery, financed by equity or retained earnings (but not debt). Taxation at the shareholder level is not included. The project is expected to break even, i.e. there is no economic rent. Other assumptions: real discount rate: 10%, inflation rate: 3.5%, depreciation rate: 12.25%.

**Figure 7. Weighted Average Effective Marginal Tax Rates**



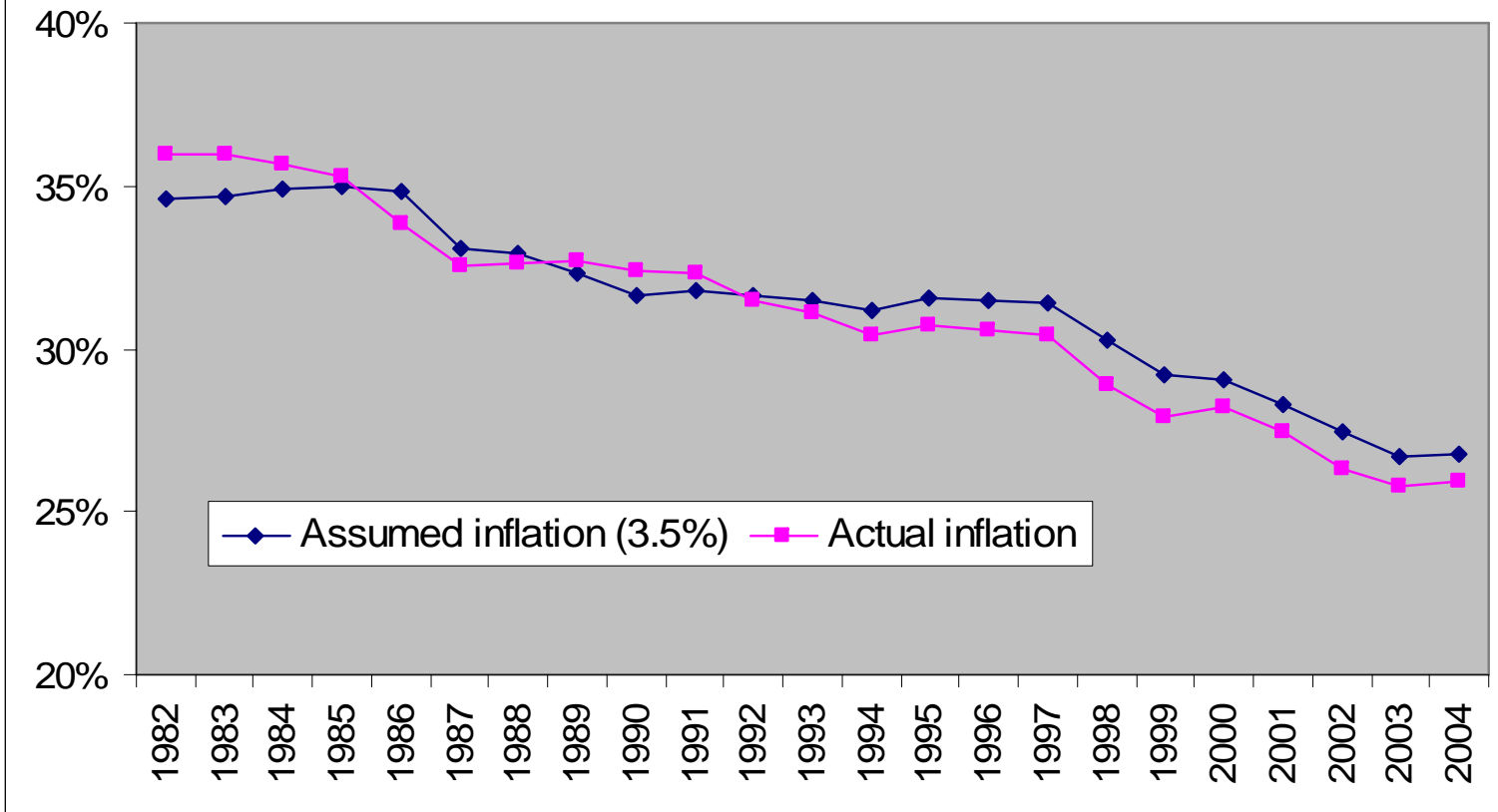
Notes: Effective marginal tax rate defined as in figure 5, except for the second series which is based on actual inflation rates (implying static expectations), rather than an assumed fixed rate of 3.5%. Average weighted by GDP in US\$.

**Figure 8. Effective Average Tax Rates  
1982 and 2004**



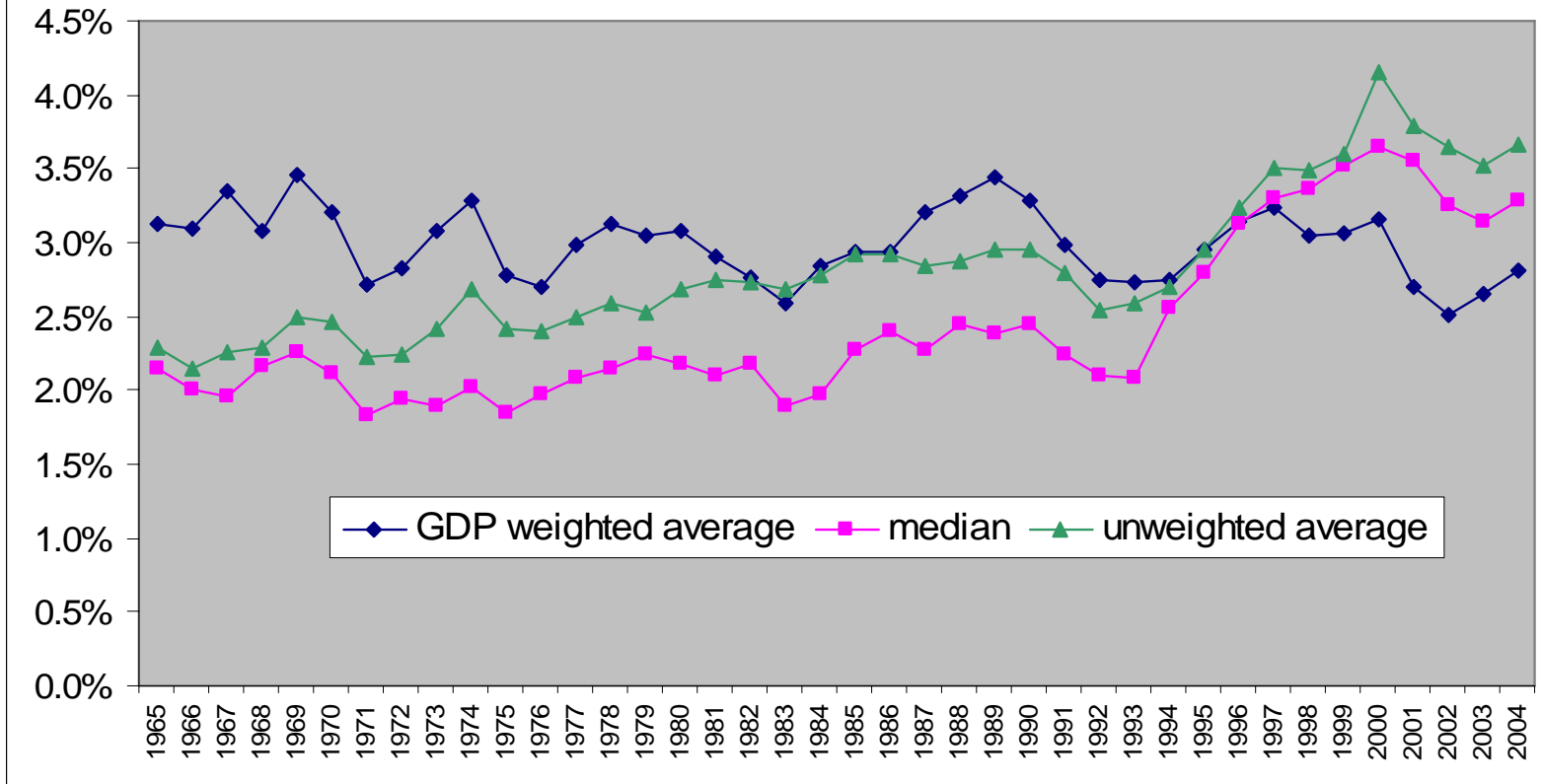
Notes: Calculations based on a hypothetical investment for one period in plant and machinery, financed by equity or retained earnings (but not debt). Taxation at the shareholder level is not included. The expected rate of economic profits earned is 10% (implying a financial return,  $p$ , of 20%). Other assumptions: real discount rate: 10%, inflation rate: 3.5%, depreciation rate: 12.25%.

**Figure 9. Weighted Average Effective Average Tax Rates**



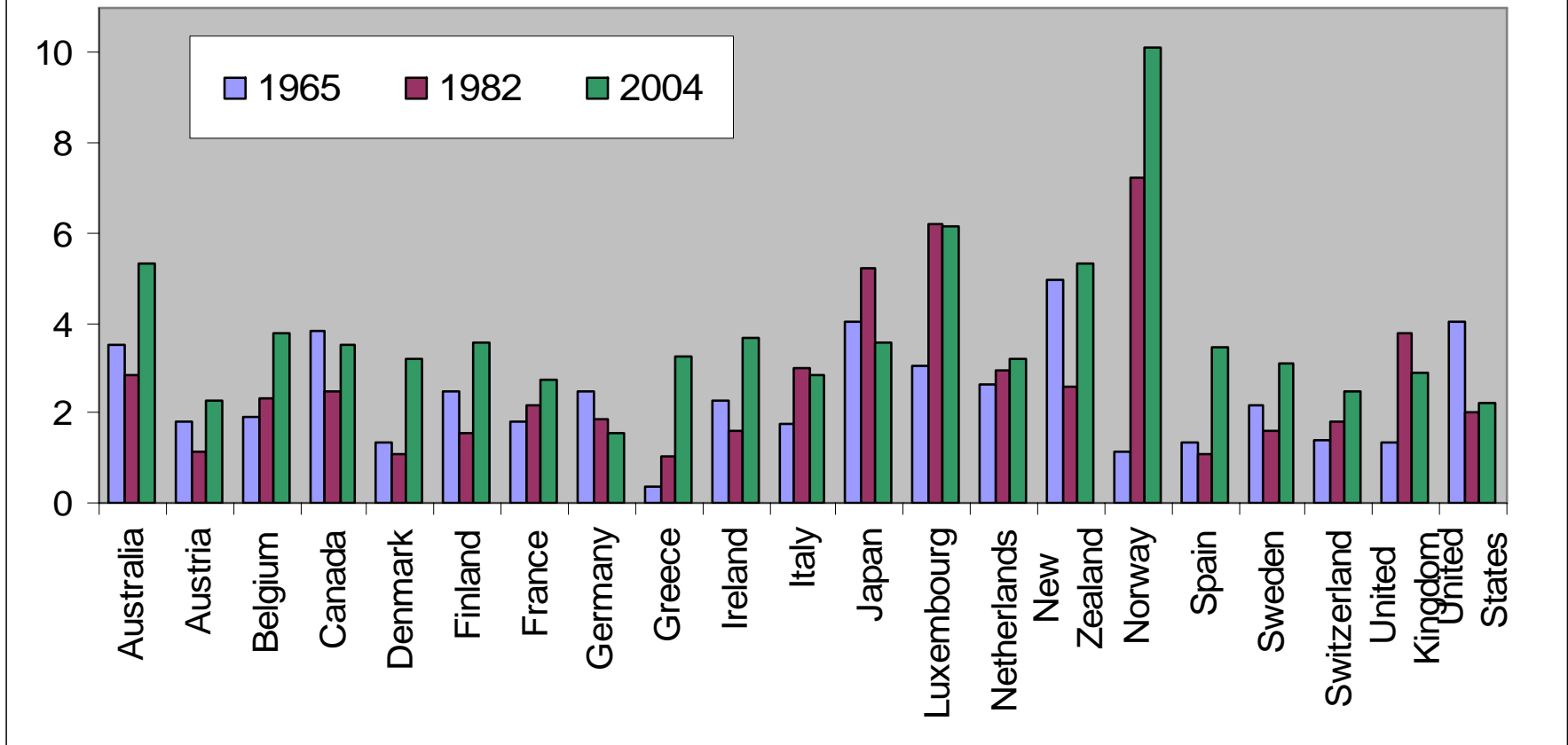
Notes: Effective average tax rate defined as in figure 7, except for the second series which is based on actual inflation rates (implying static expectations), rather than an assumed fixed rate of 3.5%. Average weighted by GDP in US\$.

**Figure 10. Corporation Tax Revenues 1965-2004  
(% of GDP)**



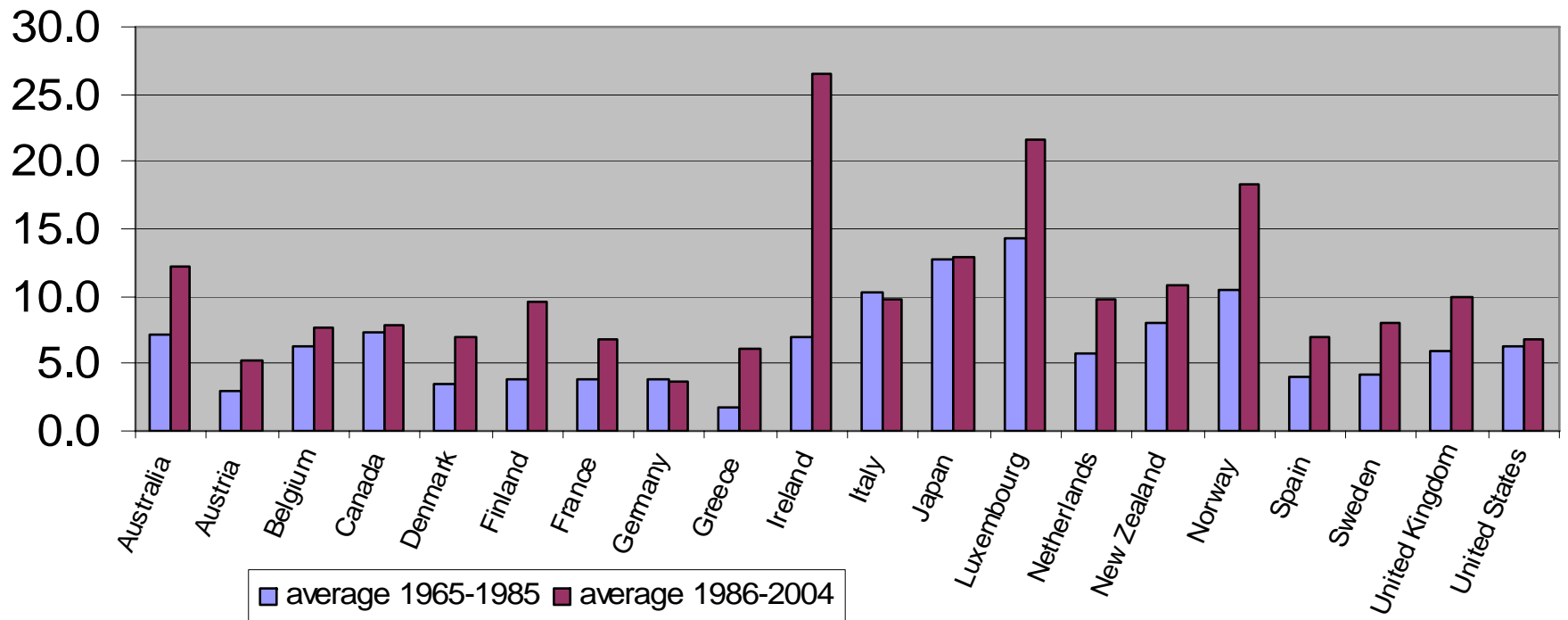
Notes: Average weighted by GDP in US\$. All taxes levied on profits and capital gains of corporations are included. Source: OECD.

**Figure 11. Corporation Tax Revenue (% of GDP)**

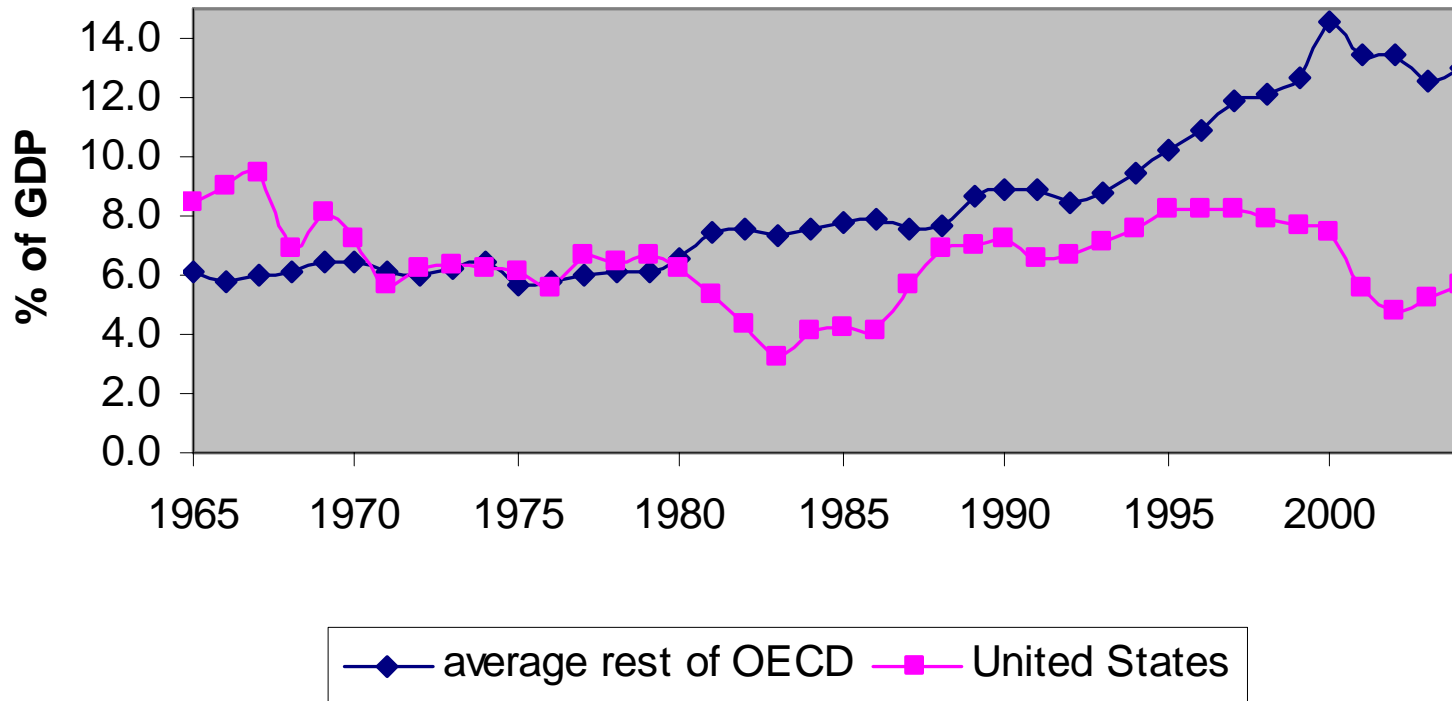


Notes: All taxes levied on profits and capital gains of corporations are included. Source: OECD.

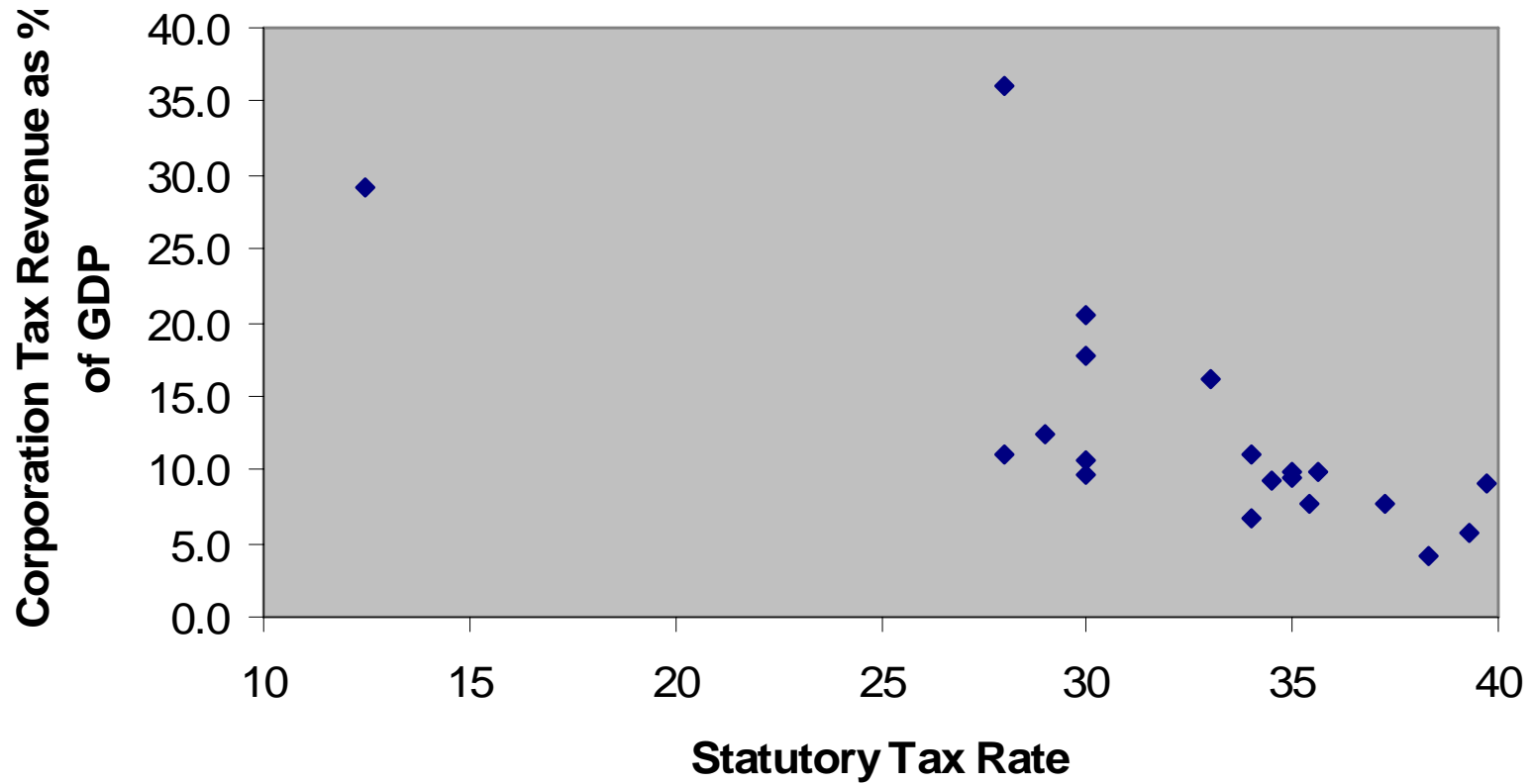
**Figure 12. Taxable profit as % of GDP:  
average 1965-1985 and 1986-2004**



**Figure 13. The Development of Taxable Profit in the United States and the Rest of the OECD**



**Figure 14. Corporation Tax revenues as % GDP, relative to Statutory Tax Rates, 2004**



**Table A1. Summary Statistics**

<b>Variable</b>	<b>Description</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>	<b>Source</b>
$\tau_{it}$	Statutory corporation tax rate	800	0.381	0.093	0.1	0.56	Price Waterhouse, Corporate Taxes: a Worldwide Summary; OTPR
$m_{it\tau}$	Cost of Capital minus real interest rate	342	0.050	0.013	0.009	0.108	Own Calculations, data from Price Waterhouse, Corporate Taxes: a Worldwide Summary and World Bank WDI
$A_{it}$	NPV of depreciation allowances for industrial buildings	444	0.400	0.150	0.16	1.00	Own Calculations, data from Price Waterhouse, Corporate Taxes: a Worldwide Summary and World Bank WDI
$TAX_{it}$	Corporation tax revenues	800	21.4	39.8	12.8	239.4	OECD Revenue Statistics
$TOPINC_{it}$	Highest marginal income tax rate	342	0.544	0.103	0.28	0.80	Annual guides from accounting firms, and specifically those from Price Waterhouse; OTPR
$PCON_{it}$	Total public consumption, as a proportion of $GDP_{it}$	342	0.191	0.042	0.088	0.298	OECD National Accounts, various years
$GDP_{it}$		800	739.5	1393.5	4.4	9925.5	OECD National Accounts, various years
$OPEN_{it-1}$	sum of inward and outward foreign direct investment, as a proportion of $GDP_{it}$ , lagged one year	342	0.032	0.040	0.00	0.315	OECD International Direct Investment Statistics Yearbook
$PURB_{it}$	proportion of population living in urban areas	342	0.768	0.108	0.557	0.972	World Bank- World Development Indicators