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EMPIRICAL ANALYSES OF CORPORATE AND PERSONAL INCOME TAX REFORMS

Thesis submitted for the degree of Doctor of Philosophy in Economics
Abstract

This thesis provides an analysis of some recent reforms to corporate and personal income taxes.

The first reform considered is the UK reform of dividend taxation in 1997. This abolished the repayability of tax credits to pension funds and thus reduced the value of dividends to one group of shareholders. Using the tax-adjusted CAPM (Brennan, 1970) we show that such a reform is unlikely to affect share prices strongly. We then provide empirical evidence for this and explain why previous research (Bell and Jenkinson, 2002) came to a different conclusion. We also consider the effects on dividend payments and company investment.

Then we turn to the introduction of a flat-rate income tax in Russia, which dramatically reduced tax rates for better-off individuals. This was accompanied by a strong increase in revenues and we investigate whether this was caused by the reforms. A brief summary of the theoretical predictions concerning labour supply and compliance suggests that this is unlikely. Using micro-data on individuals and households, and employing a difference-in-differences method, we confirm that the reform does not appear to have caused the revenue boom, although we find some evidence of improvements in compliance.

Finally we consider international corporate income tax reforms. We start with an analysis of the properties of alternative tax measures including a newly proposed one using UK data. We find that different approaches can give rise to very different quantitative estimates of tax rates, and even different estimates of measures based on the same approach can diverge strongly. We then apply the discussed measures in an analysis of corporate income tax reforms in OECD countries. We develop a number of stylised facts and discuss possible interpretations, based both on existing models and a new explanation. We also relate these findings to recent international initiatives in tax co-operation.
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Not all my work of the last few years has found its way into this thesis. But papers written with Philippe Aghion, Tim Besley, Andreas Haufler, Mike Hawkins, Ioana Marinescu, Rain Newton-Smith, Guttorm Schjelderup, Murtaza Syed and Jan Vlieghe will nevertheless have made an indirect contribution, by providing me with further research experience and practice.

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Last but not least, I would like to thank my supervisor Stephen Smith, who was extremely helpful and always willing to make time in his busy schedule, even at short notice.
Declared

No part of this thesis has been previously submitted for any degree at any university. The work presented is my own, except as detailed below.

Chapter 2 draws on joint work with Michael P. Devereux and Stephen Bond. In particular, sections 2.3 - 2.4 draw on Bond, Devereux and Klemm (2005a) while section 2.5 draws on Bond, Devereux and Klemm (2005b). My contribution to this research include the entire empirical work, the background work on the legal system, and the drafting of the description of research as provided here (which differs from the papers). The interpretation of findings is the result of a joint effort.

Chapter 3 is based on research which I contributed to a longer paper, written jointly with Anna Ivanova and Michael Keen (Ivanova, Keen and Klemm 2005). I contributed the microeconometric analysis (sections 3.4 and 3.5 and the appendices) to this research and participated in the drafting of the introduction, the theoretical background and conclusions (in which all tables and underlying calculations are my contribution). The published paper also includes a macroeconomic analysis, which was mainly the work of A. Ivanova, and which is not included in this thesis.

Chapter 4 draws on joint work with Michael P. Devereux and Rachel Griffith. Specifically, Section 4.1.2 is largely based on Devereux and Klemm (2004); Sections 4.1.1 and 4.2 are based on Devereux, Griffith and Klemm (2002); Section 4.3 draws on both Devereux, Griffith and Klemm (2002) and Griffith and Klemm (2004). Other work in this area that has contributed to my understanding of the issues includes Klemm (2001), Devereux, Griffith and Klemm (2004) and Klemm (2004). My contribution includes the entire empirical work, including the development of the implicit corporate tax rate. The interpretations are the result of a joint effort.

Alexander Klemm (PhD candidate) Stephen Smith (supervisor)
1 Introduction

Economists, and more generally social scientists, face difficulties when wishing to test their theories, as experiments are often impossible or prohibitively expensive. Changes in law that affect economic incentives therefore provide a unique opportunity as they can be seen as quasi-experiments.

Tax laws are particularly prone to change in many countries. The UK corporation tax system for example witnessed significant changes 14 times in the 25 years from 1980 to 2004 (see Devereux, Griffith and Klemm, 2004). While such frequent changes are unlikely to be optimal for providing a stable fiscal framework, they provide ample opportunity for empirical research. This thesis attempts to make use of these, and provides an empirical investigation of selected tax reforms.

The first reform considered is a tax increase on UK dividends, which was implemented in 1997. This reform was hugely complicated, having different impacts on different shareholders. The overall effect thus depends on the relative importance of different groups of shareholders. A novelty of the analysis here is that we argue that while the price of shares may be largely determined by one group of shareholders (international investors), dividend policy may still be determined, at least in some cases, by another group of shareholders (UK pension funds). It is thus possible that tax increases lead to higher share prices, as the group of shareholders determining dividends may change their preferences so that they are then more aligned with those of the price-determining shareholders. The overall conclusion from this study is that the 1997 tax increase had little real effects on dividend payouts or share prices. For a few firms though, which appear to be controlled by pension funds, it led to a change in the type of dividend paid though. This caused higher share prices, as this alternative type of dividend was preferred by international investors, but not, before the reform, by UK pension funds.

The second reform considered is the introduction of a flat rate income tax in Russia in 2001. Like the previous reform, this one had different effects across individuals, so that it is possible to study its effects by examining "differences in
The reform implied an important tax cut, particularly at the top of the income distribution. It was accompanied by strong improvements in tax revenues, which led to the widespread belief that the reform had “paid for itself” by improving tax compliance and labour supply. The aim of this chapter is to test this claim. Overall we conclude that the claim should be rejected as the additional tax revenues stemmed from the unaffected individuals. We do however find an improvement in tax compliance, although it is impossible to know whether this was caused by the reform, because of simultaneous improvements in tax enforcement.

The third reform, or more precisely group of reforms, concerns international corporate income taxation. Over the last two to three decades, most countries have reformed their corporate income tax systems. As argued in this chapter, different countries, follow similar trends, such as broadening tax bases and reducing tax rates. These policies have changed the environment companies operate in, reducing the tax burdens of profitable international firms and increasing or leaving unchanged the tax burdens of local firms with low profits. We argue that these developments are not coincidental, but can be explained by increasing competition for the highly profitable activities of multinationals, although we note that there are alternative explanations.

This thesis thus applies empirical methods to study a group of important tax reforms. While each reform is studied with an methodology that is carefully adapted for the purpose, in all cases the focus is on the microeconomic effects, i.e. the behavioural responses of the economic agents facing changes in their incentives. The findings are arranged as follows. The findings from the analysis of UK dividend tax reforms are described Chapter 2. This is followed by the findings from studying the Russian income tax reform in Chapter 3. Chapter 4 extends the analysis from national to international issues and covers both uni- and multilateral corporate income tax reform. The overall conclusions from this research are provided in Chapter 5.
2 Dividend taxation

2.1 Introduction

In 1997 and 1999 important reforms to dividend taxation took place in the UK. The 1997 reforms was a large tax change affecting a major group of shareholders and leading to revenue gains of about £5.4bn per annum (Inland Revenue, 1997). The reform affected tax-exempt shareholders. As this group of shareholders included pension funds and to some extent insurance companies, which together own about 46 per cent of the UK stock market,¹ the effect provides a useful quasi-experiment to study theories of dividend valuation and share prices. Before analysing the details, it is interesting to note that nothing much happened to the stock market on and after the announcement (see Figure 1).

Figure 1: FTSE 100 index, 2nd of July 1997 indicated by vertical line.

As the change was unannounced and—judging from the press at the time—was unexpected, this comes as a surprise. If share prices are the present discounted value of dividend streams, then share prices levels would have been expected to fall on that day. The fact they did not, provides a motivation for a deeper analysis of the effect of the reform.

¹ According to National Statistics (2003) pension funds owned 22.1% and insurance companies owned 23.5% of UK shares in 1997. Not all insurance business is affected by the tax cut though.
Prima facie evidence suggests that the existence and abolition of repayable dividend tax credits had some impact on dividend behaviour of UK companies. But we find little or no effect on anything else. The explanation we suggest is that UK equities are traded on an open market with a high degree of capital mobility. They are thus valued at what they are worth to diversified, international investors who derived little or no benefit from the UK dividend tax credit. Hence these tax credits, and domestic dividend taxation more generally, should have little or no effect on share prices.

This is broadly consistent with the empirical evidence. Indeed the limited effect on dividend behaviour that we do find suggest that the dividend policies of some UK firms were inconsistent with share price maximisation during the period of repayable tax credits: they were distorted by the influence of large local institutions. Contrary to popular belief, we find that the abolition of repayable dividend tax credits had a small positive impact on the stock market valuation of these firms. This is because they removed a distortion that made these firms less valuable to diversified, international investors.

This chapter will provide an analysis of the effects of UK dividend tax reform on the valuation of dividends, dividend payout behaviour, share prices and portfolios. The chapter is structured as follows: section 2.2 provides a detailed description of the tax system and the reforms. Section 2.3 discusses a theoretical model of the stock market in a small open economy and derives theoretically expected results of the reforms. Section 2.4 provides empirical evidence for the predictions made in the previous section. Section 2.5 compares the results obtained in this chapter with the conflicting results obtained by Bell and Jenkinson (2002) using drop-off ratios and attempts an explanation for these. Section 2.6 concludes.

2.2 Description of the reforms studied

Since winning the election in 1997, the Labour government has substantially reformed dividend taxation in the UK. The two main reforms were implemented in 1997 (Inland Revenue, 1997) and 1999 (Inland Revenue, 1998). The first of these abolished the repayability of tax credits to tax-exempt shareholders and thus constituted a move further from an imputation towards a shareholder relief
system. The second abolished Advance Corporation Tax (ACT), which made the system more generous to firms with a high share of foreign earnings. As these reforms are rather complicated, the following section first explains the initial tax system and then discusses both reforms and their effects in more detail.

2.2.1 The tax system prior to the reforms

Prior to the reform the UK had a partial imputation system. Dividends were paid out of taxed profits and shareholders could reclaim part of the tax paid at the corporate level, when taxing their dividend income. This was achieved by a tax credit that accompanied dividend payments. The tax credit was set at a level so as to cover the tax liability of a basic rate taxpayer (i.e. 20 per cent in 1997).

Higher rate taxpayers had to make an additional payment of the difference between the higher and the basic rate. Tax-exempt shareholders could claim a refund of the tax credit. Note that this last group is rather substantial, as it includes such diverse groups of shareholders as people on low incomes, charities, and most importantly, pension funds.

As the amount of the tax credit was linked to the basic rate personal income tax, but not to the amount of corporation tax paid by the company, there was no guarantee that the relief corresponded to the corporation tax paid. In fact, as the corporation tax rate was higher than the basic rate income tax (33 per cent before the 1997 budget), generally the relief provided was only partial. In principle the relief could have also exceeded corporation tax, e.g. if a firm with a tax loss paid out dividends, but such a case was prevented by Advance Corporation Tax (ACT). ACT was a prepayment of corporation tax that firms had to pay at the moment of making a distribution. This payment could be set against the final corporation tax liability, however only up to the point that companies who distributed at most 100 per cent of their UK earnings would have benefited from this, i.e. up to the ACT rate times UK profits. If firms distributed more dividends,

---

2 The percentage is expressed as a share of the gross dividend, i.e. the dividend including the tax credit. So a basic rate taxpayer received a gross dividend of $D/(1-0.20)$, where $D$ is the net dividend. On that he faced a tax of 20%, which exactly offset the tax credit: $D(1-0.20)/(1-0.20) = D$.

3 The higher rate tax rate is 40%. Hence a shareholder faced an additional tax on dividends of 25%: $D(1-0.40)/(1-0.20) = D(1-0.25)$. 

15
e.g. because they paid dividends despite making losses or out of profits from foreign earnings, then this became "surplus ACT", which could not be set against taxes, although firms were allowed to carry such amount forward. If the likelihood of ever being able to use this surplus ACT became sufficiently small, companies often chose to write off the amount as "irrecoverable ACT".

In July 1994 a new scheme called Foreign Income Dividends (FID) was introduced. This allowed firms to pay dividends without an ACT charge, provided they were paid out of foreign earnings and had been declared by the company to be a FID. FIDs however did not have tax credits attached to them. For tax-paying shareholders they were nevertheless treated as if accompanied by a tax credit.

For most firms, ACT only affected the timing of corporation tax payments, in that it brought a share of payments forward from the date of corporation tax liability (nine months after the accounting year) to the date(s) of dividend payments. For some firms however, particularly those with substantial foreign earnings, ACT was equivalent to an additional tax. This provided an incentive to shift foreign profits into the UK and might have provided a disincentive to paying dividends.

The combined effects of ACT and tax credits are summarised in the following table:
Table 1: The effect of taxes on dividends, pre 1997

<table>
<thead>
<tr>
<th>Shareholder</th>
<th>ACT position</th>
<th>Type of dividend</th>
<th>Net dividend</th>
<th>Gross dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no surplus</td>
<td>ordinary</td>
<td>$X$</td>
<td>$\frac{X}{1-c}$</td>
</tr>
<tr>
<td>tax-exempt</td>
<td>FID</td>
<td></td>
<td>$X$</td>
<td>$X$</td>
</tr>
<tr>
<td>surplus</td>
<td>ordinary</td>
<td>$(1-c)X$</td>
<td>$X$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FID</td>
<td></td>
<td>$X$</td>
<td>$X$</td>
</tr>
<tr>
<td></td>
<td>no surplus</td>
<td>ordinary</td>
<td>$X$</td>
<td>$\frac{1-m}{1-c}X$</td>
</tr>
<tr>
<td>tax paying</td>
<td>FID</td>
<td></td>
<td>$X$</td>
<td>$\frac{1-m}{1-c}X$</td>
</tr>
<tr>
<td>surplus</td>
<td>ordinary</td>
<td>$(1-c)X$</td>
<td>$(1-m)X$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FID</td>
<td></td>
<td>$X$</td>
<td>$\frac{1-m}{1-c}X$</td>
</tr>
</tbody>
</table>

Notes: $X$ is the amount of cash used for distributions and, if necessary, ACT payments. $c$ is the rate of ACT and the tax credit, $m$ is the personal income tax rate. Effect of recovering surplus ACT from past years ignored.

The table shows how the tax system affects gross and net dividends for a firm which had set aside for distributions a fixed amount $X$. For the level of the net dividends, the ACT position of the firm and the type of dividend are relevant. A firm in a surplus ACT position will have to cover the ACT charge out of the funds set aside for distribution, which will reduce the net dividend. This can be avoided by paying a FID, provided the firm has sufficient foreign earnings. The amount of the gross dividend depends on the tax position of the shareholder. In case of ordinary dividends, shareholders always receive a tax credit, in the case of FIDs, this is only the case when the taxpayer is not tax-exempt.

The table provides some interesting insights about optimal ways to pay out dividends. In the case of a firm wholly owned by tax-exempt shareholders, it is optimal to pay ordinary dividends, as long as there is a minimal probability of recovering some of the ACT in the future. In the extreme case, where none of the ACT is ever recoverable, the shareholders would be indifferent between FIDs and ordinary dividends. In the case of tax paying shareholders, the situation is the
opposite: if the firm is not in a surplus ACT position shareholders are indifferent, otherwise they prefer FIDs.

Note that firms can declare both FIDs and ordinary dividends, although they cannot pay different types of dividends to different shareholders. A firm could thus optimally pay those dividends that would suffer from irrecoverable ACT as FIDs and pay the remainder as ordinary dividends. This would be optimal, because for the dividends facing irrecoverable ACT, tax paying shareholders prefer FIDs and tax-exempt shareholders are indifferent, while for the dividends not facing ACT, tax-exempt shareholders prefer ordinary dividends and tax payers are indifferent. In practice the probability of recovering surplus ACT can be difficult to predict so that firms may not be able to determine the optimal ratio.

2.2.2 The 1997 reform

On the 2nd of July, the newly elected Labour government abolished the repayability of tax credits to tax exempt shareholders. This took immediate effect for pension funds, and was gradually introduced for most other categories of tax-exempt shareholders, such as charities, low-income individuals, etc.

Table 2 repeats the analysis of Table 1, but for the post 1997 system:
Table 2: The effect of taxes on dividends, 1997-1999

<table>
<thead>
<tr>
<th>Shareholder</th>
<th>ACT position</th>
<th>Type of dividend</th>
<th>Net dividend</th>
<th>Gross dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>no surplus</td>
<td>ordinary</td>
<td>$X$</td>
<td>$X$</td>
<td></td>
</tr>
<tr>
<td>tax-exempt surplus</td>
<td>ordinary</td>
<td>$(1-c)X$</td>
<td>$(1-c)X$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FID</td>
<td>$X$</td>
<td>$X$</td>
<td></td>
</tr>
<tr>
<td>no surplus</td>
<td>ordinary</td>
<td>$X$</td>
<td>$\frac{1-m}{1-c}X$</td>
<td></td>
</tr>
<tr>
<td>tax paying surplus</td>
<td>ordinary</td>
<td>$(1-c)X$</td>
<td>$(1-m)X$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FID</td>
<td>$X$</td>
<td>$\frac{1-m}{1-c}X$</td>
<td></td>
</tr>
</tbody>
</table>

Notes: same notation as Table 1.

The reform thus made paying ordinary dividends less attractive to tax-exempt shareholders. These shareholders were now indifferent in the case of no-surplus ACT and strictly preferred FIDs otherwise. There was then no conflict between the interests of tax-exempt and tax paying shareholders anymore, as both either preferred FIDs or were indifferent.

2.2.3 The 1999 reform

The 1999 reform abolished ACT and FIDs and changed the rates of tax credits and tax liabilities. The ACT abolition had already been announced in March 1998, when the 1998 Budget was presented. To prevent firms with accumulated stocks of ACT to use these up quickly, a new scheme called "shadow ACT" was introduced. This is calculated just like ACT, but firms do not need to pay it. The only effect of this is that firms can only use up ACT stocks after taking account of their shadow ACT.

After these reforms, the system was thus equivalent to one which exempted dividends from tax for tax-exempt and basic rate taxpayers, and charged a reduced rate for higher rate payers. This is summarised in Table 3.
The second aspect of the 1999 reform, the change in the rate of the tax credit and the income tax rates on dividends had no effect on UK resident shareholders, because the two changes were exactly offsetting. The credit rate was reduced from 20 per cent to 10 per cent, as was the basic income tax rate, so that dividend income continued not to be taxed for basic rate taxpayers. For higher rate payers, the rate was reduced from 40 per cent to 32.5 per cent, yielding as before the reform an additional tax of 25 per cent on net dividends. The change of tax and tax credit rates can thus be ignored for domestic shareholders. It did however affect some foreign shareholders, where the tax treaty provided for a payment of the tax credit across borders. Particularly, this affected US shareholders, who received a tax credit of 20 per cent prior to the reform. This was subject to a 15 per cent withholding tax, yielding a net credit of 6.25 per cent. The reform reduced both the withholding tax and the credit to 10 per cent, so that dividends are now paid without any net credit.

2.3 Effects of the reform – theory

In theory the value of a share is modelled as the present discounted value of after-tax dividends. As tax treatments are different across shareholders, different shareholders will value the same pre-tax dividend stream, i.e. the same share, differently. A model is therefore needed that explains how shareholders with different tax treatments both want to hold the same asset at the same price. The usual solution is to consider risk, and how it increases as shareholders portfolios hold increasing amounts of their wealth in a particular class of assets, thereby foregoing benefits of diversification. This effect can be modelled as an increase in the discount rate.

We suppose for simplicity that there are just two types of shareholders: subsidised ones (pension funds) and unsubsidised ones (everyone else, including
foreign investors). If prior to the reform, both subsidised and unsubsidised investors choose to hold a share, then they will clearly be differentially affected by the reform and hence reallocations of portfolios will occur. Whether these reallocations lead to large or small adjustments in share prices will then depend on how large the reallocations are relative to the total wealth of each group of investors. Particularly, if the subsidised investors decide to reduce their holding of the asset after the reform, but the unsubsidised investors hold only a tiny fraction of their wealth in the asset, then the price effect may be minimal.

In other words, the effect will depend on whether the subsidised or the unsubsidised investor is price determining. In the small open economy of the UK, international investors, whose total wealth is much larger than the one of UK pension funds, are likely to determine the prices. We would therefore not expect a large fall in share prices. This is developed in more detail and more formally in the remainder of this section.

2.3.1 A formal account

2.3.1.1 Valuation of shares

Abstracting from capital gains tax and transactions costs, standard equity valuation models, following King (1974) suggest that the value of a share is given by:

\[ V_t = \frac{1}{1 + \rho_t} \left( \gamma_t D_t - N_t + E_t[V_{t+1}] \right) \]

where \( V_t \): value of equity in period \( t \), \( D_t \): dividend paid in period \( t \), \( N_t \): value of new equity issued in period \( t \) and \( \rho_t \): discount rate between periods \( t \) and \( t+1 \) and \( \gamma_t \): is the tax discrimination factor, defined as \( \gamma_t = \frac{1 - m_t}{1 - c_t} \).

\( \gamma_t \) is the tax discrimination factor, defined as \( \gamma_t = \frac{1 - m_t}{1 - c_t} \).

\[ \gamma_t = \frac{1 - m_t}{1 - c_t} \]

With capital gains tax, this parameter would be \( \gamma_t = \frac{1 - m_t}{1 - c_t(1 - z_t)} \), where \( z_t \) is the capital gains tax rate.
Defining $\beta_t^{t+s}$ as the total discounting factor between periods $t$ and $t+s$, (i.e. $\beta_t^{t+s} = \prod_{i=1}^{t+s} \frac{1}{1 + \rho_i} = \frac{1}{1 + \rho_t} \frac{1}{1 + \rho_{t+1}} \ldots \frac{1}{1 + \rho_{t+s}}$), equation E1 can be rewritten:

$$E2 \quad V_t = E_t \left[ \sum_{s=0}^{\infty} \beta_t^{t+s} (y_{t+s} D_{t+s} - N_{t+s}) \right]$$

For $\gamma$ constant, this simplifies to:

$$E3 \quad V_t = \gamma E_t \left[ \sum_{s=0}^{\infty} \beta_t^{t+s} D_{t+s} \right] - E_t \left[ \sum_{s=0}^{\infty} \beta_t^{t+s} N_{t+s} \right]$$

Therefore, the higher $\gamma$, the higher a given stream of expected dividends should be valued. Pre 1997, pension funds thus valued shares more highly ($\gamma = 1.25$) than basic rate ($\gamma = 1$) or higher rate ($\gamma = 0.75$) taxpayers.

Hence different shareholders will value a given share differently. The question arises then of whose valuation determines the market price, which necessarily is the same for all investors. If UK tax-exempt shareholders were the price-determining shareholders for most UK stocks, then the 1997 reform, which reduced their $\gamma$ by 20 per cent, should have reduced the stock market by a corresponding figure. As documented in Figure 1, this does not seem to be the case. The following section will discuss whose valuation may drive share prices and a process which ensures that at the margin all shareholders (who are not at a corner solution) value shares at the same level.

2.3.1.2 Portfolio equilibrium

A model is needed that in which different investors are willing to hold both UK equities and other assets, even though relative tax treatments of both assets differ across investors. From the finance literature (Brennan, 1970) the common approach is to consider the risk of assets and the investors' averseness to risk. One way to incorporate the attitude towards risk into a model of valuation is to increase the discount rate as risk increases. The resulting discount rate then does not only include the time-value of money but also a risk premium component. It
is then possible that two investors hold the same asset, even though one of them receives higher (post-tax) returns from that asset, and both receive the same returns from an alternative asset. This can occur if the investor receiving the higher return, holds a higher fraction of his wealth in that asset, so that the risk premium increases. The marginal valuation of an asset is thus equated by different discount rates.

Specifically, in the UK, as UK institutions increased the share of UK equities in their portfolios, so they increased their exposure to UK-specific risks. Their equilibrium portfolio share was higher than it would have been without the tax advantage, but still less than 100 per cent.

For illustration, let us consider the following example. Suppose there are many risky assets and one risk-free asset (which is neither taxed or nor subsidised for any investors). Investing one unit in the risk-free asset gives a payoff of \((1+r')\) with certainty in the following period. Investing one unit in a particular risky asset gives an uncertain payoff of \(D\) in the following period.

Suppose initially there is no tax or subsidy on this payoff, and all investors are identical. The optimal portfolio allocation in which investors hold strictly positive amounts of both the risk-free asset and this risky asset is characterised by

\[
P = V[(1+r')P] = V[\tilde{D}]
\]

where \(V[\tilde{X}]\): investor’s current valuation of a possibly uncertain payoff of \(\tilde{X}\) in the following period, \(P\): current price of the risky asset that pays \(\tilde{D}\) in the following period.

The equation illustrates that by investing \(P\) in the safe asset, an investor gets a certain payoff of \((1+r')P\), and by investing \(P\) in the risky asset, investor gets uncertain payoff \(\tilde{D}\). If the valuations were not the same, the investor would not hold both assets, but only the one with the higher marginal valuation.
Provided valuations satisfy value additivity, we can obtain that a certain payoff in the following period is discounted as the risk-free interest rate. E.g. for an asset paying 1 with certainty we have:

\[ 1 = V \left( (1 + r) \right) = (1 + r) V[1] \]

\[ \iff V[1] = \frac{1}{1 + r} \]

For the risky asset we can equally define the discount rate for the expected payoff \( E[\tilde{D}] \) to be \( \rho \), satisfying:

\[ P = V[\tilde{D}] = \left( \frac{1}{1 + \rho} \right) E[\tilde{D}] \]

Clearly \( \rho > r \) if holding this asset adds to overall risk of the investor’s portfolio. The risk premium \( \rho - r \) may for example be characterised by the capital asset pricing model (Lintner (1965), Sharpe (1964)).

Suppose the government introduces a subsidy to the payoff on this particular risky asset only, for one class of investors only. In terms of the studied reforms, consider the refundable tax credit on UK dividends to UK pension funds, with no subsidy on UK dividends for foreign pension funds, and no subsidy for UK pension funds on the risk-free asset. Consider an equilibrium in which both subsidised and unsubsidised investors choose to hold strictly positive amounts of both the risk-free asset and this particular risky asset. As before, an unsubsidised investor can get certain payoff \( (1 + r)P \) by investing \( P \) in the risk-free asset, or uncertain payoff \( \tilde{D} \) by investing in the risky asset.

Market price of risky asset must again satisfy

\[ P = V_1 \left( (1 + r)P \right) = V_1[\tilde{D}] \]

\[ i.e. \, V[a + b\tilde{X}] = a + b V[\tilde{X}] \, \text{for known } a, b. \]
where \( V_i[\tilde{X}] \) = valuation of possibly uncertain payoff \( \tilde{X} \) for the unsubsidised investors

A subsidised investor can equally get a certain payoff of \((1+r')P\) by investing \( P \) in the risk-free asset. The uncertain payoff of the risky asset however is now \( \gamma \tilde{D} \), where \( \gamma > 1 \) indicates a net subsidy.

Market price of risky asset must also satisfy

\[
E \quad P = V_{r}[\Gamma(1+r')P] = V_{r}[\gamma \tilde{D}]
\]

where \( V_i[\tilde{X}] \) = valuation of possibly uncertain payoff \( \tilde{X} \) for subsidised investors.

The market price \( P \) must be common to both types of investors:

\[
E \quad P = V_{r}[\tilde{D}] = V_{r}[\gamma \tilde{D}]
\]

If both classes of investors agree on \( E[\tilde{D}] \), it follows that the expected payoff must be discounted at a higher rate by the subsidised investors than by the unsubsidised investors. Let \( \rho_i \) (\( \rho_r \)) denote the discount rate used by unsubsidised (subsidised) investors

\[
E \quad P = \left( \frac{1}{1+\rho_i} \right) E[\tilde{D}] = \left( \frac{1}{1+\rho_r} \right) E[\gamma \tilde{D}]
\]

Hence we can obtain

\[
E \quad (1+\rho_r) = \gamma (1+\rho_i) > (1+\rho_i) \quad \forall \gamma > 1
\]

So indeed the discount rate of the subsidised investor must be higher than that of the unsubsidised one. The intuition behind this result is that subsidised investors are induced to hold a larger share of their wealth in the subsidised asset, and thus require a higher risk premium for bearing more of the idiosyncratic (diversifiable) risk on this particular asset.
How does the subsidy affect the market price? As the subsidy both increases the risk premium required by the subsidised investors – who are overweight in the subsidised asset relative to an optimally diversified portfolio without distortionary taxes – and reduces the risk premium required by the unsubsidised investors – who conversely must be underweight in the subsidised asset, the effect would tend to raise the equilibrium market price of the subsidised asset.

However, in a small open economy, the effect on the market price of the subsidised asset will tend to zero if the wealth of the subsidised (national) investors is small relative to the wealth of the unsubsidised (international) investors.

The intuition behind that is that the extra amount invested by subsidised investors in the subsidised asset will be relatively large relative to their wealth, but relatively small relative to the wealth of the unsubsidised investors. Therefore the portfolios of the unsubsidised investors are not much affected and hence their required rate of return is also unchanged. An infinitesimal price increase would thus be sufficient to induce unsubsidised investors to sell their shares to subsidised ones.

Thus a tax or subsidy on the return on (one class of) domestic assets for (one class of) domestic shareholders in a small open economy would be expected to have no significant effect on the price of this class of assets if the asset is traded in an international capital market with a high degree of capital mobility and the portfolio equilibria with or without the tax/subsidy feature both the subsidised asset and other assets being held by both (taxed/subsidised) domestic investors and by foreign investors.

These conditions seem likely to be satisfied for UK dividend tax provisions that applied only to dividends paid on UK equities to tax-exempt UK institutions. The abolition of repayable dividend tax credits in July 1997 provides an opportunity to test this.
2.3.1.3 Optimal dividend policy

In the section above the dividend was treated as given. In practice it is of course a choice variable that firms might use to maximise their value. In the economic literature there are different strands of thought on optimal dividend policy. One of them is the "tax irrelevance" view according to which taxes are irrelevant to dividend policy, because they can be avoided completely (Miller and Scholes, 1978). Another one is the so-called "new view" (King, 1977, Auerbach, 1979, Bradford, 1981), which postulates that for mature firms dividends are simply the residual when a firm has exhausted all its investment opportunities that are worthwhile at the cost of capital of retained earnings. Taxes at the personal level in this view do not affect the cost of capital, investment or the amount of gross dividends. The "traditional" view however sees taxes as affecting both the cost of capital of retained earnings and new equity issues, because dividends provide shareholders with some non-monetary benefit, e.g. because of some information value in the principal agent relationship between shareholders and company directors. In this last case dividends would increase if personal taxes on dividend fell.

In the case of a small open economy and a reform affecting personal income taxes only, it turns out that all three views imply the same. Firms, which aim to maximise their market value, should not change their dividend policy as a result of the reform. This is because the reform did not affect (much) foreign institutions with \( \gamma \approx 1 \) both before and after July 1997, so that even the "traditional" view would imply no adjustment.

If however firms do not choose their dividend policy to maximise their value, but instead pick a dividend policy, which is optimal for the most influential shareholders, the results are different. If the most influential shareholders are tax-exempt (\( \gamma > 1 \)) shareholders such as pension funds, they may have had an incentive to lobby for high dividend payouts prior to the reform. In the standard equity valuation model (see equation E1) the value to subsidised shareholders is maximised by issuing an infinitely high amount of new shares in order to pay infinitely high dividends, abstracting from transactions costs and surplus ACT. In practice, the tax advantage of this round trip of shareholders funds was
eliminated beyond some point by the presence of surplus ACT, which offset the
tax benefit at the shareholder level by a tax cost at the corporate level for firms
paying dividends in excess of profits (as described in section 2.2.1). Nevertheless, if firms were choosing dividend policies in the interest of UK
pension funds, with $\gamma = 1.25$ prior to July 1997, we may expect to see dividend
policies with high new issues and high dividends prior to the reform. Devereux,
Keen and Schiantarelli (1994) provide a formal analysis consistent with this
prediction.

As the reform removed this incentive, dividend payments of such pension fund
controlled firms should fall. Other considerations, such as transaction costs of
issuing new equity and surplus ACT suggest that it is likely that UK firms would
strictly prefer a financial policy that minimised dividend payments after July
1997, as in the standard “New View” model for $\gamma < 1$ shareholders.

Because the previous policy was not optimal for the marginal shareholders, i.e.
the international investors, this change in dividend policy should lead to an
increase in the share price of such firms as a result of the reform.

In the UK, during the relevant period, firms did not only need to choose the
optimal amount of dividend payments, but also the type of dividend paid, i.e.
ordinary dividend or FID. Again the prediction is that firms which maximise
their market value should not change their behaviour, as the trade-off between
both dividends was unaffected for international (and domestic tax-paying)
investors. For “pension-fund controlled” firms however, the previous
disadvantage of FIDs, namely their lack of a tax credit, is now shared by ordinary
dividends. Some of these firms thus faced incentives to switch from ordinary
dividends to FIDs. Note that this would lead to an increase in net dividends as
the saved surplus ACT can be paid out to shareholders. For pension funds this
gain merely replaces the lost tax credit and they are indifferent at the margin. For

---

6 While we loosely speak of “switching” the relevant issue is just that they are starting to pay
FIDs. They may continue also paying ordinary dividends. In fact this is likely as the relative size
of foreign profits restricts firms ability to pay FIDs.
international investors though, this is an increase in dividends and thus likely to lead to an increase in share prices.

So if there are pension-fund controlled firms, then we would expect their dividend payments to increase if they switch to FIDs, or to decrease if they continue paying ordinary dividends. In both cases their share prices are likely to increase as a result of the reform. For all other firms we expect no changes to dividend payments or share prices.

2.3.2 Predictions

Based on the analysis of portfolio equilibria in a small open economy sketched above, we can make a number of testable predictions about the likely effects of the 1997 reform, removing a subsidy from one class of investors:

1. The share of UK equities in the portfolios of UK pension funds should fall.
2. Ownership of UK equity by foreign shareholders (or domestic taxpayers) should increase.
3. If UK firms choose dividend policies to maximise their stock market valuation, there should be little or no effect on their dividend behaviour.
4. There should be little or no effect on the market value of UK equities. If dividend policy is not chosen to maximise market values, but in the interest of influential shareholders, there should be a positive price effect.

2.4 Effects of the reform – empirical evidence

This section will first briefly discuss the empirical evidence on equity ownership (predictions 1 and 2) in subsection 2.4.1. The following two subsections analyse in more detail the evidence on dividend behaviour (prediction 3) and the effect on the market value of UK equities (prediction 4).

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7 In principle there could also be a fall in dividend payments by firms switching to FIDs if the latter effect outweighs the former.
2.4.1 Equity ownership

The first prediction concerned the share of UK equities in the portfolios of tax-exempt shareholders. The two most important categories of such shareholders are pension funds, and with respect to their pension business, insurance companies. Table 4 shows the fraction of UK shares in total equity holdings for these two groups of shareholders.

Table 4: Share of UK equities in total equity holdings of pension funds and long-term insurance companies, in per cent

<table>
<thead>
<tr>
<th></th>
<th>Pension Funds</th>
<th>Insurance Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>75.0</td>
<td>80.9</td>
</tr>
<tr>
<td>1991</td>
<td>74.2</td>
<td>79.6</td>
</tr>
<tr>
<td>1992</td>
<td>76.2</td>
<td>80.3</td>
</tr>
<tr>
<td>1993</td>
<td>74.9</td>
<td>78.2</td>
</tr>
<tr>
<td>1994</td>
<td>74.6</td>
<td>77.9</td>
</tr>
<tr>
<td>1995</td>
<td>75.7</td>
<td>77.7</td>
</tr>
<tr>
<td>1996</td>
<td>76.6</td>
<td>79.0</td>
</tr>
<tr>
<td>1997</td>
<td>76.5</td>
<td>80.5</td>
</tr>
<tr>
<td>1998</td>
<td>75.5</td>
<td>80.6</td>
</tr>
<tr>
<td>1999</td>
<td>70.7</td>
<td>76.7</td>
</tr>
<tr>
<td>2000</td>
<td>68.8</td>
<td>78.6</td>
</tr>
<tr>
<td>2001</td>
<td>67.1</td>
<td>75.1</td>
</tr>
</tbody>
</table>

Source: Financial Statistics, tables 5.1A and 5.1B.

The table documents the fall in the fraction of total UK quoted equity owned by UK pension funds and insurance companies after 1997. Of course other factors will have played a role, particularly the general globalisation of the financial markets. It is interesting to note though that up to 1997 the share of UK equities in remained rather constant at around 75 per cent of total equity holdings. After 1997 the share drops by almost 10 percentage points, although not immediately.

The second prediction concerned the ownership of UK shares by investors who were not (or not much) affected by the reform. One way to analyse this would be to obtain data from portfolios of private tax paying investors as well as foreign institutional investors. A simpler approach is to examine the ownership of UK shares by different groups of investors. Table 5 shows the beneficial ownership of UK equities.
Table 5: Beneficial ownership of UK equities, percentages

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UK Pension Funds</td>
<td>31.7</td>
<td>31.3</td>
<td>32.4</td>
<td>31.7</td>
<td>27.8</td>
<td>22.1</td>
<td>21.7</td>
<td>19.6</td>
<td>17.7</td>
</tr>
<tr>
<td>UK Insurance</td>
<td>20.4</td>
<td>20.8</td>
<td>19.5</td>
<td>20</td>
<td>21.9</td>
<td>23.5</td>
<td>21.6</td>
<td>21.6</td>
<td>21.0</td>
</tr>
<tr>
<td>Companies Foreign</td>
<td>11.8</td>
<td>12.8</td>
<td>13.1</td>
<td>16.3</td>
<td>16.3</td>
<td>24</td>
<td>27.6</td>
<td>29.3</td>
<td>32.4</td>
</tr>
<tr>
<td>Shareholders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


This table shows that the share of equities owned by foreign shareholders has increased considerably since 1997, and the shares owned by previously subsidised investors decreased accordingly. Unfortunately it is not possible to compare the post reform period to the immediate pre-reform period, because no data are available for 1995 and 1996. As above, some of the changes might be attributed to globalisation more generally. Indeed the trend towards higher fractions of share ownership by foreign shareholders can be noticed throughout. The increase between 1994 and 1998 however is arguably stronger than before or after.

In summary this section confirms the predicted changes to equity ownership patterns. While the evidence presented may not be sufficient in itself, it should be seen in connection with the more detailed evidence on dividend behaviour and the market value of equities presented in the following two sections.

2.4.2 Dividend behaviour

The prediction of no changes to dividend behaviour depends on two assumptions. First, it is assumed that stock market values of UK companies reflect the valuation of diversified foreign institutions with $\gamma = 1$ both before and after July 1997. Second, dividend policies of UK firms are assumed to be chosen to maximise stock market valuations. Only if both of these assumptions hold, we should see no change in dividend behaviour after the abolition of repayable dividend tax credits for tax-exempt UK institutions in July 1997.

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8 There is no clear fall for insurance companies here, unlike in the previous table. Part of the reason is that the data used to construct Table 5 do not allow distinguishing between long-term and other insurance business, the former of which is more likely to include much of the affected pension business.
If these assumptions held for all firms, then clearly one would see no effect on dividends, or at least none that may be attributable to the reform. The only hope of empirically detecting some effect is therefore to identify firms violating at least one of the two necessary assumptions and to compare them to the remaining firms.

As the first assumption is not very controversial\(^9\) with the UK commonly modelled as a small open economy, it would not be compelling to look for a violation of it, and we will assume that it holds throughout for all firms. There is however some scope for possible violations of the second assumption. Even though international shareholders may be determining the share price, their preferences may not be heeded in an AGM, where not all shareholders take part. If an influential group of shareholders can manage to change dividend policy in their interest, than this may be beneficial to them, even if it leads to lower share prices as the value of the share drops for the price-determining investor, who would have preferred a different dividend policy.

The empirical strategy used is then to determine those firms for which the second assumption is likely to be violated so that a change in dividend behaviour is possible. Under the assumption that both necessary conditions continue to hold for all other firms, we can then define those as the control group, in which no change in dividend behaviour is expected. By finding a differential effect between the treatment and control group we can then conclude that the members of the treatment group indeed did not fulfil the second condition. The empirical strategy in this setup is thus necessarily limited: it is not possible to prove logically that most firms were not affected by the reform. It is just possible to identify some firms where some action is expected and document that this occurs in the expected direction. While this constitutes evidence for the interpretation put forward in this chapter, it thus not possible to prove that it is true.

More specifically, if the dividend policies of some UK firms were chosen to reflect the tax preferences of UK pension funds and insurance companies, for

\(^9\) The findings using drop-off ratios discussed below in section 2.5 also confirm this.
whom high dividend policies and the avoidance of FIDs were tax efficient prior to July 1997, we would expect some reduction in dividend payout ratios after the abolition of repayable tax credits as well as a shift to FIDs compared to other firms.

2.4.2.1 Data

Throughout this section we use a dataset containing dividend payment data and company accounts data, both of which were obtained from Thomson Financial Datastream. The resulting dataset contains 696 firms and 4225 observations covering the years 1994 to 2001. We also merge in ownership data obtained from CDA/Spectrum. We only have these ownership data up to 1997 for 148 firms out of the above.

2.4.2.2 Empirical specification

One approach to deal with this would be to develop a model of dividend policy. This would allow controlling for other factors that affect dividend payout decisions. A simpler method, and one less dependent on a particular model, would be to estimate the differential effect of the reform on those firms affected by the reform compared to those unaffected. As explained above firms with a pension-fund determined dividend policy prior to the reform are likely to be affected, while other firms were not.

While defining the treatment group theoretically is straightforward, it is much harder to identify this group empirically. We consider three approaches.

Ownership data

First, we define the treatment group as comprising the firms which are owned to a large extent by pension funds. The corresponding control group thus comprises the firms where pension fund ownership is low.

---

10 Numerous papers follow this route. Those using UK data include inter alia the following: Feldstein (1970) studied the effect of higher taxation of payouts relative to retentions in the UK in this earlier time period. Edwards et al. (1986) find that cross-company variations in tax costs are relatively less important than intertemporal differences.
This approach faces both conceptual and practical problems. Conceptually, the fraction of equity owned by pension funds may not be a good indicator of which firms are more likely to choose financial policies that are tax-efficient for pension funds. In our approach below, we choose as the treatment group those firms for which pension fund ownership ratios are above the sample median. We also consider an alternative approach where we require ownership ratios to be in the upper quartile, and which gives very similar results. However, even in the upper quartile the ratio ranges from just 15 per cent to 33 per cent, which may well be too low to imply much influence on dividend policies. A practical problem is that data on beneficial ownership is expensive. We have this only for a sub-sample of 330 firms in the period 1988-97.

**ACT data**

While the criterion based on ownership data relies on an *ex ante* possibility of a pension fund influencing dividend behaviour, we can instead look for behavioural evidence revealing *ex post* which firms acted in the interest of pension funds or other subsidised investors.

The decision of whether to pay FIDs can be used as such a behavioural indication. From section 2.2.1 it follows that pension funds preferred dividend payments to FIDs. Even in the extreme case where an ordinary dividend payment meant incurring irrecoverable ACT, they were indifferent between both types of distributions. As long as there was some \( p \) probability of recovering ACT later, such shareholders preferred dividends. For all other shareholders the situation was the opposite: FIDs were preferred except when all ACT was clearly recoverable. The very low take-up of FIDs suggests that the interests of pension funds may have affected dividend policy in a number of firms. Table 6 shows how many firms have used this new type of dividend since its introduction in July 1994.
Table 6: Number and proportion of firms paying foreign income dividends

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/94 - 6/95</td>
<td>5</td>
<td>0.39%</td>
</tr>
<tr>
<td>7/95 - 6/96</td>
<td>32</td>
<td>2.36%</td>
</tr>
<tr>
<td>7/96 - 6/97</td>
<td>46</td>
<td>3.22%</td>
</tr>
<tr>
<td>7/97 - 6/98</td>
<td>130</td>
<td>8.91%</td>
</tr>
<tr>
<td>7/98 - 6/4/99</td>
<td>108</td>
<td>8.18%</td>
</tr>
</tbody>
</table>

Table 6 shows that very few companies chose to pay FIDs prior to the reform. From July 1997 onwards the share increased considerably though, as then the preferences of pension funds and other shareholders were aligned. This implies that firms would have used more FIDs prior to July 1997 if it had not been for the influence of pension funds.

An alternative definition of the treatment group would then be to include firms with surplus ACT that did pay dividends but chose not to pay FIDs, as these firms are likely to have been influenced by the tax preference of UK pension funds. This criterion will lead to some firms being wrongly allocated to the treatment group, as there are likely to be some fixed costs of setting up a FID scheme, so that even firms not controlled by pension funds may have opted against FIDs. Our results are therefore likely to be biased downwards.

We identify firms with surplus ACT as those whose stock of written off ACT is positive in the last accounting year before the reform. The stock is calculated as the sum of ACT deemed as irrecoverable (Datastream item 164) over the entire data history available of a firm.

**Foreign profit data**

Unfortunately the data on ACT may be unreliable. This is both because of not knowing the complete history of ACT write-offs and because of occasional inconsistencies in the data.\(^1\) We therefore also consider indirect evidence of ACT, namely the presence of foreign profits. This may lead to a downward bias.

\(^1\) We have the history only from the moment a firm is covered by Datastream, i.e. normally when it is publicly traded. The inconsistencies include cases where a stock of ACT is never recovered, even for firms with large domestic profits.
in our results, as not all firms with foreign profits will have a surplus ACT problem.\textsuperscript{12}

While the latter two approaches have the advantage of being based on ex-post observations, they have a different disadvantage. That is that they will identify a subgroup of pension fund controlled firms. Any pension fund controlled firm without an ACT problem cannot be identified, as such a firm would pay ordinary dividends regardless of the controlling investor. This is likely to cause a downward bias in our results.

Whichever approach we use to define the treatment group, we need to remember that predictions for dividend payments are different depending on whether firms switch to FIDs or continue paying dividends ("PFC - div"). We therefore split the treatment group of pension-fund controlled firms into two subgroups, those switching to FIDs ("PFC - switch") and those sticking to dividends ("PFC - div"). Moreover we add any firm, which switches from ordinary dividends to FIDs, to the first group (PFC - switch), even if they otherwise do not fulfil criterion for the treatment group, as such a switch is a very strong indication of pension fund control. Table 7 shows how many firms are allocated to each group before and after the reform.

Table 7: Observations by groups of firms

<table>
<thead>
<tr>
<th>Approach</th>
<th>Group</th>
<th>Before reform</th>
<th>After reform</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership data</td>
<td>PFC - switch</td>
<td>189</td>
<td>203</td>
<td>392</td>
</tr>
<tr>
<td></td>
<td>PFC - div</td>
<td>188</td>
<td>174</td>
<td>362</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>220</td>
<td>211</td>
<td>431</td>
</tr>
<tr>
<td>No FID pre1997 despite ACT</td>
<td>PFC - switch</td>
<td>189</td>
<td>203</td>
<td>392</td>
</tr>
<tr>
<td></td>
<td>PFC - div</td>
<td>499</td>
<td>470</td>
<td>969</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>1420</td>
<td>1440</td>
<td>2864</td>
</tr>
<tr>
<td>No FID pre1997 despite foreign profits</td>
<td>PFC - switch</td>
<td>189</td>
<td>203</td>
<td>392</td>
</tr>
<tr>
<td></td>
<td>PFC - div</td>
<td>852</td>
<td>848</td>
<td>1700</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>1071</td>
<td>1062</td>
<td>2133</td>
</tr>
</tbody>
</table>

Notes: A firm which switches from dividends to FIDs is always allocated to PFC - switch, irrespective of the other criteria. Therefore this group is of the same size for every approach.

\textsuperscript{12} In principle the probability of having surplus ACT will depend on the relative size of foreign profits. However, while Datastream data reliably reveal the presence of foreign profits (by the presence of foreign tax payments) they do not allow the size of foreign profits to be estimated.
Having defined the treatment groups, we run the following regression:

\[
DIV_{it} = \beta_0 + \beta_1 PROF_{it} + \beta_2 SALES_{it} + \gamma_1 (PCF - switch)_{it} + \gamma_2 (PCF - div)_{it} + \gamma_3 Post_{it} + \gamma_4 Post(PCF - switch)_{it} + \gamma_5 Post(PCF - div)_{it} + f_i + u_{it}
\]

where:

- **DIV**: total dividends (ordinary plus FIDs),
- **PROF**: profits earned for ordinary, adjusted for extraordinary items (Datastream item 182),
- **SALES**: sales (Datastream item 104),
- **PFC - switch**: Dummy for pension fund controlled firms switching to FIDs,
- **PFC - div**: Dummy for pension fund controlled firms sticking to ordinary dividends,
- **POST**: post-reform dummy.

The remaining variables are interactions between dummies. A heteroskedastic random error \((u_{it})\) and a firm fixed effect \((f)\) are also included.

We estimate this equation in a number of different ways. First, we consider within group estimation, to deal with fixed effects. We run such regressions both with and without the control variables of profits and sales.\(^\text{13}\) In order to deal with concerns of possibly higher dividend variation among larger firms, we also estimate the equation using a weighted least squares procedure, with weights of \(1/SALES^2\). This is efficient if \(\text{Var}(u_{it}) = \sigma^2(\text{SALES})^2_{it}\) and is equivalent to

\(^{13}\) It may be argued that the inclusion of profits biases against finding a result, because the tax reform will have boosted profits in those firms, in which previously irrecoverable ACT has become recoverable through the switch to FIDs. There are two reasons for still finding an effect though: first, our profit measure does not include profits from non-operating activities, second, even if profits increased, if all of the tax saving were paid out, we would still see dividends increase relative to profits.
regressions on the above equation divided by sales, i.e. on the dividend sales ratio. This approach has also been used in other recent studies e.g. Khan (2005).

2.4.2.3 Results and interpretation

Table 8 shows results for the regression using the definitions of the treatment group based on ownership data. Table 9 repeats the analysis for the criterion based on ACT and Table 10 repeats it for the overseas profits criterion.

Table 8: Difference in differences in dividend payments, ownership criterion

<table>
<thead>
<tr>
<th>Estimation method</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within groups</td>
<td>Within groups</td>
<td>Within groups, weighted</td>
</tr>
<tr>
<td>Post</td>
<td>-1,961.107</td>
<td>-2,624.010</td>
<td>19.398</td>
</tr>
<tr>
<td></td>
<td>(4,344.769)</td>
<td>(4,474.376)</td>
<td>(24.410)</td>
</tr>
<tr>
<td>Post*(PFC - switch)</td>
<td>19,614.862</td>
<td>13,753.696</td>
<td>396.459</td>
</tr>
<tr>
<td></td>
<td>(9,090.890)**</td>
<td>(7,928.909)*</td>
<td>(242.190)</td>
</tr>
<tr>
<td>Post*(PFC - div)</td>
<td>6,835.821</td>
<td>6,216.981</td>
<td>176.175</td>
</tr>
<tr>
<td></td>
<td>(5,340.025)</td>
<td>(5,089.286)</td>
<td>(91.796)*</td>
</tr>
<tr>
<td>Sales</td>
<td>0.022</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.005)***</td>
<td>(0.003)**</td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td>-0.029</td>
<td>0.161</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.026)***</td>
<td></td>
</tr>
<tr>
<td>const.</td>
<td>30,249.030</td>
<td>7,509.034</td>
<td>25.208</td>
</tr>
<tr>
<td></td>
<td>(1,641.584)***</td>
<td>(3,903.990)*</td>
<td>(22.408)</td>
</tr>
<tr>
<td>Obs.</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
</tr>
<tr>
<td>R²</td>
<td>0.96</td>
<td>0.97</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Notes: Standard errors are given in parentheses and are robust to heteroskedasticity and serial correlation. Stars indicate the level of significance (*: 10%, **: 5%, ***: 1%).
Table 9: Difference in differences in dividend payments, ACT criterion

<table>
<thead>
<tr>
<th>Estimation method</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>74.147</td>
<td>-865.201</td>
<td>-3.517</td>
</tr>
<tr>
<td></td>
<td>(2,346.078)</td>
<td>(1,770.901)</td>
<td>(8.219)</td>
</tr>
<tr>
<td>Post*(PFC – switch)</td>
<td>15,759.608</td>
<td>13,988.950</td>
<td>437.419</td>
</tr>
<tr>
<td></td>
<td>(8,349.048)**</td>
<td>(7,794.498)*</td>
<td>(250.787)*</td>
</tr>
<tr>
<td>Post*(PFC – div)</td>
<td>4,169.342</td>
<td>3,036.739</td>
<td>24.735</td>
</tr>
<tr>
<td></td>
<td>(2,955.479)</td>
<td>(2,354.549)</td>
<td>(22.543)</td>
</tr>
<tr>
<td>Sales</td>
<td>0.004</td>
<td>0.013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.002)**</td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td>0.187</td>
<td>0.146</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.144)</td>
<td>(0.043)**</td>
<td></td>
</tr>
<tr>
<td>const.</td>
<td>22,093.172</td>
<td>11,305.303</td>
<td>67.996</td>
</tr>
<tr>
<td></td>
<td>(918.780)***</td>
<td>(5,045.777)**</td>
<td>(5.279)**</td>
</tr>
<tr>
<td>Obs.</td>
<td>4219</td>
<td>4219</td>
<td>4219</td>
</tr>
<tr>
<td>R²</td>
<td>0.86</td>
<td>0.87</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Notes: Standard errors are given in parentheses and are robust to heteroskedasticity and serial correlation. Stars indicate the level of significance (*: 10%, **: 5%, ***: 1%).

Table 10: Difference in differences in dividend payments, overseas profits criterion

<table>
<thead>
<tr>
<th>Estimation method</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>1,523.676</td>
<td>460.704</td>
<td>-1.105</td>
</tr>
<tr>
<td></td>
<td>(1,261.422)</td>
<td>(1,120.132)</td>
<td>(7.564)</td>
</tr>
<tr>
<td>Post*(PFC – switch)</td>
<td>16,130.080</td>
<td>12,641.084</td>
<td>435.289</td>
</tr>
<tr>
<td></td>
<td>(8,111.332)**</td>
<td>(7,526.630)*</td>
<td>(250.974)*</td>
</tr>
<tr>
<td>Post*(PFC – div)</td>
<td>-831.922</td>
<td>-1,227.328</td>
<td>8.362</td>
</tr>
<tr>
<td></td>
<td>(3,927.974)</td>
<td>(2,337.513)</td>
<td>(33.726)</td>
</tr>
<tr>
<td>Sales</td>
<td>0.004</td>
<td>0.013</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.002)**</td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td>0.186</td>
<td>0.146</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.144)</td>
<td>(0.043)**</td>
<td></td>
</tr>
<tr>
<td>const.</td>
<td>22,076.990</td>
<td>11,243.334</td>
<td>67.684</td>
</tr>
<tr>
<td></td>
<td>(912.184)***</td>
<td>(5,051.793)**</td>
<td>(5.334)**</td>
</tr>
<tr>
<td>Obs.</td>
<td>4219</td>
<td>4219</td>
<td>4219</td>
</tr>
<tr>
<td>R²</td>
<td>0.86</td>
<td>0.87</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Notes: Standard errors are given in parentheses and are robust to heteroskedasticity and serial correlation. Stars indicate the level of significance (*: 10%, **: 5%, ***: 1%).

We find in all regressions that pension fund controlled firms which switched to FIDs increased their dividend payouts relative to other firms (Post*(PFC – switch)), as predicted. This finding is robust both to estimation techniques and the approach used to allocate firms into groups, although in one case the p-value...
drops to 10.4 per cent. The dramatically different coefficients obtained using the weighted least squares method can be explained by the fact that without controlling for heteroskedasticity, coefficients will be estimated with extremely low precision. Noting that weighted least squares can also be interpreted as ordinary least square on E12 after dividing every variable by sales, it is apparent this estimator will moreover be much less sensitive to outliers in the highly skewed distribution of profits and sales. Overall, the coefficients of the weighted least square approach should thus be considered the more informative ones.

The findings on those pension fund controlled firms which kept paying ordinary dividends are less clear. Using the ownership data, we find that such firms have, if anything, increased their dividend payments. Using the other two approaches we find no relationship that is anywhere close to being statistically significant.

The coefficients on profits and sales are generally positive as expected, although not significantly so in the case of the unweighted regressions. Interestingly though, whether or not regressions are weighted, the signs of the difference-in-difference results are not affected.

These results are robust to a number of variations. They are robust to different definitions of the post-reform dummies. In the results shown accounting years were allocated to the post-reform period if all dividend payments took place after the reform. An alternative definition, which allocates all accounting years to the post period if at least one dividend payments occurred after the reform left result virtually unaffected.

Overall the results could be seen as mainly supporting the new view of dividend taxation. Nevertheless, they are largely consistent with the hypothesis that large local institutions exerted some influence over the dividend behaviour of some UK companies. There is however one alternative interpretation that we need to rule out. It may be the case the fall in dividend payments was not due to the effects of the 1997 reform, but instead of the 1999 reform on international shareholders from certain treaty countries, such as the USA. As outlined in section 2.2.3, US shareholders had their net UK tax credit on UK dividends removed. While the net credit was of very small value, it may in principle have
affected their preferences for dividends. Specifically, they may have preferred lower dividend payouts after the reform. To test this we have rerun the above model, having added in a further dummy for the post 1999 period. Irrespective of how this was defined and of whether this was interacted with both treatment dummies or just one treatment group dummy, it always turned out to be insignificant.\textsuperscript{14} We concluded that the 1999 reform did not drive our results.\textsuperscript{15} We also reran regressions after dropping post 1999 reform observations, and our results were essentially unchanged.

The results obtained thus suggest that some firms have employed dividend policies which were not consistent with share price maximisation.\textsuperscript{16} If this is true, then this should have implications on share prices, as adopted dividend policies that were inconsistent with share price maximisation. The following section examines this issue further.

2.4.3 Market value of UK equities

If share prices reflect the valuations of shareholders with $\gamma \approx 1$, then the presence of modest transaction costs associated with issuing new equity would indicate that share prices are maximised by a policy of minimising dividend payments. If pension fund controlled UK firms deviated from this policy in the period before July 1997, their stock market values should have been lower as a result, as their dividend policy was not optimal to international shareholders. If it had been anticipated that they would change their dividend behaviour following the abolition of repayable dividend tax credits, their stock market values of “pension fund controlled” firms should have risen around July 1997, relative to those of the control group. To analyse this we use again a difference-in-differences approach and run the following regression:

\textsuperscript{14} The two possible definitions of the post reform dummy are either allocating accounting years with dividend payments in both periods to the pre or post reform period.

\textsuperscript{15} This is not to say that the 1999 reform did not have effects, which would require more analysis. The relevant point here is that any such effects did not drive our findings.

\textsuperscript{16} Work in progress is looking at whether this reduced pressure to pay out high dividends – consistent with the government’s aim in abolishing repayable dividend tax credits – had any impact on the investment spending of this group of firms – the stated rationale for the tax change. Current findings indicate that “pension fund control” of dividend policies had no detectable effect on investment levels.
\[ r_i = \beta_0 + \beta_1 (PCF - \text{switch})_i + \beta_2 (PCF - \text{div})_i + u_i \]

where \( r_i \) the return of share \( i \) and dummies are defined as above.

The return is defined as the total return to a share, including dividends and capital gains. It can be defined over different time periods, or event windows. We run 50 regressions with event windows ranging from 1 to 50 trading days. We run both regressions with a raw rate of return and with one adjusted for market movements. This is done by obtaining a historic estimate of the correlation between the rates of return of each share with the market portfolio. This approach is based on the capital asset pricing model (Sharpe (1964) and Lintner (1965)). The correlation is usually labelled \( \rho \). The adjusted return is then obtained as \( r^a_i = r_i - \rho \mu \), where \( r^a_i \): the market return and \( r^a_i \): the adjusted or abnormal return.

Table 11 shows the results for six event studies, half of which use abnormal returns. In both cases short, medium-length and long event windows are considered.

<table>
<thead>
<tr>
<th>Event window (days after reform)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted for market movements</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>PFC - switch</td>
<td>-0.013</td>
<td>-0.016</td>
<td>0.060</td>
<td>-0.018</td>
<td>-0.027</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td>(0.005)**</td>
<td>(0.009)*</td>
<td>(0.013)**</td>
<td>(0.005)**</td>
<td>(0.009)**</td>
<td>(0.012)**</td>
</tr>
<tr>
<td>PFC - div</td>
<td>0.002</td>
<td>-0.002</td>
<td>-0.003</td>
<td>0.002</td>
<td>-0.002</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.007)</td>
<td>(0.010)</td>
<td>(0.004)</td>
<td>(0.007)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Const.</td>
<td>0.002</td>
<td>-0.004</td>
<td>0.004</td>
<td>-0.005</td>
<td>-0.015</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.002)**</td>
<td>(0.003)**</td>
<td>(0.005)**</td>
</tr>
<tr>
<td>Observations (firms)</td>
<td>367</td>
<td>597</td>
<td>658</td>
<td>367</td>
<td>596</td>
<td>656</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.03</td>
<td>0.00</td>
<td>0.03</td>
<td>0.04</td>
<td>0.01</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Notes: The event window begins 1 day before the reform and lasts for as many days after the reform as indicated. Heteroskedasticity-robust standard errors in parentheses. Stars indicate the level of significance (*: 10%, **: 5%, ***: 1%).

Table 11 shows that the shares of pension fund controlled firms, which switched to FIDs, underperformed in the short run, but significantly outperformed the
market after a longer time period. On the other hand, there is no evidence of differential performance for those pension fund controlled firms, which continued with a policy of paying ordinary dividends only. As the choice of the length of the event window is somewhat arbitrary, Figure 2 shows more systematically the estimated abnormal differential returns ($\beta_1$ and $\beta_2$) for both switcher and other pension fund controlled firms for periods ranging from 1 to 50 trading days following the reform.\footnote{17}

Figure 2: Differential returns of pension fund controlled firms (ACT criterion)

![Graph showing differential returns of pension fund controlled firms](image)

Notes: The level of significance is 5 per cent.

We find a statistically significant increase of around 0.4 per cent in the value of the firms, which switched to FIDs relative to the control group, about 4-5 weeks after the July 1997 Budget. This reversed a fall of around 0.3 per cent in the week immediately following the Budget. There is never an effect on those firms which continue paying ordinary dividends. Figure 3 shows the results obtained using the alternative criterion, based on overseas profits. Results are similar,

\footnote{17 The figure looks similar if normal returns are shown instead.}
except the firms not switching to FIDs witness a temporary fall in their market value.

**Figure 3: Differential returns of pension fund controlled firms (overseas profit criterion)**

Overall we thus find as expected that the part of the treatment group which switched to FIDs increased in value, although we do not find an increase among the part of the treatment group, which continued paying ordinary dividends.

The question arises of whether the increase in share prices of the switching firms is consistent with our hypothesis, or whether the delay of four to five weeks is too long for this to be attributed to the tax change, assuming an efficient stock market. Given the complexity of the effects, and the fact that not they had to be understood by international as well as domestic investors, it may possible to explain the delay. The immediate reaction might well have been a fall in value of firms paying high dividends and refusing to pay FIDs, as their dividend policy suddenly became even less optimal. Once behavioural responses were taken into account, i.e. investors understood that the dividend policy would change, the effect became positive.
The lack of increase in the market value of the part of the treatment group which did not switch to FIDs could either be explained by the misallocation described above, or—if one does not believe misallocation to be too serious—to the lack of response in the dividend policy, so that there was no reason for a change in market value.

2.4.4 Conclusions from the empirical evidence

The empirical evidence described here is wide-ranging from changed ownership pattern, to estimated effects on dividend behaviour and share prices. Probably none of the results shown would be sufficient in itself to provide reliable support. Taken together however they provide compelling evidence in favour of the view that the reform did not affect dividend payout behaviour or share prices for most firms, and that in the cases where it had an effect it tended to lead to higher share prices.

2.5 Evidence from drop-off ratios

A recent paper by Bell and Jenkinson (2002) (BJ henceforth) uses the 1997 reform to test whether taxes affect the valuation of dividends and, who the marginal shareholders are. The paper finds that average valuations of dividends have fallen significantly after the reform, suggesting both that pension funds were marginal shareholders of the average firm and that the reform did affect their valuation of dividend streams. This result is in contradiction to the findings presented in this chapter. It is also quite puzzling given the behaviour of the stock market (see Figure 1) around the reform. After all, if dividends are worth less to shareholders after the reform, their present discounted value should have fallen and led to a downward adjustment of share prices. It is of course possible that on the same day some other good news became available that improved predictions about gross dividend streams so much as too exactly cancel out the effect of higher taxes. Alternatively market participants may not have immediately understood the consequences of the reform. Or, as we will argue, the BJ result may not correctly have identified the effect of the reform and the shareholders affected by the reform may not have been the marginal ones, at least not in the sense of price determining ones.
This section will in details discuss the BJ results, provide a critique of their interpretation and suggest an alternative one.

2.5.1 The Bell and Jenkinson study

2.5.1.1 The drop-off ratio

When a share goes ex-dividend, the marginal shareholder is indifferent between either selling the share at the cum-dividend price, thus forgoing the dividend, or keeping the share and thus receiving a dividend. Following Elton and Gruber (1970) this can be written as:

\[ E_{14} \quad P_c - z(P_c - P_0) = P_{ax} - z(P_{ax} - P_0) + D(1 - m) \]

where \( P_c \): cum-dividend price, \( P_{ax} \): ex-dividend price, \( P_0 \): purchase price, \( z \): capital gains tax rate, \( m \): as above (personal income tax rate).

This can be rearranged to:

\[ E_{15} \quad \frac{P_c - P_{ax}}{D} = \frac{1 - m}{1 - z} \]

The term on the left-hand side is generally referred to as the drop-off ratio (DOR). The term on the right-hand side is sometimes called tax discrimination factor (often labelled \( \gamma \)). This formulation thus provides a simple method for obtaining estimates of average tax rates faced by marginal investors. In practice it is however difficult to obtain prices just before and after a share goes ex-dividend, particularly as this usually happens over night. Instead empirical studies can at best use the closing price on the last cum-dividend date and compare this to the opening price on ex-dividend date. More often, only an average or mid-day price is available. The difference between both prices will thus reflect movements caused by factors other than the dividend payment. It is thus necessary to average over a large number of shares in order to get reliable estimates. Furthermore adjustments for market movements can be made (see below).
Elton and Gruber (1970) estimated the DOR to be on average 78 per cent, suggesting that the average marginal shareholder did face positive dividend taxation in the US, with a net tax rate of 22 per cent.

In the UK, the tax discrimination factor has to be modified to allow for the tax credit. As the tax credit increases the gross dividend from $D$ to $D/(1-c)$, this changes the factor to:

\[ \gamma = \frac{1 - m}{(1 - z)(1 - c)} \]

A few interesting features of this result are:

If there are no taxes on dividends, then the DOR will equal 1, as the price drop will on average equal the gross dividend paid. If dividends are taxed, share prices will fall less than by the dividend rate. Finally, if there is a net tax credit, such as in the case of UK pension funds before the 1997 reform, then share prices should fall by more than the dividend rate ($\gamma = 1/(1-c)$).

**2.5.1.2 Estimation strategy**

BJ apply this methodology to the 1997 reform in the UK. The most straightforward way to implement a test of whether DORs have fallen as a result of the reform would be to run a regression of the DORs on a constant and a dummy indicating the post-reform period. Such an approach may however be inefficient, as the DOR of firms with small dividends payments would be given more weight. Lakonishok and Vermaelen (1983) propose to deal with this in the following way:

Assume that price changes are random variables which can be written:

\[ P_e - P_o = \alpha D + \epsilon \]

with $E(\epsilon) = 0, Var(\epsilon) = P^2_e \sigma^2$.

i.e. assuming that the standard deviation of the price change is proportional to the share price, a standard assumption in the finance literature. To obtain the DOR, we divide equation E 17 by $D$:  

47
\[ \frac{P - P_{ex}}{D} = \alpha + \frac{\varepsilon}{D} \]

The variance of the error term will then be: \( \text{Var} \left( \frac{\varepsilon}{D} \right) = \frac{\sigma^2}{D^2} \). Lakonishok and Vermaelen (1983) suggest an alternative statistic to the average drop-off ratio to deal with this.\(^\text{18}\) Another possibility is to multiply Equation E 18 by \( D/P_c \), as done, \textit{inter alia}, in Boyd and Jagannathan (1994) and in BJ. This gives:

\[ \frac{P - P_{ex}}{P_c} = \alpha \frac{D}{P_c} + e \]

where \( e = \varepsilon/P_c \) and hence \( \text{Var}(e) = \sigma^2 \). When adding a dummy for the post-reform period, this is of course also multiplied by the same factor. Furthermore BJ argue that is better to add a constant to equation E 16, based on microstructure models developed by Boyd and Jagannathan (1994) and Frank and Jagannathan (1998), which suggest a negative intercept in such a regression.

A further adjustment is the common deduction of market movements multiplied by a historic estimate of the correlation between a share’s and the market’s return.

\[ 2.5.1.3 \text{ Data} \]

We set up our data to mirror as closely as possible the data used by BJ, to ensure that any differences we encounter are not caused by the data sample.

Specifically, we use data from Thomson Financial Datastream on dividend payments. This data set contains one observation per payment, i.e. typically two observations per firm and year, as most UK firms pay an interim and a final dividend per accounting year. We merge daily data on share prices and return

\[ ^{18} \text{The suggested statistic is } \sum \frac{P_c - P_{ex}}{P_c} / \sum \frac{D}{P_c}. \text{ Numerator and denominator can be calculated separately and then divided. This statistic implies that in a portfolio each share is given equal weight, unlike in the average DOR where more weight is given to shares with low dividend yield. In the approach used by BJ and many others, more weight is given to high dividend yield shares.} \]
indices into this data set, keeping in each case the observation on the day of the
dividend payment and on the day before, i.e. the cum- and ex-dividend price.

Before running regressions, we clean the resulting data sets as follows. We drop
any observations where core data are missing, such as the payment date, the ex-
dividend date, the (cum- or ex-dividend) share price or the value of the dividend.
We also drop observations where the last cum-dividend observation predates the
ex-dividend by more than 5 trading days. We drop a few observations for which
we cannot work out the accounting year end date, because we need this in order
to match the dividend payment data with company accounts. After matching the
data with company accounts, we drop all firms, for which the sum of individual
dividend payments over the years does not match up with the total dividend
payments reported in accounts. Then we drop all dividend payments that relate to
Foreign Income Dividends, as the tax treatment for these types of dividends was
different. We also drop any observation for which the price did not move on the
ex-dividend date. This is because in such a case it is likely that the share was not
traded. It seems less likely that the share was traded, but that some positive news
exactly counteracted the fall in the share price due to the loss of the right to the
dividend. Finally we drop any outliers, which we define as DORs in excess of
5.19

As explained above, we adjust returns for general market movements using the
CAPM. To allow comparisons with BJ, we follow their approach in estimating
the correlation of each share’s monthly returns with market returns (β). We thus
run separate regression of each share’s monthly return (including capital gains
and dividends) on the monthly return of the FT All Share index during the 5
years preceding the reform. We only keep shares with at least 36 historical

19 These very high DORs are the result of shares not changing much in price on the day they go
ex-dividend. This is thus generally the result of fluke, as some good news becomes available that
coincidentally has the same price effect as the loss of dividend. As there is no obvious reason to
assume that this is more likely to occur after than before the reform, simply dropping these
outliers appears justifiable here, as it is not expected to affect both time periods differentially. A
different situation is encountered in chapter 4, where again a ratio can be large because of a small
denominator. In chapter 4 though, this occurs when comparing two groups, one of which is much
more likely to be affected by such outliers. In that case, simply removing them would thus
differentially affect both groups and potentially affect results so that a different method needs to
be devised to deal with outliers.
observations. The cleaning procedure of BJ is virtually the same as ours, except that they do not delete data where the sum of dividends does not equal the figure reported in company accounts, and that they do not drop outliers as defined above. Hence our sample is slightly smaller with data on 7966 dividend payments by 1275 firms.

2.5.1.4 Results

Table 12 presents the results obtained from running the regressions. The table shows both the results as published in BJ and our replication of these. In both cases a regression based on all available firms and the largest 250 firms is shown.

Table 12: Regression results obtained by BJ and replication

<table>
<thead>
<tr>
<th></th>
<th>BJ all firms</th>
<th>BJ largest 250</th>
<th>Replication all firms</th>
<th>Replication largest 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>8837</td>
<td>2348</td>
<td>7966</td>
<td>1565</td>
</tr>
<tr>
<td>pre 07/97</td>
<td>0.890**</td>
<td>1.028**</td>
<td>0.904**</td>
<td>0.978**</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.027)</td>
<td>(0.013)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Δ post 07/97</td>
<td>-0.106**</td>
<td>-0.204**</td>
<td>-0.080**</td>
<td>-0.168**</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.041)</td>
<td>(0.024)</td>
<td>(0.050)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. Results obtained by regressing DORs multiplied by $D/P_c$ on $D/P_c$ and a post-reform dummy multiplied by $D/P_c$. Stars indicate the level of significance (*: 10%, **: 5%). BJ did not report the level of significance on the constant and, because of rounding, this cannot be inferred for the smaller sample.

The results we obtained are very similar, although not identical. While we estimate a smaller fall in DORs, we confirm the finding that there has been a significant drop. On the whole this replication is very close, considering the difficulties inherent in trying to exactly replicate other authors' work.

We have considered a number of robustness checks for this estimation, which suggests that the results are robust. Specifically, we have run the following alternative specifications. (a) We include a constant to allow for certain ex-dividend day trading behaviour as suggested in microstructure models in Boyd and Jagannathan (1994) and Frank and Jagannathan (1998): this does not affect the estimated coefficients (b) We avoid correcting for market movements: this hardly affects the coefficients and leads to a slightly more significant falls in
DORs. (c) Not dealing with heteroskedasticity, i.e. just regressing the DOR on a constant and a post reform dummy: This does not affect the results of the sample of large firms. For the entire sample though, this reduces the coefficient on the estimated fall in DORs by half. The estimated fall in this case is only weakly significant at 13 per cent.\textsuperscript{20}

The results are thus very robust. While, in the case of the large sample, the finding is dependent on the method used to deal with heteroskedasticity, it is reassuring, that in the smaller sample, where less heteroskedasticity is to be expected, the results are robust to that variant.

We can therefore be confident that any further results we present, some of which are in contradiction to the results or the interpretation by BJ, are not simply due to differences in the source data, the cleaning procedure or the computational implementation.

\textbf{2.5.2 Further investigation}

Having established that the BJ results are replicable, we now extend the analysis of DORs to consider features not covered in the BJ study. However, even without further investigation, we note that there may be doubts about the interpretation of the DORs as estimated above and by BJ. While the estimated drop, at least for the larger companies, is pretty close to the theoretical drop in value for pension funds (20 per cent (BJ) or 17 per cent (authors) vs. 20 per cent in theory), the levels are not as expected. If it were true that pension funds were the marginal shareholders, we would expect a fall from a level of 1.25 before the reform to 1 after the reform. Even though there might be some costs to receiving dividends and reinvesting them, these costs are unlikely to be so large as to reduce the value of dividends by such a large amount.

\textbf{2.5.2.1 Timing}

The previous analysis ignored precise timing issues, as there was just one post-period dummy. In order to see more precisely when the fall in the DOR occurs,\textsuperscript{20} BJ report, without showing actual results, that they found minimal differences when considering this variant.

\textsuperscript{20} BJ report, without showing actual results, that they found minimal differences when considering this variant.
we can calculate the average DOR for shorter periods such as years and quarters. In order to ensure full comparability with the previous results, we again employ the GLS-equivalent procedure of multiplying the regression equation by \( D/P_c \) as explained in section 2.5.1.2.

Table 13: Estimated drop-off ratios by year / half-year

<table>
<thead>
<tr>
<th>Half year</th>
<th>Yearly</th>
<th>Half-yearly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995h1</td>
<td>.91 (.02)</td>
<td>.92</td>
</tr>
<tr>
<td>1995h2</td>
<td>.88 (.03)</td>
<td>.87</td>
</tr>
<tr>
<td>1996h1</td>
<td>.89 (.03)</td>
<td>.91</td>
</tr>
<tr>
<td>1996h2</td>
<td>.91 (.03)</td>
<td>.84</td>
</tr>
<tr>
<td>1997h1</td>
<td>.89 (.03)</td>
<td>.80</td>
</tr>
<tr>
<td>1997h2</td>
<td>.88 (.04)</td>
<td>.88</td>
</tr>
<tr>
<td>1998h1</td>
<td>.76 (.06)</td>
<td>.77</td>
</tr>
<tr>
<td>1998h2</td>
<td>.76 (.04)</td>
<td>.76</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. Results obtained by regressing DORs multiplied by \( D/P_c \) on \( D/P_c \) for each year and half-year.

From the yearly DORs we note that any strong drop occurred in 1999 only, some 18 months after the reform. When looking at half-yearly estimates of DORs, there is a drop of around 8 percentage points immediately following the reform, followed by a further fall of 4 percentage points in the next six months period. Curiously though, there is a reversal in the following six month, with the DOR reaching a level which exceeds the pre-reform one by three percentage points. Only in 1999 the DOR is much reduced, by between 15 and 16 percentage points. These findings suggest that changes in the DOR are quite erratic and might have nothing to do with the reform. To explore how DORs change over time, the following section considers longer term evidence.
2.5.2.2 Longer term evidence

Figure 4 plots DORs for all the years for which we have sufficient data for their calculation. The original sample is marked by two vertical bars.

Figure 4: DORs from 1988 to 2000

It can be seen that the movement of the DORs is indeed most erratic. Between 1988 and the mid-nineties, there is a discernable increase, despite the fluctuations. Over this period however tax-exempt institutions owned a similar fraction of UK equity, and their valuation parameter $\gamma$ fell as the credit rate was reduced from 25 per cent in 1988 to 22.5 per cent in 1993 and 20 per cent in 1994. During the window studied above, there is a fall, but the level reached at the end is about the same as the one prevailing in 1988. Finally in the year 2000 DORs fell to the lowest level ever, even though there was no further reform affecting the valuation of dividends.

---

21 Results obtained by regressing DORs multiplied by $D/P_c$ on $D/P_c$ for each year and half-year.
A recent paper by Chetty, Rosenberg and Saez (2005), which calculates DORs for the USA is also interesting in that it finds a very similar pattern of DORs over time in the US. This suggests that either the UK tax reform also affected US shares, or more likely, that the fall in DORs around 1997 should be attributed to something other than the tax reform. The paper by Chetty et al. focuses on the 2003 US reforms, which reduced shareholder taxation by halving income tax rates for individual shareholders and during which DORs rose. They argue, using a statistical approach to estimate the power of hypothesis tests, that this rise cannot be attributed to the reform, because of great volatility in the series.

The conclusion from this analysis is that there may well be something going on, but the movement is unlikely to be determined by tax reforms.

2.5.2.3 Distribution of DORs

Another extension is to consider the distribution of DORs rather than just the mean. In principle the 1997 tax reform should have affected those shareholders with the highest valuations. In the presence of clientele effects, highly taxed investors would hold shares in low-dividend-paying firms, and lightly taxed (or subsidised) investors would hold shares in high-dividend-paying firms. If this were the case, then the 1997 reforms should have reduced the DORs of firms paying high dividends and with a large DOR.²²

BJ present evidence in support of such clientele effects in their paper. They split the sample into quintiles by yearly dividend yields, both before and after the reform. Then they run the regressions separately for each quintile and find that the fall in DORs was significant only for the larger quintiles. We replicate these results, as documented in Table 14.²³ We find that indeed the drops of DORs were significant only for high dividend yield shares, although it is not the case the top quintile has the largest drop.

²² Empirically these two criteria are not very related. The coefficient of correlation between the dividend yield and the DOR is less than 1%.

²³ Unlike BJ, we present results based on individuals payments rather than artificial portfolios made up of all dividend payments within a day. BJ state that results were similar in both cases.
Table 14: Regression results by dividend yield quintiles

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>1594</td>
<td>1593</td>
<td>1594</td>
<td>1593</td>
<td>1592</td>
</tr>
<tr>
<td>pre 07/97</td>
<td>0.821</td>
<td>0.834</td>
<td>0.912</td>
<td>0.927</td>
<td>0.917</td>
</tr>
<tr>
<td></td>
<td>(0.050)**</td>
<td>(0.033)**</td>
<td>(0.028)**</td>
<td>(0.025)**</td>
<td>(0.023)**</td>
</tr>
<tr>
<td>Δ post 07/97</td>
<td>-0.021</td>
<td>0.007</td>
<td>-0.114</td>
<td>-0.114</td>
<td>-0.078</td>
</tr>
<tr>
<td></td>
<td>(0.086)</td>
<td>(0.053)</td>
<td>(0.051)**</td>
<td>(0.040)**</td>
<td>(0.043)**</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. Results obtained by regressing DORs multiplied by \( D/P_c \) on \( D/P_c \) and a post-reform dummy multiplied by \( D/P_c \). Sample split by dividend yield quintiles before and after reform, where (5) is the top quintile. Stars indicate the level of significance (*: 10%, **: 5%).

These results seem to support the existence of clientele effects. There are however doubts about the chosen method for splitting the sample: BJ compared the top quintile before the reform to the top quintile after the reform, but the firms whose shares are compared could be different ones in each period. This seems reasonable in a world where shareholders constantly adjust their portfolios in response to small changes in dividend yields, so that in each period, shareholders who prefer high-yield shares own different firms. It is less reasonable in a world where shareholders hold a certain share, because of its long-run dividend yield.\(^{24}\) It is also problematic if the aim is to study the 1997 UK reform, as whatever clientele effect might have existed before the reform, should disappear after the reform, as the abolition of the tax rebate removed, or at least limited, the preference of pension funds for high yield shares. It would then arguably be more revealing to split shares based on their pre-reform dividend yield into quintiles, and then compare the post-reform DORs of these very same firms to the pre-reform ones. If the conjectures about clientele effects are correct, one would expect larger falls in DORs in the top quintiles of this split. The results of this approach are shown in Table 15.

\(^{24}\) When making the case for using annualised dividend yields rather than immediate ones, BJ in fact argue in support of such a longer run strategy.
### Table 15: Regression results by pre-reform dividend yield quintiles

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>1387</td>
<td>1649</td>
<td>1633</td>
<td>1598</td>
<td>1525</td>
</tr>
<tr>
<td>pre 07/97</td>
<td>0.765</td>
<td>0.859</td>
<td>0.908</td>
<td>0.935</td>
<td>0.910</td>
</tr>
<tr>
<td>(0.058)**</td>
<td>(0.035)**</td>
<td>(0.025)**</td>
<td>(0.025)**</td>
<td>(0.023)**</td>
<td></td>
</tr>
<tr>
<td>Δ post 07/97</td>
<td>0.014</td>
<td>-0.041</td>
<td>-0.086</td>
<td>-0.122</td>
<td>-0.032</td>
</tr>
<tr>
<td>(0.081)</td>
<td>(0.057)</td>
<td>(0.040)**</td>
<td>(0.046)**</td>
<td>(0.044)</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. Results obtained by regressing DORs multiplied by D/Pc on D/Pc, and a post-reform dummy multiplied by D/Pc. Sample split by pre-reform dividend yield quintiles, where (5) is the top quintile. Stars indicate the level of significance (*: 10%, **: 5%).

These results are less supportive of the argument. For the shares whose pre-reform dividend yield was among the top quintile, the reduction in the DOR is now insignificant.

An alternative way to split the sample would be directly by DORs rather than dividend yields. If DORs are a good indicator of marginal shareholders, then clearly shares with initially high DORs are predominantly owned by subsidised investors. That is, the top part of the distribution of DORs should have been reduced, but the lower part should have been unaffected. To examine this, Figure 5 plots the median and the upper and lower quartiles and deciles of the distribution of estimated DORs.

**Figure 5: The distribution of estimated DORs**
The figure reveals that the fall actually came exactly from the opposite end of the distribution. For example, the upper quartile starts of at a level of 1.29, close to the theoretical level of 1.25 for tax-exempt shareholders. It increases over time slightly and very gradually, reaching around 1.40 in 1999. There is no sign of any reduction due to the 1997 tax reform. The 90th percentile began at around 1.9, before rising strongly to about 2.4 in 1998, before falling back slightly in 1999.

The average drop found above is rather explained by developments at the lower spectrum of the distribution. Both lower quartile and decile fall over the period. The lowest decile falls particularly strongly and continuously, beginning at around 0.1 in 1995 and ending at around -0.6 in 1999. This is consistent with a steep increase in the number of negative DORs. Overall, then, it is clear from the Figure that the distribution of DORs widened significantly over the period shown. This has been the case even though the tax treatment of different investors has tended to narrow. This suggests that developments other than tax reforms have been the dominant factor in affecting DORs.

2.5.2.4 Negative DORs

A negative drop-off ratio is obtained when the firm’s equity valuation goes up on the ex-dividend day (relative to the market), despite the loss of the entitlement to the dividend payment. Table 16 presents the shares of negative DORs in each year.

<table>
<thead>
<tr>
<th>Year</th>
<th>88</th>
<th>89</th>
<th>90</th>
<th>91</th>
<th>92</th>
<th>93</th>
<th>94</th>
<th>95</th>
<th>96</th>
<th>97</th>
<th>98</th>
<th>99</th>
<th>00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of negative DORs</td>
<td>21</td>
<td>14</td>
<td>13</td>
<td>9</td>
<td>15</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>10</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

Notes: Calculated for full sample of firms.

Both in 1988 and 1999/2000 the unusually low mean drop-off ratios are associated with an unusually high proportion of negative drop-off ratios. Negative DORs would be expected in periods when the stock market is rising and volatile or when there is great variability in the performance of different
sectors. It is not clear how the increase in the proportion of negative drop-off ratios in the stock market bubble period 1998-2000 should have anything to do with the abolition of dividend tax credits.

2.5.3 Conclusions from Drop-off ratios

Putting the evidence together we note that the mean drop-off ratio fluctuates considerably over time, and appears to be sensitive to the proportion of observations with negative drop-off ratios. Thus whilst there is no doubt that the mean drop-off ratio did fall in the late 1990s, after the abolition of repayable dividend tax credits in July 1997, it is not clear that this development can be attributed to the tax change. For such an interpretation the main fall occurs too late, the wrong part of the distribution is affected, movements of a similar magnitude occur in other periods and large fluctuations are associated with changes in the fraction of negative drop-off ratios. As evidence for the claim that UK pension funds were the marginal shareholders for a large fraction of quoted UK firms, this therefore does not seem to be compelling.

If however UK pension funds were not the marginal shareholders for many firms, this helps to explain why there was not a major fall in the UK stock market around the time when repayable tax credits were abolished.

2.6 Conclusion

Domestic dividend tax provisions that apply only to domestic shareholders and to dividends paid by domestic firms have little or no effect on stock market valuations in an open international capital market with a high degree of capital mobility. Share prices depend on the value of firms to diversified international investors, which is largely unaffected by domestic dividend taxation. This is consistent with evidence from abolition of repayable tax credits for UK pension funds and insurance companies in July 1997.

The main effects were to reduce ownership of UK equities by these tax-exempt UK institutions, and to reduce their income by around £5bn per year. This may have been partially offset by improved risk diversification though. With the benefit of considerable hindsight, the accompanying reduction in the Corporation
Tax rate looks poorly targeted. If "compensation" for the loss of these tax credits were deemed necessary it would have been better directed at pension providers.

The effects on firms were comparatively minor, and seem to indicate dividend behaviour that was inconsistent with share price maximisation in some firms. The evidence for this takes the form of: an increase in the payment of Foreign Income Dividends, up to their abolition in April 1999 and an increase in dividend payments by firms switching to FIDs. As result firms whose dividend policies appear to have been influenced by large local institutions in the period before July 1997 tend to have witnessed a small increase in their stock market valuation.

These findings have important implications for public economics (effects of dividend taxation) and the literature on corporate control (what objectives do firms pursue?). The key policy implication is that the "losers" really were private pension providers and, ultimately, future pensioners. Tax provisions which have the potential to distort, and seem to have actually distorted, corporate financial behaviour are probably not the best way to encourage private pension provision though and other means may be better suited for that aim.
3 The Russian 'Flat Tax' Reform

3.1 Introduction

At the start of 2001, Russia unified its marginal rates of personal income taxation—previously at 12, 20 and 30 per cent—at the single rate of 13 per cent. In the year following the adoption of this 'flat tax,' revenue from the personal income tax (PIT) increased by about 46 per cent (about 26 per cent in real terms); relative to GDP, PIT revenues increased by nearly one-fifth. Such a strong revenue performance following a marked reduction of marginal tax rates quickly attracted attention and emulation in East Europe. While the Baltic countries had preceded Russia in introducing single rate income tax structures—Estonia leading the way in 1994—the Russian experience was clearly the most influential. It was followed by the adoption of various forms of flat tax—the common element being a single, low marginal rate of PIT—in Serbia, the Ukraine, and Slovakia (in 2003), and most recently by Georgia and Romania (in 2005), with rates ranging from 12 (Georgia) to 19 per cent (Slovakia). Similar reforms have been under consideration in Belarus, Guatemala, the Kyrgyz Republic, El Salvador, Paraguay, and Poland. More recently, the 'flat tax' has come to feature prominently in policy debates in Western Europe and the US. The Russian reform has thus come to be extraordinarily influential, making it arguably the most important tax reform of the last decade.

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25 This chapter is based on Ivanova, Keen and Klemm (2005). It draws particularly on the microeconomic analysis, undertaken by myself. For a macroeconomic analysis of the reform, undertaken mainly by A. Ivanova, refer to the published version.

26 This term has come to be used extremely loosely. The Russian version was not a flat tax in the sense of Hall and Rabushka (1995), which is essentially an expenditure tax implemented by combining a flat tax on wage income and a cash flow business tax levied at the same rate (although Rabushka (2003) has spoken positively of the Russian experience). More generally, the various 'flat taxes' adopted in Russia and elsewhere differ quite markedly from one another, including in whether the rate of corporation tax (or even VAT) is aligned with that of the PIT. (with the Russian variant in this respect being one of the less dramatic reforms). Hence the inverted commas in our title.

27 Outside Europe Bolivia has had such a tax system since 1986. Other small states and territories (such as Jersey) have had flat rate income taxes for decades.

28 As a variant, Armenia has redesigned its progressive PIT and regressive social insurance schedule so that the combination of the two has a single positive marginal rate.

29 See for example the positive assessment in The Economist of 16 April 2005.
Given the importance of the reform not only for Russia itself but also for the many countries that have adopted, or are considering adopting, similar measures, it is clearly important also to understand the experience there, and the lessons that can appropriately be drawn from it. Did the reform indeed have the strong positive effects on compliance and/or labour supply (especially the former) that its advocates have claimed? Were these effects even so strong that the lower tax rates "paid for themselves"?

The purpose of this chapter is to address these and related questions, by using the individual- and household-level panel data that are now available in the Russian Longitudinal Monitoring Survey (RLMS), spanning pre-and post-reform periods, to provide a clear assessment of the impact of the reform on tax revenue, work effort, wage rates and taxpayer compliance.

Though it has been much commented on, and admired, the Russian experience has been subject to very little rigorous empirical analysis. The only econometric analysis of which we are aware is presented in a series of papers from the Institute for Economies in Transition. The empirical strategy in this work—as in Sinelnikov-Mourylev et al (2003), for instance—has been to use the RLMS to construct observations at the level of the regions of Russia and ask whether the implied PIT base has increased more in those regions where the weighted average marginal tax rate was most reduced. The conclusion drawn is that there has indeed been a significant effect of this sort, with the authors ultimately attributing about half of the revenue gain to the reduction in marginal rates. Though striking, these results are subject to a number of limitations. It could be the case, for instance, that those regions in which the proportion of incomes subject to the higher rates of tax prior to reform was greatest were also systematically those which saw, for some reason, the greatest increase in the incomes of those subject to essentially the same marginal rate before and after reform (and hence also the greatest increase in the tax base). Micro-level panel data are needed to identify such possibilities, offering potentially the best basis

30 Informal accounts are provided in IMF (2002) and Chua (2003).
31 See also chapter 4 of Glavatskaya and Ser'yanova (2003).
upon which to assess the implications of the reform. That is the approach pursued here.

The concern in this chapter, it should be stressed, is solely with positive aspects of the reform, in terms of its impact on revenue, compliance and labour supply; we do not attempt to gauge the extent of any efficiency or welfare gains, or to evaluate its distributional impact. The focus is also only on relatively short term effects, though it could be that full supply responses to the reform occur only after some time, either because of market rigidities, or because the reform was not initially perceived as permanent.

The structure of this chapter is as follows. Section 3.2 describes the PIT and (important in understanding its effects) related tax reforms in 2001. Section 3.3 briefly reviews the lessons of theory as to the likely effects of the reform. The main analysis, based on micro panel data, is in Section 3.4, which describes the data and methodology used, and in Section 3.5, which reports results. Section 3.6 concludes.

### 3.2 PIT and the 2001 tax reforms

This section describes the PIT reform and other tax changes that took place around the same time.

#### 3.2.1 Reform of the taxation of income

The change in the rate structure of the PIT, which took effect on January 1, 2001, is summarized in Table 17.

The threshold level of taxable income at which the higher rates began prior to reform was high: about 187 per cent of the average wage in 2000. It should be noted too that although the basic exemption grew by 30 per cent in real terms

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32 Sinelnikov-Mourylev et al (2003) argue that reduced evasion (and hence higher tax payments) by higher-rate taxpayers actually increased the effective progressivity of the PIT with respect to wage income (while finding no conclusive result for its progressivity with respect to total income).
between 2000 and 2001, it remained roughly unchanged relative to the average wage (at about 12 per cent).33

Table 17: The PIT rate structure before and after the reform

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bracket (rubles)</td>
<td>Rate</td>
</tr>
<tr>
<td>Below 3,168</td>
<td>0</td>
</tr>
<tr>
<td>3,168 to 50,000</td>
<td>12</td>
</tr>
<tr>
<td>50,000 to 150,000</td>
<td>20</td>
</tr>
<tr>
<td>Above 150,000</td>
<td>30</td>
</tr>
<tr>
<td>Bracket (rubles)</td>
<td>Rate</td>
</tr>
<tr>
<td>Below 4,800</td>
<td>0</td>
</tr>
<tr>
<td>Above 4,800</td>
<td>13</td>
</tr>
</tbody>
</table>

Source: Russian Tax Code, Part II.

Notes: * For comparison, the average annual salary was 26,676 rubles in 2000 and 39,384 rubles in 2001. The official exchange rate expressed in rubles per US dollar was 28.13 in 2000 and 29.17 in 2001.

Strictly, the post-reform PIT was not a single rate tax, since some kinds of income—from gambling, lottery prizes, some insurance payments, the benefit from loans obtained at less than market rates34 and ‘excessive’ bank interest35—were taxed at 35 per cent, approximating combined rates of the PIT and unified social tax (discussed below), in an attempt to close popular avoidance schemes (some of which showed impressive adroitness).36 For similar reasons, dividends were taxed at 30 per cent (up from 15 per cent in 2000) but with the introduction of a non-refundable credit for underlying CIT paid.

There were also changes in 2001 to the base of the PIT, with the elimination of various exclusions for military servicemen and expatriates (such as housing costs, business trips) and the introduction of a simplified system of deductions.

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33 Both before and after reform, this allowance was withdrawn in discrete jumps at higher levels of income (as described in the data appendix). This is taken fully into account in the empirical analysis reported below, but for simplicity ignored in the discussion that follows and in Table 17 and Figure 6.

34 This was calculated as the difference between the interest implied by the market rate (calculated as 75 per cent of the Central Banks’ refinancing rate on the date of receipt of a ruble loan or 9 per cent for the loans received in foreign currency) and the that actually paid.

35 Bank interest became taxable if paid at a rate exceeding 75 per cent of the Central Banks’ refinancing rate on ruble deposits or nine per cent on foreign currency deposits. Since most deposits earned less than this, interest income was generally untaxed.

36 Under one scheme, for instance, the enterprise purchased insurance against a very low probability event (deducting its premiums). At the same time, its employees entered a contract with the same insurance company for a very high probability event. Employees thus received compensation in the form of an insurance payout, which was not taxable.
(standard, social, property and professional). Moreover, there was a modification of the agreement for sharing PIT revenue between federal and regional governments: in 2000 regional governments received only 80 per cent of PIT revenues, from 2001 they received 100 per cent. This may have strengthened the collection incentive of regional governments.

Importantly, however, these changes to the PIT structure were not the only tax reform at this time. Most significant for present purposes, Part II of the new tax code also significantly altered the structure of social insurance payments, as shown in Table 18. Prior to the reform, separate contributions were paid to the pension, social, medical and employment funds at a combined rate, at all income levels, of 38.5 per cent on the employer and one per cent on the employee (this last to the pension fund). After the reform, a single ‘unified social tax’ (UST) was charged on the employer—for firms meeting various additional requirements—at marginal rates decreasing from 35.6 to 5 per cent, with the lowest marginal rate applying to salaries in excess of (the very high level of) 600,000 rubles.

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37 To qualify for the regressive rate, the average payment per employee had to be above a threshold (2500 rubles in 2001) when a certain number of employees with the highest incomes were excluded from the calculation. The rationale for this was apparently to encourage compliance on a broad base by denying benefit to firms that declared only a few highly-paid individuals. Moreover, to discourage income shifting, the regressive social scheme in 2001 could be applied only by taking into account average payment per employee in 2000.
Table 18: Social tax rate structure before and after the reform

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Income Range</td>
<td>Marginal Rate</td>
</tr>
<tr>
<td>Employee</td>
<td>All</td>
<td>1</td>
</tr>
<tr>
<td>Employer</td>
<td>All</td>
<td>38.5</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Russian Tax Code, Part II. Notes:

- Different rates apply to agricultural workers, lawyers, self-employed and Northern ethnic communities. In some regions some additional charges were levied, for instance, in Moscow an Education Levy of 1 per cent.
- This was made up of contributions to the Pension Fund (28 per cent), Social Insurance Fund (5.4), State Employment Fund (1.5), and Medical Insurance Fund (3.6).

The combined effect of both reforms on effective marginal tax rates is shown in Figure 6, which plots marginal tax rates before and after the reform against the income level. Below 100,000 rubles (about 254 per cent of the average wage), the combined marginal rate fell by 7.1 points. For those initially paying PIT at the lower rate of 12 per cent, the net effect of the 2001 reforms was a reduction in the combined marginal rate of PIT and social insurance of about 1.3 percentage points.38

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38 Because the social taxes are charged on a tax-exclusive basis, this is calculated as the difference between (0.12+0.01+0.385)/(1.385) and (0.13+0.356)/(1.356).
Notes: The density shown is the kernel of the distribution of gross incomes in 2000. One individual reporting earnings of 2,353,564 rubles was dropped to improve clarity of the chart. (This individual did not participate in the 2001 survey, so is not included in the regression analysis either). The calculation of marginal tax rates takes into account that taxes formally levied on the employer are expressed on a tax-exclusive, while those levied on the employee are expressed on a tax-inclusive basis. Hence, the overall marginal tax rate for individuals in the 12 per cent bracket in 2000 is calculated as 
\[\frac{0.12+0.01+0.385}{1.385}\], where the numerator is the sum of PIT of 12 percent, social taxes on the employee of 1 per cent, social taxes on the employer of 38.5 per cent. The denominator is adjusted for the employer's social taxes of 38.5 percent. The breakpoints for 2001 are converted to 2000 rubles for comparability.

3.2.2 Other tax changes

Several other tax changes that also took effect at the start of 2001 are summarised in Table 19.
Table 19: Major other changes in the Russian Federation Tax Code in 2001

<table>
<thead>
<tr>
<th>Type of Tax</th>
<th>Rate</th>
<th>Base</th>
<th>Other changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate Income</td>
<td>Combined maximum rate</td>
<td>Increased from 30 to 35 per cent</td>
<td>Federal rate (11 per cent) and regional rate (up to 19 per cent) remained unchanged but municipalities were allowed to impose an additional rate of 5 per cent</td>
</tr>
<tr>
<td>Income Tax</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value Added Tax</td>
<td>No changes</td>
<td></td>
<td>Scaling back of exemptions, including a narrowing of the exemption for pharmaceuticals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a) Shift from the origin to the destination basis for trade with other CIS countries (except Belarus, and on energy), b) adoption of measures directed at reducing the compliance burden for small traders</td>
</tr>
<tr>
<td>Turnover taxes</td>
<td>1.5 per cent</td>
<td>abolished, Road User tax reduced from 2.5 to 1.5 per cent.</td>
<td>Social Infrastructure Maintenance tax of</td>
</tr>
</tbody>
</table>

Tax administration was also undergoing significant change at the time of the PIT reform, as described in Chua (2003). Through the latter 1990s, there is no doubt that the system was in something close to chaos, with very poor compliance, widespread use of tax offsets, and difficult relations between levels of government. Gaddy and Gale (2005) cite estimates that in the mid-1990s only eight per cent of large enterprises paid their tax bills in cash, 63 per cent effectively paid in kind and the rest did not pay at all. Brooks (2001) quote an estimate that 90 per cent of private sector income was concealed from the tax authorities, and report dramatic difficulties in collecting tax on the other 10 per cent: in 1996, “26 tax collectors were killed, 74 were injured in the course of their work, 6 were kidnapped and 41 had their homes burnt down”. Salaries of tax officials were very low, contributing to an environment of corrupt practices and further undermining respect for government and tax administration.
Part I of the new tax code, which became effective on 1 January 1999, sought a thorough modernisation of tax administration. It provided for the introduction of a common taxpayer identification number and allowed, in certain cases, for the indirect assessment of tax liability. More authority was also given to the State Tax Service, in particular, in allocating income, deductions and credits across related taxpayers, and in enforcing debt repayments by liquidated companies. Importantly, Part I also eliminated a ceiling on interest accrued on overdue taxes. Some of its provisions, however, worked in the opposite direction: for example, tax obligations were deemed discharged once the taxpayer had provided a payment order to a bank, which allowed taxpayers to claim fulfilment of their obligations without actually paying any tax. On balance, the general thrust of the administrative reforms at this time was to strengthen the effectiveness and powers\(^\text{39}\) of the tax administration—at least potentially. In the oil sector, there are signs of strengthened enforcement, including a meeting between President Putin and twenty-one leading oil oligarchs to discuss the passage of new laws designed to curtail the use of tax avoidance schemes (Desai, Dyck and Zingales (2004)). But how and when the reforms in the legal framework and political environment changed practice through the wider tax system is very hard to judge: we have not been able to find any direct evidence on this, and opinions on how much actually changed at this time do vary.

There was thus much more going on at the start of 2001 than simply the change in the rate structure of the PIT. One key implication is that it is difficult to isolate effects of the PIT reform alone. The reductions in social insurance taxes, in particular, would be expected to trigger quite similar behavioural responses, making it especially difficult to disentangle the two.

### 3.3 Predictions of theory

To provide a stylised framework for coming to grips with the anatomy of the 2001 reform, write revenue from the PIT, \(R\), as \(\tau \lambda w L\), where \(\tau\) denotes the (tax-inclusive) tax rate, \(\lambda\) the ratio of declared taxable income to true taxable income

\[^{39}\text{In particular, the tax police were authorized to conduct tax audits if sufficient evidence of a suspected tax crime was available, and to investigate non-tax commercial crimes such as money laundering.}\]
(so describing the degree of compliance, with $\lambda = 1$ corresponding to fully truthful reporting), $w$ the gross wage rate and $L$ the level of employment (here abstracting, for simplicity, from capital income components of the PIT base). Denoting proportionate changes by hats, the revenue effect of any reform is then approximated by:

$$E20 \quad \hat{R} \approx \hat{\tau} + \hat{\lambda} + \hat{w} + \hat{L}.$$ 

Though some elements of the 2001 PIT reform tended to increase revenue at unchanged behaviour, these—though certainly important for some individuals—were relatively minor (the most important probably being the elimination of the exemption for military servicemen). Thus the reform corresponds, for those initially paying PIT at a higher rate, to a substantial reduction in $\tau$, amplified by the reduction in social insurance taxes. The question is whether the three types of response to the reform remaining on the right of E20 could have led to such an increase in the tax base as to account, to any substantial degree, for the strong performance of PIT revenue subsequent to the reform. The rest of this section considers each in turn, and the possibility that the reform may have led to some income-shifting between the CIT and PIT.

3.3.1 Gross wage rates

In the formal sector, one would expect the gross wage $w$ to fall as a consequence of the reduced tax wedge (both PIT and social taxes). Translated into the terms

$$\dot{w} = \left(\frac{e^S}{e^S + e^D}\right) \left(\frac{\lambda \tau}{1 - \lambda \tau}\right) \left(\hat{\tau} + \hat{\lambda}\right)$$

so that the gross wage falls unless compliance increases by a greater proportion than the tax rate falls. Using this relationship (and now ignoring, counter-factually but for clarity, the social taxes that would also be expected to affect net wage and hence labour supply), it is straightforward to show that in this simple framework the overall effect on PIT revenue is

$$\dot{R} = \left[\left(\frac{e^S (1 - e^D)}{e^S + e^D}\right) \left(\frac{\lambda \tau}{1 - \lambda \tau}\right) + 1\right] (\hat{\tau} + \hat{\lambda}).$$
of the empirical exercise below, the implication is that gross wage rates of groups most affected by the reform should have fallen relative to those of groups less affected. In the informal sector, the gross wage might conceivably have risen (in order to leave take-home wages in line with those available in the formal sector); but this would have had no direct impact on tax revenue.

3.3.2 Work effort

Effects on labour supply might be expected from both the change in gross wage rates and the change in the parameters of the PIT and social taxes. The former depends routinely on the elasticity of labour supply, so the latter is the focus here.

To simplify, imagine a reform that leaves the exempt amount and starting marginal rate of tax unchanged but lowers, to the same level, the (single) top rate. (In fact, as seen above, the starting marginal rate—inclusive of social insurance—fell by 1.3 percentage points and the pattern of effects at the higher rate was more diverse). As shown in Figure 7, by reducing the higher marginal rate to the level of the basic rate the reform has the effect of rotating the budget constraint relating before- and after-tax income anti-clockwise around the kink point (at the level of income at which that higher rate initially applied) until the budget constraint becomes a straight line.

The upper panel of Figure 7 illustrates the impact of this on a taxpayer who pays at higher than the basic rate prior to the reform. The substitution effect of the reform—isolated by comparing the initial choice at \( a \) to that which would be made under the hypothetical dashed budget constraint passing through \( a \) but parallel to the new budget constraint—\( a \) is to increase pre-tax income, to a point

A necessary condition for revenue to increase (given \( f + X < 0 \)) is thus that the elasticity of labour demand exceed unity. Given this, the increase is larger the greater is the elasticity of the supply of labour, the higher is the tax rate and the higher is the initial level of compliance.

41 After-tax income, on the vertical axis, corresponds to consumption; and pre-tax income, on the horizontal axis, is proportional (assuming that the gross wage rate is independent of hours worked) to labour supply. So the figure just shows the consumer’s choice between consumption and leisure.

42 This is the Slutsky substitution effect. Alternatively the Hicks substitution effect could have been used, which would have pivoted the budget constraint around the original utility curve.
like $b$ (and hence also to increase the tax base), reflecting the reduction in the marginal tax rate. Acting in the opposite direction is an income effect—represented by the comparison between $b$ and the choice that would be made under the post-reform budget constraint—that arises not only from the increase in the marginal wage but also from the increase in net income consequent upon the reduced taxation of intra-marginal income initially taxed at the higher rate. Under the standard assumption that leisure is normal, this tends to reduce work effort, and, hence, the tax base. For such an individual, the labour supply effect of the reform is thus ambiguous—a familiar conclusion. For an individual who, prior to the reform, locates interior to the segment of the budget constraint corresponding to the basic rate it is clear—and so not illustrated—that the reform simply has no effect on work effort or, hence, the tax base.

There is, however, another important possibility. The individual shown in the middle panel of the figure locates, prior to reform, exactly at the kink point at which the higher rate of tax begins. In this case the reform has only a substitution effect, and work effort increases from that at $a$ to that at a point like $b$. This may seem an extreme case—though one might in principle expect some 'bunching' of taxpayers at kink points of this kind—but points to a possibility of some importance to our empirical work. Suppose that individuals do not chose, as has been implicit in the figures so far, between a continuum of possibilities along the budget constraint but rather must choose between distinct alternatives located discretely along the budget line. Consider, for example, the individual shown in the third panel, and who can choose only between gross income levels at $a$ and at $b$. Prior to the reform, $a$ is preferred: the individual pays tax at the basic rate. After the reform, however, the contract offering the higher level of gross income—the net income from which has now increased to $c$—becomes the more attractive of the two. In such a case the reform elicits a positive supply response even from an individual who, prior to the reform, paid tax at the lower rate. Similar effects may obviously arise if individuals simply make errors in their instead of pivoting it over point $a$. Thus it would have kept utility rather than purchasing power constant. This would not change the interpretation though, as the Hicks substitution effect would equally be negative. For a proof that both Hicks and Slutsky substitution effects are negative for normal goods see for example Varian (1993).
optimisation. Recognizing this possibility—that the reform might increase the work effort of those not directly affected by it—will be important in the empirical work below.

There is another case in which the reform might increase work effort: workers who face some fixed cost in working might shift, as a consequence of the reform, from inactivity to earning a level of pre-tax income higher than that at which the higher rate previously began. (It could not be optimal to enter work at a lower income level, since that option was available but rejected prior to the reform). But this seems very unlikely to have been important in practice, given the very high income level at which the higher rates began.

**Figure 7: Labour supply before and after the reform**

![Labour supply graph](image)

### 3.3.3 Compliance

The analysis above assumes that individuals are perfectly truthful in their tax affairs. The second main route by which the reform might affect the tax base,
however, is through an impact on compliance.\footnote{Labour supply and compliance decisions are in principle inter-related. But the analysis of that joint decision proves cumbersome, and for present purposes adds little to the insights gained by considering each in isolation (as discussed, for instance, by Slemrod and Yitzhaki (2002)).} And indeed this is the route that tends to be stressed in positive assessments of the reform.

It seems to be widely believed—indeed taken as obvious—that a reduction in the rate at which a tax is levied will tend to improve compliance with it. The theoretical literature, however, paints a more subtle picture. In the model of tax avoidance of Slemrod (2001), for example, reducing the tax rate does indeed lead to reduction in the proportion of income that taxpayers shield, at some cost, from taxation.\footnote{There are other models that give the same conclusion. Engel and Hines (1999), for instance, show that increased tax rates may also lead to more evasion when individuals are aware that past declarations will be re-opened if they are selected for audit.} In the model of tax evasion as a gamble of Allingham and Sandmo (1972), on the other hand, if the fine in the event of being caught increases with the amount of tax evaded then, as shown by Yitzhaki (1974), a cut in the tax rate actually leads to an increase in the extent of evasion. The same is also true in simple models of bargaining between taxpayer and corrupt inspector, so long as the penalties depend on the tax evaded.

A key factor shaping the relationship between tax rates and compliance, and helping to reconcile these diverse results, is whether the costs of attempting to reduce tax payments depends on the extent of the tax reduction itself (as in the Yitzhaki version of Allingham-Sandmo) or on the extent of the income that must be concealed to bring it about (as in Slemrod).\footnote{This is indeed the key point made by Yitzhaki as an observation on the Allingham-Sandmo model. The point seems, however, to be of even wider applicability. All this does not mean, however, that the nature of concealment costs is the only determinant of the sign of the relationship between the tax rate and compliance. One of the key lessons from Allingham-Sandmo (1974), for example, is that since the change in the tax rate affects the level of income at unchanged evasion its impact will be shaped in part by attitudes to risk.} The reason for this is straightforward. A taxpayer will presumably attempt to reduce tax liability up to the point at which the marginal benefit of doing so equals the marginal cost. Since the marginal benefit from a dollar of taxes saved is independent of the tax rate, so too, in equilibrium, must be the marginal cost. If that cost itself depends on the amount of tax concealed, then the amount of tax concealed must be
constant. But the only way to keep the amount of tax concealed unchanged when
the tax rate goes down is to conceal more income: that is, a reduction in the tax
rate must worsen compliance, as in Yitzhaki-Allingham-Sandmo. If, on the other
hand, the cost of concealment depends on the amount concealed, then since a
reduction in the tax rate reduces the benefit of concealing a given amount of tax
liability, it will lead to improved compliance, as in Slemrod.

It is natural then to wonder which form of cost structure better characterizes the
very poor compliance in Russia in the late 1990s. Fines for tax evasion did in
principle increase more than proportionately with the extent of the attempted
evasion. But the costs of evasion are more than simply the prospective penalty.
Keeping out of the tax system, in particular, may require keeping out of the
formal sector more generally, with attendant costs (such perhaps as restricted
access to credit, including the ability to take a mortgage) that depend on the size
of the business operations concealed. Thus theory gives no very firm guidance as
to the likely sign of the relationship between the tax rate and the degree of
compliance.

Nor has econometric work led to any clear-cut conclusion as to the sign of the
effect in practice: the review by Andreoni, Erard and Feinstein (1998) found that
empirical conclusions have been mixed. The same is also true of more recent
work: Schneider and Enste (2000) conclude that high tax rates encourage the
concealment of activity; Friedman et al. (2000) find the opposite.

3.3.4 Income shifting

Apart for the incentive and compliance routes, there are two other ways in which
the reform might have affected the PIT base.

The first is by inducing a reclassification of income as personal rather than
corporate, either by an explicit change in organizational form or implicitly by

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46 For instance, failure to pay taxes due as a result of understatement of the tax base or incorrect
assessment was subject to a fine of 20 per cent of the unpaid tax if the omission was
unintentional, and 40 per cent if intentional. Moreover, the effective penalty rate will be
increasing with the amount evaded to the extent that the interest charged on overdue payments
exceeds the taxpayer's cost of capital.
firms paying out earnings to those with an ownership interest (or related parties) as salary or in other forms, such as pensions or interest, that generate deductions against the business tax but are taxable as personal income. With both the maximum corporate tax rate and the tax on dividends increased at the start of 2001, at the same time as the higher rates of PIT and social taxes were cut, it might seem that receiving payments as personal income rather than in the form of retained earnings did indeed become more attractive. Two considerations seem likely to have mitigated this, however. The first is the adoption of imputation in 2001, which reduced the effective tax rate on distributed corporate earnings from 40.5 per cent (=1-(1-0.15)(1-0.3)) to 35 per cent (the imputation credit being non-refundable). Second, whereas the most marked reduction in the PIT and social insurance rates only applied to income in excess of the pre-reform thresholds for the higher rate, this reduction in the rate on distributed corporate earnings applied essentially to all profits. Thus the tax advantage of personal income may not have increased by as much as at it first seems. Whether the reform is likely to have led to significant recharacterisation is thus a priori unclear.

Second, since the reform was preannounced in June 2000, higher rate taxpayers will have had an incentive to shift taxable income into 2001, so generating an artificial increase in the taxable incomes of those who were in higher bands pre-reform. Thus if income shifting did take place it would reveal itself in the analysis below in the form of increased incomes of those initially paying tax at a higher rate.

3.4 Micro evidence: data, methodology, and hypotheses

While macroeconomic data can reveal some insights, they cannot cast any direct light on the underlying behavioural responses to the reform. The analysis

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47 Gordon and Mackie-Mason (1994) and Gordon and Slemrod (2000) find this to have been of some importance in the US

48 The picture that emerges from the macro data is a fairly straightforward one, with the strength of PIT revenues overwhelmingly due to a marked increase in gross incomes between 2000 and 2001, and any gain in compliance being very modest. For details see Ivanova, Keen and Klemm (2005).
in this chapter therefore focuses on individual- and household-level data. This section describes the data and methodology used.

3.4.1 Data

The dataset best suited to analysing micro-level responses to the tax reform is the Russian Longitudinal Monitoring Survey (RLMS) of the Carolina Population Center at the University of North Carolina, which is described in the Data Appendix (section 3.7). It provides information on the incomes and other attributes of around 3,500 adults for every year (except 1997 and 1999) between 1994 and 2002. While it would appear useful to use the entire panel, there are a number of reasons for restricting our main analysis on data for 2000 and 2001 only. First, the data are not a true panel, as homes rather than households were sampled. This is likely to lead to attrition bias, as any households who move drop out of the sample. Relatedly, a longer time series increases the probability that the composition of household changes. For the household analysis though—which is the more robust one, as will be explained—we require relatively stable household compositions. Moreover, Russia also reformed the PIT system in 1994, 1996, 1998, 1999 and 2000, so that expanding the sample would mix the effect of different reforms, which are not part of a consistent reform process (i.e. some increased while others reduced marginal tax rates).

The dataset does not contain all the variables one would ideally want. Most importantly, there are no data on tax payments or on pre-tax incomes, so that these have to be inferred from reported after-tax incomes. This requires some assumption—clearly critical given the importance of compliance effects in evaluating the reform—as to whether an individual did indeed pay taxes and whether only reported or also undeclared income is being reported in the survey. Moreover, the survey does not provide enough information to calculate all tax deductions. A further and more serious problem, common to all voluntary surveys touching on financial issues, is that both the best- and the worst-off individuals are under-represented. The former are commonly especially reluctant to disclose their incomes (perhaps for fear of investigation), or may simply value their time too highly to comply with the survey; the latter may not be included because they have no home (the RLMS being an address-based survey).
There are several income variables in the RLMS. That on which we focus is the response to the question “What was your average monthly wage after taxes over the last 12 months from the primary employer regardless of whether it was paid on time or not?” The answer to this may for some respondents include information from the pre-reform period, but this is unlikely to greatly bias the results: all interviews are undertaken in the last quarter of the calendar (and fiscal) year, so that pre-reform months will be a small part of the total. The survey also asks: “How much money in the last 30 days did you receive from your primary job after taxes?” But this is available less frequently and is less well-suited for the calculation of taxes paid (see the data appendix, section 3.7). In any event, the results are essentially the same for both income variables. There are also questions on income from secondary and additional employment. These are not included in the results shown here, as it is less clear whether they are taxed: again, however, the results that follow are broadly robust to this choice.

Before using the data we do some limited cleaning. Individuals between 20 and 60 years old throughout 2000 and 2001 are kept; those who do not report how many hours they work, report working more than 84 hours a week, do not report any income from their primary employment,49 and/or who own their own business are all dropped. While this last group would be of particular interest, as such individuals are likely to have more possibilities to evade and avoid taxes, there are simply too few of them in the sample (17 in the year 2000) to make analysis worthwhile. All this leaves 3,722 individuals. This is further reduced in the regressions, as we then only keep individuals who are present in both years and for whom the left hand-side variable is available.

49 At this stage, individuals are kept if they report positive income in at least one year. They are later dropped if they do not report the variable required.
Table 20: Comparisons of RLMS sample and official data

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated</th>
<th>Published Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1092</td>
<td>1051</td>
</tr>
<tr>
<td>2000</td>
<td>2174</td>
<td>2223</td>
</tr>
<tr>
<td>2001</td>
<td>3310</td>
<td>3282</td>
</tr>
<tr>
<td>2002</td>
<td>4332</td>
<td>4426</td>
</tr>
<tr>
<td>2000/2001</td>
<td>45.2%</td>
<td>46.3%</td>
</tr>
</tbody>
</table>

Notes: The average wage quoted is gross of income tax, but net of employer’s social taxes. Official wage data are from Goskomstat (website), tax data are from the Ministry of Taxation of the Russian Federation. Estimated data are based on RLMS sample, cleaned as described in the text; personal tax payments are calculated from reported average income over the last 12 months (pjjpayt).

Despite these various weaknesses, the key features of the RLMS sample match the corresponding official aggregates extremely closely, as shown in Table 20. Average salaries are very close to the corresponding population averages. Still more strikingly, at 45.2 per cent the growth in PIT payments in the sample over the year following the PIT reform—which we have calculated by applying the tax schedule to reported after-tax incomes (as described more fully below)—almost exactly matches the growth in the population. Note that the official figures reported in Table 20 do not include any estimate of incomes from the informal economy. The close match between the estimates from the sample and their population counterparts suggests that in answering the RLMS income questions respondents tend to conceal their receipts from informal activities and report only the net earnings that have been properly taxed. This is certainly weak evidence for such an interpretation, but there is little else to build on. In any event, this is an interpretation that we shall make heavy use of below.

More details on the data used here, and on the calculation of variables, are given in the Data Appendix (section 3.7).

3.4.2 Methodology

The approach taken in using these panel data is to compare the experiences of individuals affected by the reform with the experiences of those who are not (or, at least, are much less) affected. This ‘difference-in-differences’ methodology has been used by Feldstein (1995) and Eissa (1995) to study the US 1986 tax reform and, combined with a structural approach, by Blundell et. al. (1998) to study the effects of UK tax reforms. It is especially appropriate in the context of
the Russian reform, because the structure of that reform is such that there are some taxpayers who are strongly affected by the reform, and so form a natural ‘treatment’ group (these are those taxpayers who, prior to the reform, were liable to PIT at a rate higher than the minimum) and some other taxpayers who are largely unaffected and so form a natural ‘control’ group (those in the lowest tax bracket, who, as seen above, faced a one point increase in the marginal PIT rate and a 1.3 point reduction in the marginal rate of PIT and social insurance combined).

As social insurance taxes were changed at the same time as the PIT, they too need to be taken into account when analysing the PIT reform. Social taxes in Russia are formally incident on employers (except for the 1 per cent pension fund levy), but of course this does not imply anything about their economic incidence: at least in the long run, the effective incidence of a tax is expected to be independent of its legal incidence. Moreover, both PIT and social taxes are generally levied by withholding, with the employer legally responsible for its proper payment. In the short run, it might be that labour supply decisions depend more on taxes levied on the employee, if contracts are specified in terms of nominal wages paid after deduction of social tax but prior to PIT. A case could thus be made for looking only at taxes levied on the employee. This case is weak, however, as there is no strong reason to believe that contracts in Russia are particularly sticky and because data were in any event collected in the last quarter of the year, allowing significant time for adjustments in response to the reform. Furthermore, to the extent that tax evasion decisions are taken jointly by employer and employee, they will be affected in the same way by each tax. Therefore, while we report both results focusing on revenues from the PIT and from the PIT and social insurance combined, we do not attempt to identify distinct behavioural effects from the synchronous PIT and social insurance reforms.

The effects of the reform on the pattern of marginal tax rates (PIT and social taxes combined) was shown in Figure 6 in section 3.2 above. From this, it might seem simple to construct groups of individuals who are hardly affected, somewhat affected, and greatly affected by the reform. The actual distribution of
incomes in the sample, however—also shown in the figure—is such that few people in the sample saw their marginal tax rates fall very noticeably. For most individuals, the higher tax rate brackets (before the reform) and lower rate social tax brackets (after the reform) are irrelevant. Most individuals are thus virtually unaffected, while a few are slightly affected. While about ten per cent of the sample paid PIT at a higher rate prior to the reform,50 there is only one individual who after reform benefited from the lowest social insurance rate of 5 per cent and so enjoyed the maximum possible benefit from the reform. Given this pattern of effects, an obvious definition of the treatment group for empirical purposes would be those individuals initially paying a higher tax rate. The issue of whether or not social taxes are included in the analysis therefore does not affect the definition of treatment and control group. The only difference is that, including social taxes, there is now a tax cut even in the control group. But since it is much smaller than for the treatment group (1.3 percentage points compared to between 7.1 and 33), one would still expect a differential response to the reform.

Apart from the tax rates, the small increase in the personal allowance also affects control and treatment groups differently. This is because the increase will be worth proportionally more to poorer tax payers. Furthermore, the personal allowance is withdrawn at a faster pace after the reform. The increased allowance is therefore likely to be more important for the control group.51 But any effect is likely to be small, as the personal allowance is very low: while it could be up to two minimum wages before the reform, the minimum wage is extremely low, serving as a unit of calculation rather than an actual minimum required to cover the basic needs.

50 Although there appear to be no publicly available data on the numbers (or incomes) of taxpayers in the various rate bands prior to reform, it does seem to be widely believed that the vast majority of those who paid tax prior to reform did so at the lowest rate.

51 Because the allowance is withdrawn as income increases, the value of the allowances (allowance times tax rate) is a decreasing function of gross income, although not a monotonic one. Earners who pass the next income tax threshold see the value of the allowance going slightly up, because of the higher tax rate and then fall again as it is further withdrawn.
Once treatment and control group are defined, the methodology can be used to study not only PIT payments but also the various components shown in equation E20. It can indicate whether a reaction occurred, and how large it was compared to other groups. The method has the drawback, however, of presuming that both groups would have had the same relative changes in incomes had there been no reform. This might be problematic, given that the high and low-income individuals being compared may have different income dynamics. This problem is common in this literature. The typical alternative assumption is of constant trend growth in the absence of a reform. But this seems even less attractive, since there are many reasons why trend growth rates can change, not all of which could be controlled for. We have in any event conducted robustness exercises (building on the work of Chay, McEwan and Urquiola (2005)) to allow for the possibility of mean reversion; these are reported in Appendix II (section 3.8) and leave our conclusions broadly unaffected. A further potential difficulty is that the approach may misstate the effects of the reform if there are important general equilibrium effects at work. It is for instance possible that a positive supply response in the treatment group also benefits the control group, say by bidding up wages, which would diminish any differential effect.

Formally, the analysis involves regressions of the form:

\[
y_{it} = \beta_0 + \beta_1 T_t + \beta_2 P_t + \beta_3 (T_t \times P_t) + u_{it}
\]

where \(y_{it}\) is the endogenous variable of interest (such as PIT paid) for the \(i^{th}\) individual/household at time \(t\), \(T_t\) a dummy taking the value unity for the treatment group, \(P_t\) a dummy indicating the post-reform period and \(u_{it}\) a random disturbance (which may be heteroskedastic). The coefficient \(\beta_0\) is a constant, \(\beta_1\) indicates by how much the endogenous variable increased during the reform, \(\beta_2\) by how much the endogenous variable is higher for the treatment group and \(\beta_3\) is the difference in difference estimator, indicating by how much more the endogenous variable increased for the treatment group.\(^{52}\)

We also consider regressions in growth rates:

\[
\Delta y_{it} = \beta_0 + \beta_2 T_t + e_{it}
\]

\(^{52}\) The coefficient \(\beta_3\) can also be estimated by the simpler regression \(\Delta y_{it} = \beta_0 + \beta_2 T_t + e_{it}\) if one is not interested in the other coefficients.
These are estimated both using ordinary least squares, allowing for heteroskedasticity, and by a median regression (also known as least absolute value model). The latter has the advantage that the median is less affected by outliers, which are especially likely to arise when using growth rates (for instance if the level in the first year is close to zero). Simply dropping these outliers, as in chapter 2, would be inappropriate here, because this would change the distribution of the sample by removing especially observations from the lower part of the income distribution of 2000 and thus differentially affect both groups. A quartile regression approach however will be unaffected by large growth rates, without changing the distribution within both groups.

### 3.4.3 The null hypotheses of interest

The primary question of interest is whether the 2001 reform caused the subsequent increase in PIT revenue. As discussed above, the reform is likely to have had effects on gross wage rates, labour supply and compliance. Moreover other factors will have affected these variables.

A necessary condition that needs to be fulfilled for us to conclude that the reform contributed to the revenue boom would be that PIT payments of the treatment group have grown faster than those of the control group. The key null hypothesis is therefore:

\[ H_{lo}^{R} : \Delta R_{T} \geq \Delta R_{C} \]

where \( R \) is tax paid, subscripts \( T \) and \( C \) indicate treatment and control group; and subscript \( L \) indicates that comparison is in levels. If \( H_{lo}^{R} \) is rejected,\(^{53} \) then we conclude that the rate-reducing aspect of the reform has not contributed to the revenue boom.

\(^{53} \) The stars indicating significance in our tables are based on the 'standard' null hypothesis that increases in the two groups are the same. Rejection of this implies a fortiori rejection of the null of a higher increase in the treatment group when the estimated difference-in-difference coefficient is negative. There is no case among our results in which we do not reject the null of equality, but could have rejected the hypothesis above in a one-sided test.
revenue boom. If, on the other hand $H_{\text{L0}}^R$ is not rejected, then the reform may have contributed to the boom. In that case though we could not confidently claim that it had caused the boom, as higher growth in the treatment group is a necessary condition only. It is not sufficient, as even in the case of higher growth in the treatment group, the boom could still be mainly due to common growth in both group, which is not picked up by examining differences.

We also consider the analogous hypothesis on the relative growth rates of PIT payments in treatment and control groups:

$$H_{G0}^R : \hat{R}_T \geq \hat{R}_C$$

where the subscript $G$ indicates the specification in growth rates. Both specifications, in levels and growth rates, are of interest. That in growth rates may make the comparisons between the two groups more transparent, though as noted above, special care must be taken in this case to avoid results being contaminated by outliers.

Note that $R$ in the nulls above could be either PIT revenue alone or PIT and social insurance revenue combined. The former is our principal concern. Nevertheless, since PIT and social insurance were changed together, and are likely to have similar incidence, it is also of interest to examine the effect on PIT and social insurance combined.

Clearly too, a rejection of the nulls on tax revenue would not mean that the reform did not have important effects. It might still have boosted hours worked or compliance. Even if the nulls above are rejected there remains more to be analysed in understanding the anatomy of the impact of the reform.

The first question is whether declared income also increased faster in the treatment group:

\[ 54 \text{ In those cases where social taxes are included, there is a small reduction in tax rates also in the control group. Nevertheless, even then, rejection would rule out that the revenue increase was due to the large reduction of the higher rates.} \]
where $I \equiv wL$ again denotes reported income. (Again, we also consider the hypothesis in growth rates ($H_{I0}^{\text{LR}}$)—as we shall in all further hypotheses). If this is rejected, then the reform not only failed to boost taxable incomes sufficiently to offset the tax rate cut: it did not boost them at all.

Next, and whether or not $H_{I0}^{\text{LR}}$ is rejected, it is of interest to look at the differential behaviour of its components, namely gross pre-tax income, $I$, and compliance, $\lambda$, both in levels and growth rates. Whether the reform was associated with an increase in compliance, in particular, is of crucial importance to its assessment. The direction and extent of any supply-side effects is also key to the debate on the reform, so that we also separately analyse gross wage rates per hour and the number of hours worked.

### 3.4.4 Dealing with the non-observability of tax payments

An immediate and fundamental difficulty in testing these hypotheses is that RLMS does not provide data on tax payments, compliance, or even declared gross incomes. It provides only reported net incomes, but we do not know what exactly they represent, and in particular to what extent they include untaxed incomes. The basic assumption in the empirical work reported below is that the net incomes declared by survey respondents, $N$, are those associated with the income that is actually declared for tax purposes. That is:

\[ N = I\lambda - \tau(I\lambda) \]

where $\tau(Y)$ is the tax function. This seems a reasonable interpretation, since it is the answer that individuals would give if they referred to their last pay slip (literally or mentally) to answer the income question. It certainly seems plausible to suppose that reported net incomes will generally not include undeclared incomes, since individuals may not fully believe in the anonymity of the survey and so prefer not to disclose any income on which tax has been evaded. (And even if they did trust in the anonymity, they would have a strategic incentive not to reveal their illegal income so as not to allow this phenomenon to be detected and acted upon). Moreover, such an interpretation is consistent with the close
match between the estimates from the sample, calculated on the basis of E 26, and their population counterparts that emerged in Table 20 above—for if the incomes reported in the sample did include unofficial incomes, then one would expect to find much higher incomes and tax payments than in the official figures in the table, which do not include the hidden economy.

Denoting by \( n(Y) = Y - \tau(Y) \) the function giving net income as a function of gross, the assumption in E 26 enables the gross reported income of a respondent to be calculated as

\[ I\lambda = n^{-1}(N) \]

and their tax payments as \( \tau(n^{-1}(N)) \). These estimates enable tests of hypotheses \( H^* \) and \( H^\ast \).

To test the others we use the consumption data in the survey under the assumption that these measure true net income:

\[ c = I - \tau(I\lambda). \]

The assumption here that savings are zero is clearly extreme, though it seems a reasonable approximation for many in the sample: only 61 households in the sample report any savings. What is really needed for our analysis below, in any event, is not the savings be zero but rather than they not be affected by the reform—an assumption we shall later test, as best we can. Using E 28, gross income and compliance can be estimated separately as:

\[ I = c + \tau(I\lambda) \]

\[ \lambda = \frac{n^{-1}(N)}{c + \tau(I\lambda)}. \]

As total hours worked are reported directly by respondents, the hypotheses on labour supply are easily tested; and so, by dividing gross incomes by hours worked, are those regarding the wage rate.

---

55 With savings \( s \), these formulae become \( I = c + s + \tau(I\lambda) \) and \( \lambda = n^{-1}(N) / [c + s + \tau(I\lambda)] \) respectively.
3.5 Panel data results

The key step in testing the hypotheses above is to define the treatment and control groups. To deal with this clearly and systematically, we proceed first under the assumption that taxes are fully complied with (so that $\lambda = 1$), in which case individuals can be allocated between these groups simply on the basis of the income reported in the survey, and then turn to the more general case in which there may be some concealment from the tax authorities.

3.5.1 Results assuming full compliance

We use a variety of ways to split taxpayers into control and treatment groups.

The first is according to the marginal tax rate faced by each individual before the reform, which is the approach taken by Feldstein (1995) and others. Results for PIT payments are shown in Table 21.

<table>
<thead>
<tr>
<th>Marginal Tax Rate, 2000</th>
<th>0 per cent</th>
<th>12 per cent</th>
<th>20 per cent</th>
<th>30 per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of taxpayers</td>
<td>100</td>
<td>2130</td>
<td>173</td>
<td>11</td>
</tr>
<tr>
<td>Pre reform</td>
<td>0</td>
<td>373.1</td>
<td>2355.0</td>
<td>7621.1</td>
</tr>
<tr>
<td>Change</td>
<td>80.6</td>
<td>165.6</td>
<td>-104.3</td>
<td>-3961.0</td>
</tr>
<tr>
<td>Growth rates (per cent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of taxpayers</td>
<td>0</td>
<td>2130</td>
<td>173</td>
<td>11</td>
</tr>
<tr>
<td>Mean</td>
<td>-</td>
<td>104.3</td>
<td>-0.4</td>
<td>-45.6</td>
</tr>
<tr>
<td>Median</td>
<td>-</td>
<td>34.0</td>
<td>-6.3</td>
<td>-35.1</td>
</tr>
</tbody>
</table>

Source: Authors' calculations, figures in real 1995 rubles.

The first row gives the number of taxpayers in each group. As mentioned above, the number of individuals paying tax at a higher rate pre-reform—and especially at the highest rate—is rather small. There are also relatively few individuals earning less than the personal allowance, since as noted above this is very low. The second row shows how much tax, including social tax, individuals paid on average in each group (in real 1995 rubles). The third row shows by how much tax payments changed between 2000 and 2001. Strikingly, tax payments have
fallen for all groups except those initially paying low tax rates: those groups with the largest tax cuts have witnessed the largest falls in tax payments.56

The other rows in Table 21 repeat the analysis for growth rates of PIT payments. Since the mean growth rate can easily be affected by outliers, we also show the median growth rates for each group. (Note that no growth rate can be calculated for those earning less than the allowance, as the base would be zero). Again we find that the higher the initial tax rate, and hence the larger the tax rate reduction, the lower is the growth of tax payments.57

A second way of splitting the sample is between those who paid tax at no more than the minimum rate prior to reform and those who paid at a higher rate. The advantage of this split is that it avoids the very small group sizes obtained above. Results are in Table 22. Apart from the levels, changes and growth rates, this table also shows the difference-in-differences estimates obtained by running the regressions described in the previous section. These results clearly suggest that tax payments in the treatment group fell while those in the control group increased, in both levels and growth rates, implying a rejection of $H_{10}$.58

56 There are a number of possible differences in differences in levels that can be analysed at this point. Comparing each group with the one just below (those paying tax at 30 per cent to those paying at 20 per cent, and so on.), all differences are statistically significant—and point to a greater increase in PIT payments in the lower marginal rate groups—except that between those paying 12 per cent and those facing a zero marginal tax rate.

57 The differences in differences in growth rates can also be analysed as in the previous footnote. With OLS regressions, all differences in growth rates are significant; with median regressions the difference between individuals in the 30 and 20 per cent brackets becomes insignificant, although individuals in both groups have significantly lower PIT growth rates than those in the 12 per cent bracket.
Table 22: PIT payments at individual level, split between lower- and higher-rate payers

<table>
<thead>
<tr>
<th>Group</th>
<th>Control (0 to 12%)</th>
<th>Treatment (20 to 30%)</th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td>No. of taxpayers</td>
<td>2230</td>
<td>184</td>
</tr>
<tr>
<td>Pre reform</td>
<td></td>
<td>356.4</td>
<td>2669.9</td>
</tr>
<tr>
<td>Change</td>
<td></td>
<td>161.8</td>
<td>-334.9</td>
</tr>
<tr>
<td>Growth rates (percent)</td>
<td>No. of taxpayers</td>
<td>2130</td>
<td>184</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>104.3</td>
<td>-3.2</td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td>34.0</td>
<td>-8.7</td>
</tr>
</tbody>
</table>

Note: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure.

The third sample split we consider addresses the possibility, noted in Section 3.3 above, that if there is not a continuum of wage contracts then even some individuals paying tax at the lower rate might have been affected by the reform. To deal with this, we consider an extended treatment group consisting of all those individuals earning, before the reform, more than 75 per cent of the threshold income level at which the higher rates began (which is likely to err on the side of including too many individuals in the treatment group). The results are shown in the first and fourth rows of Table 23, next to the results from the previous table. They lead to the same conclusion as above: that the reform did not cause the growth of PIT revenues.

In Table 23 we also show results on other variables of interest. Apart from PIT revenues, we consider combined PIT and social insurance revenues, gross incomes, hours worked and wage rates. In each case we present results for both the previous and the extended treatment group. For clarity, only the difference-in-differences estimators are shown, once more both for the levels and for the growth rates.

The results show that it was not only PIT payments that fell in the treatment group relative to the control group, but also the sum of PIT and social insurance payments. Thus $H_{10}^R$ is also rejected for the sum. So too is the hypothesis that gross income grew more in the treatment groups than in the control group ($H_{10}^{Rt}$).
though not significantly so for the regression in levels. Interestingly, this is in stark contrast to the results for the US reported in Feldstein (1995), who found that following the 1986 US tax reform gross incomes increased more for those facing the greater cut in the tax rate. Goolsbee (1999), however, argues that other reforms in the US did not lead to significantly stronger growth among the most affected individuals.
Table 23: Difference-in-differences estimators for different variables, individual level

<table>
<thead>
<tr>
<th></th>
<th>Diff. in Diff., Treatment Group: 20–30 Per cent</th>
<th>Diff. in Diff., Extended Treatment Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in PIT</td>
<td>-496.7***</td>
<td>-232.3**</td>
</tr>
<tr>
<td></td>
<td>(160.7)</td>
<td>(104.2)</td>
</tr>
<tr>
<td>Change in total tax</td>
<td>-1860.2***</td>
<td>-1110.0***</td>
</tr>
<tr>
<td></td>
<td>(452)</td>
<td>(303.9)</td>
</tr>
<tr>
<td>Change in gross income</td>
<td>-158.8</td>
<td>-100.9</td>
</tr>
<tr>
<td></td>
<td>(100.9)</td>
<td>(67.6)</td>
</tr>
<tr>
<td>Change in hours worked</td>
<td>-2.155**</td>
<td>-2.135***</td>
</tr>
<tr>
<td></td>
<td>(1.174)</td>
<td>(0.811)</td>
</tr>
<tr>
<td>Change in wage rate</td>
<td>-0.491</td>
<td>-0.280</td>
</tr>
<tr>
<td></td>
<td>(0.564)</td>
<td>(0.367)</td>
</tr>
<tr>
<td>Growth rates (per cent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean growth rate, PIT</td>
<td>-107.4***</td>
<td>-102.0***</td>
</tr>
<tr>
<td></td>
<td>(125.3)</td>
<td>(13.2)</td>
</tr>
<tr>
<td>Mean growth rate, total tax</td>
<td>-51.1***</td>
<td>-47.2***</td>
</tr>
<tr>
<td></td>
<td>(3.8)</td>
<td>(3.4)</td>
</tr>
<tr>
<td>Mean growth rate, gross income</td>
<td>-41.9***</td>
<td>-41.2***</td>
</tr>
<tr>
<td></td>
<td>(3.9)</td>
<td>(3.3)</td>
</tr>
<tr>
<td>Median growth rate, PIT</td>
<td>-41.9***</td>
<td>-32.9***</td>
</tr>
<tr>
<td></td>
<td>(7.0)</td>
<td>(3.7)</td>
</tr>
<tr>
<td>Median growth rate, total tax</td>
<td>-28.3***</td>
<td>-24.2***</td>
</tr>
<tr>
<td></td>
<td>(4.7)</td>
<td>(2.4)</td>
</tr>
<tr>
<td>Median growth rate, gross income</td>
<td>-26.0***</td>
<td>-25.5***</td>
</tr>
<tr>
<td></td>
<td>(5.7)</td>
<td>(2.3)</td>
</tr>
<tr>
<td>Mean growth rate, hours worked</td>
<td>-5.6***</td>
<td>-5.9***</td>
</tr>
<tr>
<td></td>
<td>(1.5)</td>
<td>(1.2)</td>
</tr>
<tr>
<td>Mean growth rate, wage rate</td>
<td>-37.7***</td>
<td>-38.1***</td>
</tr>
<tr>
<td></td>
<td>(5.5)</td>
<td>(4.4)</td>
</tr>
<tr>
<td>Median growth rate, hours worked</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(2.4)</td>
<td>(1.8)</td>
</tr>
<tr>
<td>Median growth rate, wage rate</td>
<td>-22.4***</td>
<td>-23.4***</td>
</tr>
<tr>
<td></td>
<td>(3.8)</td>
<td>(3.2)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions these were obtained with a bootstrap procedure. Regressions on PIT, total tax and gross income based on 2,414 individuals, regressions on hours worked and wage rates based on 2,409 individuals (as not all individuals report hours worked). Total tax and PIT show annual figures, while the gross income is a monthly figure. Gross income is gross of PIT and social tax. The extended treatment group is defined to include all individuals earning at least 75 per cent of the higher-rate threshold.

Having found that gross incomes tended to increase less in the treatment than in the control group, the question is whether this is because the treatment group reduced its labour supply and/or because gross wage rates for these individuals have fallen (in each case relative to the control group). The results in the remaining rows of Table 23 suggest that (relative) reductions in both hours
worked and (especially) the wage rate play a significant role in explaining the relative decline in the gross incomes of the treatment group.

As noted earlier, the thrust of these results is robust to a number of extension, including the use of different definitions of income (including secondary jobs and casual employment), and excluding under-employed individuals (working less than 10 hours per week), and addressing mean reversion. For brevity, these results are not reported here.

All this assumes, however, that survey respondents were fully compliant. The next subsection relaxes this heroic assumption.

3.5.2 Allowing for tax evasion and underreporting

In the presence of tax evasion, the allocation of individuals into control and treatment groups is more complicated. One problem is that gross incomes can no longer be inferred from reported net incomes as the evaded part of income is by assumption not reported. As discussed in Section 3.4.4, we shall instead take the consumption data in RLMS as an estimate of true net income. We use reported net income as an estimate of declared net income, which allows us to calculate taxes. Gross income can then be calculated as the sum of reported consumption and calculated taxes. Armed with such estimates, the question arises as to whether an individual whose gross income so calculated is greater than the higher rate threshold, but who under-declares and so pays tax at the lower rate, should be allocated to the treatment or control group. If such individuals continue not to pay tax after the reform, it may seem that they were unaffected. In fact though they will be affected, because the cost and benefits of under-declaration have changed. We therefore include them in the treatment group. 58

The attraction of using consumption as a proxy for true total net income is that it is less likely than income declared in the survey to be underreported. And indeed we find that consumption, even restricted to non-durable goods, is for many...

58 The point is similar to that which led us to consider individuals close to the threshold as being affected: while such individuals did not face higher tax rates, they are still affected by the tax cut since the costs of avoiding higher tax rates changes.
survey families much higher than reported net income. Unlike income, however, consumption data are only available in RLMS at the family level. Individual-level consumption data would have enabled the analysis to continue at the individual level, but family level consumption data may be more reliable in that the person providing the information about household consumption will presumably be aware of most major expenditure occurring in the household although not necessarily about the incomes financing the consumption. Formally, for household \( j \) comprising individuals \( i \), we thus estimate gross family income as:

\[
I_j = c_j + \sum_{i} \tau_i (l_i).
\]

where \( c_j \) is the consumption at the household level, and \( \tau_i \) are the taxes paid by each family member \( i \), which are based on their reported incomes \( (l_i) \). Equivalently total hours worked at the household level are calculated as the sum of hours worked by all household members. The gross wage rate is defined the total gross income divided by total hours worked.

The use of consumption data provides a further unrelated advantage: consumption is a much better proxy for permanent income than even truthfully reported current income, since the latter may be affected by temporary shocks. Individuals with a positive (negative) income shock would be wrongly allocated to the treatment (control) group, biasing the results by making a fall in income amongst the treatment group (and a rise in the control group) more likely. To prevent similar effects from the purchase of expensive consumer durables, the consumption variable used here includes only expenditure on non-durables.

We now define the treatment group as those families whose gross family income from employment (estimated as described above, less any pensions or unemployment benefits) per working adult\(^{59}\) suggests that they would have had one higher rate taxpayer if their incomes had been fully taxed. This, in turn, we take to be the case if gross employment income per working adult is equal to or greater than the threshold at which the higher rate applied prior to reform. Of

\(^{59}\) These are all adults who report that they are working, including those on paid leave.
course, this will exclude some families with members who would have been subject to the higher rate, since even lower family incomes can lead to higher tax rates if they are not equally distributed across working adults.

To check that any differences in results from the previous section are not simply due to moving from individual to household data, Table 24 reports regressions in which the treatment group consists of families that (under the assumption of full compliance) included at least one higher rate taxpayer before the reform. Thus the only difference between this and Table 22 above is that the groups are defined by applying the same criterion at individual and household levels. The results indicate that simply moving to household data does not yield qualitatively different results, in that there is again significantly stronger performance of PIT revenues in the control group than in the treatment group.

Table 24: Changes in PIT paid at household level, treatment and control groups defined on basis of reported income

<table>
<thead>
<tr>
<th></th>
<th>Control: No Higher Rate Payer</th>
<th>Treatment: At Least 1 Higher Rate Payer</th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td>No. of families</td>
<td>1108</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>Level, pre reform</td>
<td>43.6</td>
<td>286.1</td>
</tr>
<tr>
<td></td>
<td>Change in total tax paid</td>
<td>23.5</td>
<td>-33.1</td>
</tr>
<tr>
<td>Growth rates (per cent)</td>
<td>No. of families</td>
<td>1074</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>Mean growth rate</td>
<td>152.5</td>
<td>-2.9</td>
</tr>
<tr>
<td></td>
<td>Median growth rate</td>
<td>39.0</td>
<td>-3.6</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure. The levels are monthly tax figures in 1995 rubles. The treatment group contains all families with at least one higher-rate taxpayer, on the basis of individual reported incomes.

Table 25 presents results obtained using the evasion-robust criterion for allocating households to groups. (Interestingly, with this criterion the treatment group almost doubles in size—which in itself already suggests enormous under-reporting, given that the consumption based definition of the treatment group is likely to be a lower bound on the number of families with at least one affected
individual). The results show that even controlling for tax evasion and misreporting, income grew more slowly in the treatment group than in the control group, though this difference is statistically significant only when comparing median growth rates. While the findings are thus weaker than before, there is still no evidence of a positive effect on the treatment group.

Table 25: Changes in PIT paid at household level, treatment and control groups defined by consumption-based estimate of gross income

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Treatment</th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of families</td>
<td>1040</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Level, pre reform</td>
<td>53.9</td>
<td>153.8</td>
<td></td>
</tr>
<tr>
<td>Change in total tax paid</td>
<td>19.3</td>
<td>7.2</td>
<td>-12.1</td>
</tr>
<tr>
<td>Number of families</td>
<td>1009</td>
<td>203</td>
<td></td>
</tr>
<tr>
<td>Mean growth rate</td>
<td>140.8</td>
<td>99.6</td>
<td>-41.2</td>
</tr>
<tr>
<td>Median growth rate</td>
<td>36.7</td>
<td>20.7</td>
<td>-16.0**</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure.

Table 26 repeats the analysis for the payment of PIT and social insurance combined, and for declared incomes. The findings with total labour taxes are very similar to those with PIT only: all differences are negative, and those comparing medians even significantly so. For declared income, the increase in levels for the treatment group was insignificantly higher than in the control group when levels are compared; for growth rates, the difference is again negative, and in case of the comparison of medians, significant.
Table 26: Difference-in-differences estimates for PIT, total tax and declared income, household level

<table>
<thead>
<tr>
<th></th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td></td>
</tr>
<tr>
<td>Change in PIT</td>
<td>-12.1</td>
</tr>
<tr>
<td></td>
<td>(18.0)</td>
</tr>
<tr>
<td>Change in total tax</td>
<td>-49.8</td>
</tr>
<tr>
<td></td>
<td>(58.2)</td>
</tr>
<tr>
<td>Change in declared income</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>(159.1)</td>
</tr>
<tr>
<td>Growth rates (percent)</td>
<td></td>
</tr>
<tr>
<td>Mean growth rate, PIT</td>
<td>-41.2</td>
</tr>
<tr>
<td></td>
<td>(35.4)</td>
</tr>
<tr>
<td>Mean growth rate, total tax</td>
<td>-2.3</td>
</tr>
<tr>
<td></td>
<td>(15.1)</td>
</tr>
<tr>
<td>Mean growth rate, declared income</td>
<td>-1.1</td>
</tr>
<tr>
<td></td>
<td>(13.4)</td>
</tr>
<tr>
<td>Median growth rate, PIT</td>
<td>-16.0**</td>
</tr>
<tr>
<td></td>
<td>(6.5)</td>
</tr>
<tr>
<td>Median growth rate, total tax</td>
<td>-8.7**</td>
</tr>
<tr>
<td></td>
<td>(3.5)</td>
</tr>
<tr>
<td>Median growth rate, declared income</td>
<td>-7.8*</td>
</tr>
<tr>
<td></td>
<td>(4.2)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure. Declared income is gross of PIT and social tax. Control and treatment group defined using the consumption-based estimate of gross income.

Table 27 shows that relative gross incomes fell in the treatment group. To establish whether this is due to reduced labour supply or to lower wage rates, Table 28 considers separately gross wages per hour and the number of hours worked, suggesting that the fall in gross income was due only to a reduction (as theory predicts) in the gross wage rate. Hours worked, for which the theoretical prediction is ambiguous, did not change differentially across groups.
Table 27: Difference-in-differences estimates for gross income, household level

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Treatment</th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of families</td>
<td>1040</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Levels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre reform</td>
<td>969.4</td>
<td>3076.0</td>
<td>-858.6***</td>
</tr>
<tr>
<td>Change</td>
<td>293.6</td>
<td>-565.1</td>
<td>(204.6)</td>
</tr>
<tr>
<td>Growth rates</td>
<td>Mean</td>
<td>50.3</td>
<td>-53.1***</td>
</tr>
<tr>
<td>(per cent)</td>
<td></td>
<td></td>
<td>(5.6)</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>25.2</td>
<td>-39.0***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(4.6)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure. Declared income is gross of PIT and social tax. Control and treatment group defined using the consumption-based estimate of gross income.

Table 28: Difference-in-differences estimates for hours worked and wage rate, household level

<table>
<thead>
<tr>
<th></th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td>Change in hours worked 1.80</td>
</tr>
<tr>
<td></td>
<td>(3.83)</td>
</tr>
<tr>
<td></td>
<td>Change in wage rate -12.7***</td>
</tr>
<tr>
<td></td>
<td>(3.0)</td>
</tr>
<tr>
<td>Growth rates</td>
<td>Mean growth rate, hours worked 2.7</td>
</tr>
<tr>
<td>(per cent)</td>
<td>(4.2)</td>
</tr>
<tr>
<td></td>
<td>Mean growth rate, wage rate -55.8***</td>
</tr>
<tr>
<td></td>
<td>(7.2)</td>
</tr>
<tr>
<td></td>
<td>Median growth rate, hours worked 0</td>
</tr>
<tr>
<td></td>
<td>(0.2)</td>
</tr>
<tr>
<td></td>
<td>Median growth rate, wage rate -36.9***</td>
</tr>
<tr>
<td></td>
<td>(5.1)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure. Declared income is gross of PIT and social tax. Control and treatment group defined using the consumption-based estimate of gross income.

3.5.3 Effects on compliance

A key concern in evaluating the 2001 reform is the nature and extent of any impact on compliance. The approach adopted here—using consumption data to proxy net incomes—enables this to be estimated. As reported in Table 29, the implication of this approach is that prior to the reform individuals in the treatment group declared on average only 52 per cent of their incomes, while those in the control group declared 74 per cent (which in itself suggests that higher tax rates are associated with lower compliance). The reform leaves
compliance amongst the control group virtually unchanged, but for the treatment group it increases by 17 points, to 70 per cent. The weighted average growth rate of compliance in the treatment group is thus about one-third. The unweighted average and the median growth rates are very different at 125 per cent and 36 per cent, suggesting a very skewed distribution. All approaches, however, lead to the impression of very strong improvements in compliance in the treatment group.

Table 29: Difference-in-differences estimates for compliance, household level

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Treatment</th>
<th>Difference in Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of families</td>
<td>1040</td>
<td>206</td>
<td></td>
</tr>
<tr>
<td>Levels</td>
<td>74.4</td>
<td>52.3</td>
<td></td>
</tr>
<tr>
<td>Pre reform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change</td>
<td>-0.3</td>
<td>17.4</td>
<td>17.7***</td>
</tr>
<tr>
<td>(4.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth rates (percent)</td>
<td>Mean</td>
<td>24.0</td>
<td>124.6***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(100.6***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(23.5)</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>2.4</td>
<td>35.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>33.6***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(6.5)</td>
</tr>
</tbody>
</table>

Notes: Heteroskedasticity-robust standard errors in parentheses. For median regressions they were obtained with a bootstrap procedure. Declared income is gross of PIT and social tax. Control and treatment group defined using the consumption-based estimate of gross income.

The results above clearly depend on the assumption of unchanged savings behaviour. This is a concern, since it might plausibly be that members of the treatment group increased their savings rate following the reform, perhaps expecting the reform not to be temporary and so perceiving a transitory income gain. Our estimate of compliance would then be biased upwards, since in (11) consumption would increasingly understate true net income. To check for this possibility we have examined savings data. We found that very few families report any savings: 49 in the control and 12 in the treatment group. While we do not find a statistically different change in savings rates between the two groups, this is not surprising given the small sample size and further analysis does not seem worthwhile. But while very few families report any monetary savings, they may be saving by purchasing durable goods. We have therefore also analysed expenditure on durable goods, and found that this has fallen in the treatment group relative to the control group—the opposite of what one would expect if the latter had perceived a transitory income gain. It therefore seems unlikely that a
differential change in savings underlies the finding of an apparent increase in compliance.

Though the results in this respect appear reasonably robust, they clearly need to be interpreted with care; the point estimates of the degree of compliance, in particular, rest on strong assumptions. Moreover, it may be that any improvement in compliance was due not to the parametric tax reform but to a synchronous strengthening of tax administration. Nevertheless, the potential magnitude of the implied improvement in compliance is striking.

One other piece of indirect evidence to be found in the RLMS is of interest. Respondents are asked how far they feel that decisions not to pay tax reflect a perception that others do not pay. Their answers to this are likely to indicate their own beliefs as to the extent of compliance by others. Table 30 compares responses to this question before and after the reform. There is clearly a noticeable reduction in the proportion of survey participants—by around one-third—feeling that perceived non-compliance by others was very important to the compliance decisions. The proportion thinking it important to some lesser degree, however, increased, rather clouding the picture. Overall, however, the proportion of respondents thinking compliance not very important increased from about 71 to 82 per cent.$^{60}$

<table>
<thead>
<tr>
<th></th>
<th>Very important</th>
<th>Important</th>
<th>Somewhat important</th>
<th>Irrelevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>26</td>
<td>39</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>2002</td>
<td>17</td>
<td>46</td>
<td>25</td>
<td>11</td>
</tr>
</tbody>
</table>

Source: RLMS.

Note: These questions were not included in the 2000 and 2001 surveys. We have therefore chosen the surveys closest in time to the reform, which did contain these questions.

---

$^{60}$ The decline in the stock of enterprise tax arrears around the time of the reform—in the year from January 2001, consolidated tax arrears declined from 4.3 to 3 per cent of 2001 GDP—is also suggestive of improved compliance. Again, however, this does not bear as directly on the 2001 reform as one would wish.
3.5.4 Summary of results and anatomy of the increase in PIT revenue

The evidence presented here suggests that the increase in PIT revenues following the 2001 reform was mainly the result of developments among individuals who were largely unaffected by it. There is no evidence of positive supply responses, since gross incomes fall in the treatment group and hours worked are largely unaffected. The only, but potentially important, positive effect detected in the treatment group was an improvement in compliance.

While these results imply that the reform did not cause the revenue boom, it is still of interest to understand the contribution to that strong revenue performance of the various factors at work. Using the household data, we calculate that tax revenues (from PIT only) increased by 25.2 per cent in real terms between 2000 and 2001.61 This overall rise is due mainly to growth of 35.7 per cent in the control group, while tax payments by the treatment group grew by only 4.7 per cent.

The increase in the PIT rate on low incomes will explain part of this revenue increase. To investigate this, we have calculated how much tax would have been raised in each group if incomes and compliance rates had remained unaffected by the reform. In this case, tax receipts from the treatment group would have fallen by 11.4 per cent, while those from the control group would have increased by 0.8 per cent. Overall, tax receipts would have fallen by 3 per cent. So the tax increases in the lower part of the income distribution were not sufficient to compensate for the tax cuts higher up the distribution.

The increase in PIT revenue is thus explained by the increase in declared gross incomes. The nature of this increase, however, differs greatly between treatment and control groups. The declared incomes of the control group increased by 27.5 per cent, most of which (23.9 percentage points) come from higher income rather than improved compliance. In the treatment group, on the other hand, declared

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61 This is slightly different from the figure in Table 20, because it is based on household rather than individual data. This is necessary, as we can only estimate compliance rates at the household level.
incomes increased by 17 per cent, and this was all due to improved compliance—
gross incomes for this group in fact fell quite strongly. Given their far greater
importance in the overall tax base, however, it is the increase in the incomes of
the control group—not the improved compliance of the treatment group—that
drives the overall improvement in revenue.

If social security contributions are added to the picture, then revenues from the
treatment group actually fell, even taking improved compliance into account. The
reform did not "pay for itself".

3.6 Concluding discussion: what Lessons for others?

The 2001 Russia flat tax reform has been one of the most influential and widely
emulated tax reforms of recent years. Understanding its effects is far from
simple, however, given not only the limitations on data—the panel data we use
do not include direct observations on tax payments or true gross incomes—but
also the wide range of tax and other changes occurring at the same time. In
particular, the synchronous substantial reduction in social insurance contributions
means that the change in the PIT structure was not the only major change in
labour taxation in 2001, so that changes in PIT revenue, and in such other
quantities of interest as hours worked and wage rates, cannot be attributed to
changes in the PIT alone. Nevertheless, the analysis here does provide some
insights into the effect of the PIT reform.

Most important, it is hard to attribute the very strong performance of PIT
revenues after the reform to tax reform itself. This conclusion emerges from both
the broad macro evidence and, even more strikingly, from the analysis of micro-
level data. Evidence of the latter kind is especially compelling in the context of
the Russian tax reform, since its structure was such as to have little impact on
many individuals and households, so lending itself to a difference-in-differences
analysis, comparing developments between a control group of those little
affected and a treatment group of those quite strongly affected. And that analysis
shows quite robustly that the strongest growth in PIT payments came
systematically from those who were little affected by the reform. This is true, for
example, whether or not one assumes that survey respondents report their true
disposable incomes truthfully, and is robust to a range of empirical strategies.
Nor are there any clear signs that the increase in PIT revenue was due to large scale shifting of income from the corporate to personal sectors. There is, in short, no strong evidence that tax reform itself caused the PIT revenue boom.

Nor is there any evidence that the rate reduction had any strong incentive effect, with labour supply changes over this period being essentially the same for both those affected and those unaffected. What can be found in the data is a significant reduction in the relative gross wage rates of those most affected by the reform. All this is consistent with, for instance, the elasticity of supply of higher-paid labour being low relative to that of labour demand.

This is not to say, however, that the reform did not have significant behavioural effects. For the evidence also points to a marked increase in tax compliance following the reform, with an increase of around 17 percentage points in the proportion of their income declared by those affected by the reform. Though the precise estimate should be treated with great caution, there are clear signs of a significant effect.

One cannot necessarily attribute this improvement in compliance to the parametric tax reform itself, however. It might reflect the efforts at improved enforcement undertaken at around the same time. There is, however, no obvious way of exploring this potential explanation with the data available to us. One could hope to identify effects from any differential changes in enforcement (audit rates and the like) across the regions (enabling a further dimension of differencing), but we have not been able to obtain information of this kind. Whatever its cause, however, there are signs that a strong improvement in compliance did take place around the time of the flat tax reform, and that this at least mitigated the revenue loss otherwise associated with the parametric reform.

It is natural to ask what lessons can be drawn for other countries considering the adoption of similar reforms. The key conclusion is simply the need for prudence: the Russian tax cuts did not pay for themselves through their effects on work effort or compliance. The strength of PIT revenues in Russia over this period was largely driven by an increase in real wage rates unrelated to the reform. This may have been associated with the strong energy prices, wider structural reforms or
simply a return to more normal trend levels, and in any event a full understanding is likely to hinge on features of the of Russian labour markets—the explanation lies beyond the scope of this thesis, but in any event is inessential to this key point. These structural differences may in part account for the difference between the present results for Russia and the finding of strong effects for the United States by Feldstein (1995), although Goolsbee (1999) argues that even in the United States such findings are rather atypical.

Many of those same structural features and rigidities will be present in other transition countries, at least the slowest reformers amongst them, and so would also be likely to intermediate the effects of similar reforms there. To the extent that the apparent improvement in compliance in Russia was conditioned on the initially high level of non-compliance there, similar effects might be expected, prima facie, in other countries with similar levels of non-compliance—and similarly chaotic tax administration. It is in such circumstances, for example—where non-compliance is rampant, and the prospects of monetary penalties for evasion have little impact—that cutting tax rates is in principle most likely to improve compliance. The estimates of the hidden economy\textsuperscript{62} reported in Table 31 show significant heterogeneity, but it seems that Russia has not been atypical in the extent of hidden activities, implying that similar improvements in compliance could be achieved elsewhere—although, it should be stressed again, it is not clear how far the improvement in Russia was due to the parametric tax reform or to improved administration.

\textsuperscript{62} Most measures used in transition economies are based on electricity use, the idea being to use differences in the growth rates of electricity usage (as a proxy for the real economy) and reported GDP to deduce size of the shadow economy. There are other methods, however, which are briefly summarised in Eilat and Zinnes (2000) 17-20. All methods, it should be noted, are better suited to identifying changes in the extent of the hidden economy rather than its level.
Table 31: Estimates of the share of the hidden economy in transition countries

<table>
<thead>
<tr>
<th>Country</th>
<th>EZ</th>
<th>JKZ</th>
<th>Lacko</th>
<th>FU</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>33</td>
<td>41</td>
<td>28</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>Average of other</td>
<td>32</td>
<td>29</td>
<td>27</td>
<td>38</td>
<td>32</td>
</tr>
<tr>
<td>countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armenia</td>
<td>48</td>
<td>59</td>
<td>33</td>
<td>55</td>
<td>49</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>20</td>
<td>19</td>
<td>31</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Belarus</td>
<td>28</td>
<td>33</td>
<td>26</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>25</td>
<td>28</td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>19</td>
<td>15</td>
<td>19</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>41</td>
<td>19</td>
<td>27</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>Estonia</td>
<td>55</td>
<td>63</td>
<td>38</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>Georgia</td>
<td>26</td>
<td>29</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>28</td>
<td>34</td>
<td>28</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>67</td>
<td>27</td>
<td>59</td>
<td></td>
<td>51</td>
</tr>
<tr>
<td>Kyrgyz Republic</td>
<td>26</td>
<td>35</td>
<td>30</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Latvia</td>
<td>29</td>
<td>25</td>
<td>32</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Lithuania</td>
<td>50</td>
<td>32</td>
<td></td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>Moldova</td>
<td>56</td>
<td>38</td>
<td></td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Poland</td>
<td>14</td>
<td>14</td>
<td>21</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Romania</td>
<td>11</td>
<td>18</td>
<td>24</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Slovakia</td>
<td>12</td>
<td>11</td>
<td>23</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Slovenia</td>
<td>25</td>
<td>19</td>
<td></td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td>24.6</td>
</tr>
<tr>
<td>Ukraine</td>
<td>46</td>
<td>47</td>
<td>35</td>
<td>47.2</td>
<td>44</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>8</td>
<td>8</td>
<td>22</td>
<td>34</td>
<td>18</td>
</tr>
</tbody>
</table>

Sources and notes: The figures give estimates of the share of the shadow economy in total economic activity. The estimates given are the average for 1994/95, except for FU which are the average for 1989-2001. Sources: EZ, JKZ, Lacko: all quoted from Eilat and Zinnes (2000), where EZ are their own estimates, the other two are Johnson, Kaufmann and Zoido-Lobaton (1998) and Lacko (1999). Eilat and Zinnes report the ratio of the shadow to the official economy, which we have converted to a share in the total economic activity. Feige and Urban (2003) report results for different specifications, we quote those estimated with GLS.

However, the lessons learned from Russian experience might be of interest not only to transition economies. According to Schneider and Enste (2000), the estimated size of the shadow economies in some OECD countries such as, for example, Greece, Italy, Spain, Portugal and Belgium is comparable to that estimated for transition economies, and the trend during the 1990s was an increase in the size and labour market of shadow economies in many OECD countries. They conclude that "an increasing burden of taxation and social security payments, combined with rising state regulatory activities and labour market restrictions" are the driving forces behind an increased size of the shadow economy. The Russian 2001 reform suggests that reducing the tax burden might
indeed lead to the contraction of shadow economies, but reinforces the obvious warning that revenue may suffer in the process.

There is one widely heralded aspect of the Russian reform not addressed in the analysis reported above that, it is worth noting, seems unlikely to have had much effect. This is the simplicity of the rate structure in itself. Table 32 reports the responses of RLMS participants to the question of whether the complexity of the tax system is itself an impediment to compliance. While there is some reduction in the numbers thinking complexity very important, there is also an increase in the proportions thinking it important or somewhat important. Little sign here that the tax system has become massively simpler. This is not to deny the potential value of simple tax design in fostering compliance and reducing the scope for corruption. The key point, it seems, is that complexity much more than a matter of the number of rates, but depends on the range of allowances available, procedures to be followed, and so on. Though obvious, the point is often overlooked by the more ardent advocates of flat taxes.

Table 32: How important is the perception the system is too complicated to compliance decisions? (in per cent of responses)

<table>
<thead>
<tr>
<th>Year</th>
<th>Very important</th>
<th>Important</th>
<th>Somewhat important</th>
<th>Irrelevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>26</td>
<td>37</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>2002</td>
<td>21</td>
<td>45</td>
<td>23</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: RLMS.

Note: These questions were not included in the 2000 and 2001 surveys. We have therefore chosen the surveys closest in time to the reform that did contain these questions.

The Russian experience is potentially highly instructive for many countries, especially those facing severe compliance problems. But the central lesson is of the need for caution. Whatever the reason for the PIT revenue boom in Russia, it lies in something other than behavioural responses to the adoption of the 'flat tax'.

3.7 Appendix I: Data

3.7.1 Data sources

Panel data: RLMS
GDP deflator: IMF *World Economic Outlook.*

### 3.7.2 RLMS

The individual and household data used in the panel data analysis are from the Russian Longitudinal Monitoring Survey (RLMS) of the Carolina Population Center at the University of North Carolina. The raw data comprise 10,975 (12,121) individuals and 4,006 (4,528) households in the year 2000 (2001). Data are also available for the years 1994 to 1996, 1998, and 2002, but are not used in this thesis, except for the opinion surveys reported in Table 30 and Table 32. These are based on data from 1998 and 2002, as the 2000 and 2001 surveys did not include these questions.

The data set contains hundreds of variables. Those of interest are described in Table 33.

**Table 33: Selected RLMS variables**

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual-level data:</td>
<td></td>
</tr>
<tr>
<td>pjpayt</td>
<td>Average monthly wage over the last 12 months after taxes from primary employer.</td>
</tr>
<tr>
<td>wagelm</td>
<td>Money received after tax in last 30 days from primary job.</td>
</tr>
<tr>
<td>oijwag</td>
<td>Money received after tax in last 30 days from secondary job.</td>
</tr>
<tr>
<td>inciea</td>
<td>Money or equivalent from additional employment.</td>
</tr>
<tr>
<td>pwrkwh</td>
<td>Hours worked in usual week at primary employment.</td>
</tr>
<tr>
<td>owrkwh</td>
<td>Hours worked in usual week at secondary employment.</td>
</tr>
<tr>
<td>hrisiapw</td>
<td>Hours worked in additional employment during last 30 days.</td>
</tr>
<tr>
<td>ownent</td>
<td>Whether respondent is owner or co-owner of enterprise.</td>
</tr>
<tr>
<td>Household-level data:</td>
<td>Nominal expenditure on different food items.</td>
</tr>
<tr>
<td>alcohln, breadn, dairyn, eatoutn, eggsn, fatn, fishn, fruitsn, meatn, ofoodn, potaton, sugarn, vegetn fuelaun, clothn, fuelgsn, fuelwdn, paymntn, rentun, servicn, tobacn, assistn, luxum ncat1 – ncat6</td>
<td>Nominal expenditure on different non-food non-durable items.</td>
</tr>
</tbody>
</table>
3.7.3 Calculation of tax payments

When calculating tax revenues and pre-tax incomes, care has to be taken to correctly account for the personal allowances individuals are entitled to. This is complicated by the fact that the total yearly allowance depends on the monthly pattern of income receipts. For instance, in the year 2000 an individual received a monthly allowance of 264 rubles until the month in which cumulative yearly income exceeded 20,000 rubles. From that month onwards the allowance was 132 rubles until the cumulative yearly income reached 50,000 rubles, beyond which there was no further entitlement to an allowance. In order to be able to calculate the yearly allowance, an assumption needs to be made about the distribution of wage payments over the year. We assume that the same nominal wage is paid evenly throughout the year, although in theory there was an incentive to postpone payments to later months, to benefit as long as possible from the allowances. This incentive is unlikely to be strong, however, given the low level of the allowance. Any additional allowances, such as those linked to dependents or incapacity, are ignored.

Having obtained an estimate of the allowance, the remaining calculations are straightforward applications of the published tax rates and thresholds. As taxes are assessed at the individual level, there is no further difficulty in calculating taxes at the household level, which are just the sum of individual taxes.

3.7.4 Cleaning

3.7.4.1 Individual data

The raw data consist of 23,096 observations, 10,975 from 2000 and 12,121 from 2001. The following table shows how many observations are lost due to cleaning for each of a list of criteria. Note that the total number of lost observations is smaller than the sum for each individual criterion, because individuals can fulfil more than one of the criteria. Dropping individuals who own their own business, for example, only leads to the additional loss of 17 individuals in 2000, once the previous criteria have been applied.

Statistics reported in the thesis are based on the data cleaned only on the criteria in the upper half of the table (7,913 observations). The regressions are generally
based on the balanced panel with the "pjpayt" variable present (4,828 observations or 2,414 individuals).

Table 34: Cleaning of individual-level data

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Observations Dropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep if between 20 and 60 years of age throughout 2000 to 2001</td>
<td>10400</td>
</tr>
<tr>
<td>Drop if do not report how many hours they work or claim to work more than 84 hours per week</td>
<td>4516</td>
</tr>
<tr>
<td>Drop if do not report any income from primary employment</td>
<td>14131</td>
</tr>
<tr>
<td>Drop if own their own business</td>
<td>63</td>
</tr>
<tr>
<td>All of the above</td>
<td>15183 (7913)</td>
</tr>
<tr>
<td>Additionally</td>
<td></td>
</tr>
<tr>
<td>keep if report &quot;wagelm&quot; (necessary for Table 20)</td>
<td>1117 (6796)</td>
</tr>
<tr>
<td>keep if report &quot;pjpayt&quot;</td>
<td>704 (7209)</td>
</tr>
<tr>
<td>keep if present in both 2000 and 2001</td>
<td>2437 (5476)</td>
</tr>
<tr>
<td>keep if present in both 2000 and 2001 and report &quot;wagelm&quot;</td>
<td>3637 (4276)</td>
</tr>
<tr>
<td>keep if present in both 2000 and 2001 and report &quot;pjpayt&quot; (basis for regressions from Table 21 onwards)</td>
<td>3085 (4828)</td>
</tr>
</tbody>
</table>

3.7.4.2 Household data

The raw data consist of 8,534 observations, 4,006 from 2000 and 4,528 from 2001. The following table reports the numbers of observation lost due to cleaning.

Table 35: Cleaning of household-level data

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Observations Dropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep if can be matched to individual data, in case of family split keep larger part of a family</td>
<td>743 (7791)</td>
</tr>
<tr>
<td>Additionally</td>
<td></td>
</tr>
<tr>
<td>keep if at least one working-age adult in household</td>
<td>1977 (5814)</td>
</tr>
<tr>
<td>keep if report &quot;pjpayt&quot; for at least one member of household</td>
<td>2963 (4828)</td>
</tr>
<tr>
<td>both of the above</td>
<td>3207 (4584)</td>
</tr>
<tr>
<td>Additionally</td>
<td></td>
</tr>
<tr>
<td>keep if households present in 2000 and 2001 and the household composition does not change</td>
<td>2092 (2492)</td>
</tr>
</tbody>
</table>
3.8 Appendix II: a check on mean reversion

A recent paper (Chay et al., 2005) has considered the problem of mean reversion in difference-in-differences regressions. The paper found, in the context of the evaluation of school performance, that ignoring mean-reverting shocks can lead to serious over-estimation of the effect of policy measures that are aimed at the weaker schools. These findings may be relevant for the analysis in this chapter, too. If there are mean-reverting income shocks, then it is likely that some individuals will be allocated to the treatment group, because of good (bad) luck. In the post reform period, those individuals would see their incomes fall (rise) back to its permanent level. This would bias the difference-in-differences effect downwards.

The central results of this chapter, i.e. those on household data are likely to be less affected, because shocks across family measure will often cancel out, so that the variance of shocks to household incomes will be smaller.

One may also argue that the use of consumption data helps, as it is likely to represent permanent income, i.e. the part of income that is not due to an unexpected shock. In Russia however, as argued above, savings are negligible, even in the better-off control group. While there may be some underreporting of savings, it is still likely that our income measure may suffer from such mean-reversion.

A related, but slightly different, worry may be that growth rates of incomes are for exogenous reasons different across the treatment and control groups. It is for example possible that growth rates are structurally higher for those on low incomes, e.g. if starting salaries are low, but rise fast in early years of employment.

Chay et al. (2005) suggest dealing with mean reversion problems by adding the original income to a difference-in-differences equation as follows:

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63 This is the “regression discontinuity” approach, described as early as in Campbell and Stanley (1963). Chay et al. (2005) go far beyond that relatively simple approach and introduces numerous
\[ \Delta y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 T_t + u_t \]

This will detect a difference-in-differences effect, even if there is mean reversion. Any mean reversion in this set up should be picked up by the coefficient on original income \((\beta_1)\), while the coefficient on the treatment dummy \((\beta_2)\) picks up any additional change in income. An illustration of this is provided in the two top panels of Figure 8, which shows hypothetical data for the relationship between increases in income \((\Delta y_t)\) and original income \((y_{t-1})\). The top left panel shows, how a standard difference-in-difference methodology picks up a negative treatment effect, if the general relationship between original income and income changes is negative. The top right panel shows, how in this hypothetical case, none of the fall in income of the high income group is due to the reform, as all can be explained by the general negative relationship. Note that the relationship need not be linear, as the regression can easily be adapted by the inclusion of further polynomials of original income.

---

robustness checks, most of which cannot be adapted to our sample, which for example does not contain any obvious variables that could be used for instrumentation.
One underlying assumption of this approach is that treatment effect of the reform is a constant quantity, but that relationship between income increases and original income does not change. While this seems appropriate in case of a pure mean-reverting shock, it may be less useful if there are other reasons for a general negative relationship between income changes and original income. Here we therefore suggest a method for relaxing this assumption.

A case in which following the reform both the slope and the constant of a regression between income changes and original income change is illustrated in the bottom left panel of Figure 8. This shows hypothetical data for current year in dots and hypothetical data for the previous year in dashes. Clearly, running a regression as in E 32 on the current data only, would lead to the finding that the reform had no negative effect on income and that the negative relationship was entirely due to mean reversion. However, when data from the previous year is taken into account, one can note that the relationship between changes in income and original income has become steeper. There must therefore be some explanation for the additional negative effect that is not purely due to the pre-reform mean-reverting process. The upshot of this is that the relationship
between changes in income and original income should be estimated on pre-reform data first, if the reform is allowed to change this relationship.

The analysis can be generalised even further, by allowing the reform to have different effects on the slopes for the treatment and control group. Such differential effects could be expected if a complicated reform affected individuals in the treatment group to different degrees. In the case of the Russian income tax reform, this might be expected because marginal tax rates were reduced more for those individuals qualifying for lower social taxes. Moreover, the absolute value of the tax cut was higher, the larger the proportion of pre-reform income that previously faced higher tax rates. A hypothetical example is given in the bottom right panel of Figure 8, where following a reform, the relationship becomes flatter for the control group and steeper for the treatment group, with the absolute jump between both groups positive, but of negligible size. Overall such data would suggest that the reform had a negative effect on income changes for the treatment relative to the control group.

More formally, the analysis as presented in the bottom right panel can be obtained by running a regression of the following form:

\[ \Delta y_u = \beta_0 + \beta_1 y_{u-1} + \beta_2 P_t + \beta_3 PT_t + \beta_4 y_{u-1} P_t + \beta_5 y_{u-1} PT_t + u_u. \]

This regression will yield the pre-reform relationship between, as characterised by \( \beta_0 \) and \( \beta_1 \). \( \beta_2 \) and \( \beta_4 \) describe how the relationship changed after the reform. The differential changes are given by \( \beta_3 \) and \( \beta_5 \), which show the effect on the intercept and slope respectively. If both are of the same sign, interpretations is obvious. Otherwise, the total effect needs to be calculated, or more easily, a graph of the regression lines can be inspected.

When applying this to the Russian data sample, a further difficulty is encountered, as no data are available for 1999, during which no survey was undertaken. We therefore need to use data for 1998 to estimate the pre-reform relationship, dividing any income change between 2000 and 1998 by two, to average out the growth over the two years. This gives us an expanded data set, covering the years 1998 to 2001. After differencing and lagging, we then have
two observations per individual, and are able to run regression E33. The results are given in Table 36. Moreover, we repeat the regression after allowing the slopes to differ even in the pre-reform period between control and treatment group. While there is less reason to expect such a difference in slope before the reform, it could be feared that the comparison between pre- and post-reform periods may be biased, if a more restrictive functional form is assumed for one of them.

Table 36: Regression on pre- and post-reform data

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>increase in real income</td>
<td>-0.110</td>
<td>-0.279</td>
</tr>
<tr>
<td>Real income, t-1</td>
<td>0.253</td>
<td>(0.027)**</td>
</tr>
<tr>
<td>Real income, t-1 * (Treatment)</td>
<td>0.253</td>
<td>(0.027)**</td>
</tr>
<tr>
<td>Post-reform</td>
<td>75.493</td>
<td>2.148</td>
</tr>
<tr>
<td>Post-reform * (Treatment)</td>
<td>262.349</td>
<td>262.349</td>
</tr>
<tr>
<td>Real income, t-1 * (Post-reform)</td>
<td>0.105</td>
<td>0.274</td>
</tr>
<tr>
<td>Real income, t-1 * (Post-reform) * (Treatment)</td>
<td>-0.185</td>
<td>-0.438</td>
</tr>
<tr>
<td>Constant</td>
<td>32.157</td>
<td>105.502</td>
</tr>
<tr>
<td>Observations</td>
<td>4082</td>
<td>4082</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Note: Heteroskedasticity-robust standard errors in parentheses.

These results suggest that incomes in the treatment group indeed grew more slowly compared to the control group, even allowing for generally lower growth among better-off individuals. While incomes in the treatment group increase by a positive (and in case of regression (2) insignificant) fixed amount, this is outweighed by growth falling more as incomes increase. This is shown more clearly in Figure 9, which shows predicted income growths for regression (1) (results from regression (2) look very similar).
Overall we thus conclude that the results were not purely driven by mean reversion or more generally a pre-existing negative relationship between income changes and original income. This is reassuring, but there remain some doubts about the methodology used in this appendix, which is the reason for making it a robustness check rather than the central case.

First, the pre-reform period may not be a useful comparison, because it was also marked by a tax reform, which reduced tax rates at the upper part of the income distribution.

Second, the experiment described here cannot be easily extended to household-level regressions, as less complete households than individuals “survive” for three consecutive periods.

Third, we have made the assumption that growth rates are structurally different across income levels, and that this structure would not have changed without the reform. It is not clear whether these assumptions are necessarily better than the assumption of equal growth among both groups in the absence of reform.
4 Corporate income tax reforms in industrialised countries

This chapter provides an analysis of corporate income tax reforms and multilateral tax coordination initiatives in OECD and EU countries.

The first part of the chapter (section 4.1) discusses different corporate income tax measures. As the theoretical issues concerning different tax measures and the choice between them have already been discussed by Devereux (2004), this chapter keeps the description of measures relatively short and focuses on the issues that are likely to be relevant for empirical studies. This is followed by a careful study of different measures in the UK. The central question of this section is: How important in practice are differences between measures? Can empirical researchers pick a measure which is relatively easy to construct, secure in the knowledge that different measures typically generate similar values?

The evidence presented below indicates that different measures do indeed generate very different values. We do not go as far as testing alternative measures in, say, an econometric model of investment. However, given the results presented below, it seems highly unlikely that similar econometric results would be generated by using the different measures; not only do the measures take different values, their movement over time is also quite different.

It is of course not surprising that some of these measures differ – after all they do not all attempt to measure the same thing. It is well known, for example, that a given tax regime may have high average rates but low marginal rates. What may be more surprising is that even measures which are designed to capture the same aspect of the tax system can also vary widely. For example, average tax rates differ depending on whether they are constructed using aggregate tax revenue data, accounting data or tax legislation. Such differences reflect, for example, whether the measure is forward-looking, and whether and how different

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64 Volkerink et al. (2002) do that, at least for two different definitions of such tax rates: the one suggested by Mendoza et al (1994) and a version suggested in their paper. They replicate some recent empirical studies and find that results by Mendoza et al. (1997) and Daveri and Tabellini (2000) are not substantially changed by using their measure.
investment projects or firms are aggregated. This suggests that empirical work investigating the taxation of income from capital should take careful account of how those taxes are measured. Measures should be chosen on the basis of how well they conform to the underlying economic theory, and to taxation in practice. A measure chosen on the basis of how easy it is to construct may give misleading results.

The second part of the chapter (section 4.2) then uses the measures described above to analyse tax reforms. The motivation for this is that the last two decades have seen considerable reform to corporate income taxes in major industrialised countries. This chapter investigates whether such reforms have any similar patterns across countries. Indeed we find patterns of tax reforms and use them to build up a list of stylised facts.

Having obtained a set of stylised facts, which include the observation that tax rates have fallen, while tax bases were broadened, we consider possible explanations for them. On the face of it, these reforms seem consistent with the predictions of economic theory. It has been argued that increasing capital mobility will lead to a "race to the bottom" as countries compete with each other to attract capital. Most models of tax competition however do not allow for separate effects on tax bases and statutory rates and, at least implicitly, assume that only the effective marginal tax rate is relevant. We suggest an explanation, namely that the observed pattern was caused by competition for the highly profitable capital of multinationals as opposed to investments, which just break even. We also explore an alternative explanation for the observed reforms, based on a formal model of tax competition by Haufler and Schjelderup (2000). The idea is that, as well as competing for inward flows of capital, governments also compete for flows of taxable profit. That is, conditional on where they locate their real activities, firms may be able to shift their profit between countries in order to reduce their worldwide tax liabilities. After using up all allowances in each location, the relevant marginal tax rate for shifting profit is the statutory tax rate – which has fallen in almost all countries over the last two decades. In this model, governments use two instruments - the tax rate and allowances - to
compete over two mobile resources – capital and taxable income. We also briefly discuss an explanation for this pattern put forward by Sinn (1988, 1989).

The third part of the chapter (section 4.3) then considers multilateral tax initiatives at the OECD and the European Union level. The European Commission and the OECD have recently made attempts at international coordination to counter what they see as “harmful” tax competition. The exact aims of these policy initiatives are somewhat unclear. In practice, however, both initiatives appear to be concerned with combating profit shifting, which is consistent with both of the explanations of tax reforms outlined above. This chapter presents a detailed consideration of these issues.

Following this, we present some brief conclusions (section 4.4). Some details on calculations are given in a Data Appendix (section 4.5).

4.1 Measuring taxes on income from capital

4.1.1 Tax measures: an introduction

Before studying corporate income tax systems, it is useful to discuss the different measures that are available and their limitations. The theoretical issues of choosing between tax measures have already been discussed extensively, e.g. in Devereux (2004). Here, we focus only on the main issues, and only to the extent that they are relevant for the following empirical analysis.

The traditional method of measuring the impact of corporate income tax on the level of capital is through the cost of capital – defined as the pre-tax real required rate of return on an investment project. 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. Most theoretical papers which model the impact of corporate income tax in an open economy are based on this approach. Typically, firms are assumed to be immobile, but can raise finance for capital on the world market. A higher effective marginal tax rate

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65 This approach dates back at least to Hall and Jorgensen (1967). It was further developed by King (1977) and King and Fullerton (1984), among others.
pushes up the cost of capital, and therefore reduces the inflow (or increases the outflow) of capital.

More recently, though, attention has focussed on the discrete investment choices made by such firms, based in part on the literature on multinational firms. One common approach to modelling the location choices of multinational firms analyses whether, and how, such firms access a foreign market. One choice facing the firm is whether to produce at home and export, or whether to produce abroad. Conditional on locating abroad the firm has 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. Conditional on deciding where to locate the firm must also decide the scale of investment.

The first two of these decisions are discrete. Suppose that the cost structure of the firm prohibits both exporting and producing abroad, and also prohibits producing in more than one location. Suppose also that the firm has some market power so that it expects to earn a positive economic rent. Then it can be assumed that the firm chooses that option which generates the highest post-tax rent. In this model — unlike in the traditional model — taxes on economic rent can affect firm’s investment decisions. Specifically, the impact of tax can be measured by the extent to which the pre-tax economic rent is reduced by taxation. Conditional on the discrete choice — for example, having chosen a location — the decision of the scale of the investment will be determined by the point at which the expected marginal product equals the cost of capital. For this third stage, then, it is again the impact of taxes at the margin — that is on the cost of capital — that are relevant. It is therefore necessary to consider both marginal and average tax rates.

For both marginal and average tax rates, there are two approaches of measurement. The first is based on an analysis of the tax legislation itself. Measures in this group are based on information on the statutory tax rate, depreciation allowances and so on. The second uses tax revenues to build

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66 See, inter alia, the early literature of Dunning (1977), Caves (1974) and more recently Horstmann and Markusen (1992) and Devereux and Griffith (1998).
measures, such as by scaling observed tax revenues by GDP, total tax revenue or some approximation of the tax base.

One of the main differences between these two groups of measures is that the former is forward looking, and so captures the impact of tax on future expected earnings on a specific investment project, while the latter are backward looking, and so capture the impact of tax on the returns in any period of the whole past history of a firm’s investment decisions.

4.1.1.1 Measures based on tax legislation

This group of measures includes statutory tax rates and marginal and average effective tax rates.

Some important simplifying assumptions need to be made in developing these measures. We consider the tax system as it applies to a mature manufacturing firm. In our main calculations we do not consider the treatment of losses or other forms of tax exhaustion, although we discuss below the impact that tax exhaustion would have on our calculations. We analyse only source-based corporate income taxes – we do not include taxes levied in the country of residence of the parent company, for example. We generally exclude industry-specific measures and we do not allow for any forms of tax avoidance.

The statutory tax rate

The most basic measure of corporate income taxes 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. Our definition includes local tax rates and any supplementary charges made.67

67 In cases where local tax rates differ across regions, we use averages weighted by production where data are available. Otherwise the rate of the region in which most production takes place is used. Where local taxes or surcharges can be set off against other taxes (e.g. 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) and Devereux, Lockwood and Redoano (2001) for more detail on how the data was collected.
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, since it is the marginal rate of tax applied to any additional income, given a level of allowances. It is therefore likely to be relevant in determining the incentive for firms to shift income between countries, conditional on where their real activity takes place. We return to this issue below.

The tax base

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 feasible to present a measure which reflects all of these factors. We follow the empirical literature in focusing on depreciation allowances for capital expenditure.

A natural measure of the value of investment allowances is the present discounted value (PDV) of all allowances, including any special first year allowances. The PDV would be zero if there were no allowances at all and it would be 100 per cent with an R-base cash-flow tax that permitted the cost to be deducted immediately.

Effective tax rates

We use the term “effective tax rates”, whether marginal or average, only for measures based on tax legislation. This term has also been used to refer to tax rates estimated from data on tax revenues. We differentiate by referring to those as “implicit tax rates”.

Clearly both the tax rate and the tax base are relevant in determining incentives for investment. This is true of both types of decision described above: the discrete choice of which type of investment to undertake (or where to undertake it), and the scale of investment conditional on that choice. Given an underlying model of investment, it is possible to combine information on the tax rate and tax base in ways which summarise these incentives.
The standard approach to combining the rate and base to summarise incentives is to look at the impact of tax on a hypothetical investment project that just earns the minimum required rate of return (a marginal investment). In general, the incentives generated by the tax system depend on the form of the investment project, including the type of asset purchased and the way it is financed. However, in practice it is not possible to account for all the features and complexities of the tax system. The form of the investment modelled is therefore typically simple. Box 1 describes our approach.68 The basic approach is to find the impact of taxes on the cost of capital, given a post-tax required rate of return (equal to the discount rate). The proportionate difference between the pre-tax and post-tax required rates of return is known as the **effective marginal tax rate** (EMTR). The higher the EMTR, the greater the required pre-tax rate of return, and hence the lower is the incentive to invest.

The impact of taxes on discrete investment choices is not captured in this framework. Instead, it is necessary to consider two alternative forms of investment, each of them profitable. The impact of taxation on the choice between them depends on the proportion of total profit taken in tax. We denote this the **effective average tax rate** (EATR). If one option has a higher pre-tax profit than the other, but also a higher EATR, then the tax may lead the firm to choose the option with the lower pre-tax profit. The measure of the EATR used here is also defined in Box 1. As with the EMTR, it is defined for a particular project (the same project as for the EMTR, apart from the rate of profitability), and takes into account only the broad structure of the tax system.

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68 This is based on Devereux and Griffith (2003), and is slightly different from the well-known approach of King and Fullerton (1984) (although the measures generated are very similar).
Consider a simple one period investment, in which a firm increases its capital stock for one period only. It does so by increasing its investment by 1 at the beginning of the period, and reducing it by \(1 - \delta\) at the end of the period, where \(\delta\) represents economic depreciation. The higher capital stock generates a return at the end of the period of \(p + \delta\), where \(p\) is the financial return. The discount rate is \(r\). Ignore inflation.

One unit of capital generates a tax allowance with a PDV of \(A\). So introducing tax reduces the cost of the asset to \(1 - A\), while the saving from the subsequent reduction in investment becomes \((1 - \delta)(1 - A)\). The total return \(p + \delta\) is taxed at the tax rate \(r\).

The PDV of the investment with tax is therefore:

\[
R = \frac{(p + \delta)(1 - r) - (r + \delta)(1 - A)}{1 + r}
\]

The cost of capital is the value of \(p\), denoted \(\tilde{p}\), for which the investment is marginal i.e. \(R = 0\). The effective marginal tax rate (EMTR) is \((\tilde{p} - r)/\tilde{p}\).

We define the effective average tax rate (EATR) - for a given value of \(p\) - to be the PDV of tax payments expressed as a proportion of the PDV of total pre-tax capital income, \(V^* = p/(1 + r)\). This is comparable to other commonly used measures of the average tax rate. For a marginal investment, EATR=EMTR. For a highly profitable investment, EATR approaches \(r\).

The cash flows are slightly different in the case of debt-financed investment, but the concepts of the EMTR and EATR are unchanged.

One of the important limiting assumptions that are necessary to allow the calculation of effective tax rates is that when an investment takes place, the investor assumes that current tax rates will hold indefinitely. In principle, if there is an announcement of a future tax reform this could be accounted for, but
otherwise, it is difficult to know what the investor's assumption about tax rate stability is.

Another issue is tax-exhaustion. This was common in some countries in the 1980s – particularly in the UK, where allowances were very generous. In considering an incremental investment for a firm in this position, the tax consequences of that investment may be delayed. For example, extra allowances cannot reduce tax liabilities immediately, but only when the firm returns to a tax paying position; likewise, extra revenue is not taxed immediately, but only when the firm returns to a tax-paying position.

The effect of a period of tax exhaustion on effective tax rates depends crucially on the timing of the tax exhaustion relative to the timing of the investment. Suppose the firm pays tax in periods \( t-1 \) and \( t+1 \), but not in period \( t \). Then allowances for an investment which takes place in period \( t \) will be delayed, and hence will be less valuable; in turn, effective tax rates will be higher. However, an investment in period \( t-1 \) will generate allowances in period \( t-1 \), but the return from the investment, arising in period \( t \), will not be taxed until period \( t+1 \). This reduces effective tax rates. These effects can be quite large, but it is clear that they may shift effective tax rates in either direction. Allowing for such effects goes beyond the scope of the cross-country analysis in this chapter.\(^{69}\)

### 4.1.1.2 Measures based on tax revenue

We now turn to a consideration of the second group of measures. There are at least two approaches. First tax revenues can be divided by an approximation of the tax base, giving some average tax rate, which we shall refer to as an implicit tax rate. Alternatively tax revenues can be divided by a macroeconomic quantity such as GDP or total government revenues.

\(^{69}\) For a detailed analysis of such effects in the UK, see Devereux (1987, 1989).
Implicit tax rates

Implicit tax rates are attempts at measuring the effective average tax rates with outcome data, such as macro-economic revenue data or accounting data from firms.

Clearly, if the measure of profit used were defined in the same way as the tax system, then the proportion of it taken in tax would be equal to the statutory rate. Differences in such average tax rates from the statutory rate therefore reflect differences in the definition of profit used in the measure from the definition of profit used in the tax system.

Where it is the case that differences in the two measures of profit reflect the fact that legislators sometimes deliberately set the tax base to be narrower, or broader, than a conventional (or economically meaningful) measure of profit, then the measure provides meaningful information. However, in many cases the difference between the tax base and some other measure of profit may simply reflect differences in measurement, which provide no clear guide to incentives.

These differences in the true and measured tax base reflect several common features of tax systems. For example, the tax liabilities of a firm at any point in time reflects (i) the history of its investment up to that point (in determining what allowances it can claim in that period) (ii) tax liabilities in possibly several jurisdictions, (iii) the history of losses in the firm (that is, it may be carrying forward losses from some previous period), and (iv) the history of the tax system up to that point. As such these measures are largely backward looking and reflect the past history of investment. Each of these features may affect the tax base, but are likely to be ignored in most conventional measures of profit.

Note that these may 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.

Note that not only average tax rates can be estimated using revenue data. Gordon et al. (2004) propose a method for estimating a marginal tax rate using such data.
Corporate income tax revenues as a proportion of GDP or total tax revenue

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 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 transacted through corporate tax paying entities, average rates of profitability) and on the relative size of corporate income in GDP, which varies considerably over the economic cycle and potentially across countries.

4.1.2 A case study: the UK

Having discussed in broad terms the range of available measures, we now try to obtain as many of them as possible for the UK, to study the empirical importance of the differences between them.

4.1.2.1 An overview of measures

Figure 10: Overview of measures

Notes: Sources and definitions of measures are provided in the Data Appendix (section 4.5). These notes are only intended to provide a brief explanation and the main assumptions.

EATR: Effective average tax rate. (Economic profit rate 20%, assets: weighted average of plant & machinery and land & buildings, source of finance: weighted average of equity and debt, interest and inflation rates: actual values).


GKS: Effective marginal tax rate based on macroeconomic data, calculated as suggested in Gordon et al. (2004).

ATR: Average tax rate based on company accounts data.

ITR: Implicit tax rate for capital based on macroeconomic data as calculated by Mendoza et al.
ITR-COR: Implicit tax rate based on macroeconomic data for corporate sector only.

We begin with a brief summary of alternative approaches, based on the measures described above. Figure 10 presents a summary of five main approaches and Table 37 presents pairwise correlation coefficients for the measures. Detailed descriptions of the derivation of each measure are provided in the Data Appendix (section 4.5).

Table 37: Coefficients of correlation between tax measures from Figure 10

<table>
<thead>
<tr>
<th></th>
<th>EATR</th>
<th>EMTR</th>
<th>GKS</th>
<th>ATR</th>
<th>ITR</th>
<th>ITR-COR</th>
</tr>
</thead>
<tbody>
<tr>
<td>EATR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMTR</td>
<td>-0.4386*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GKS</td>
<td>0.6530*</td>
<td>0.7210*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATR</td>
<td>-0.1858</td>
<td>-0.0787</td>
<td>-0.1870</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITR</td>
<td>0.4896*</td>
<td>-0.2566</td>
<td>0.9334*</td>
<td>-0.1894</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ITR-COR</td>
<td>0.8129*</td>
<td>0.6374*</td>
<td>0.5073</td>
<td>0.3833</td>
<td>0.7011*</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: The number in italics indicates the number of observations the coefficient is based on. Starred values are significant at the 5%-level. Only data from 1970 onwards used. Tax measures as in Figure 10.

This figure reveals enormous variation across alternative measures of the tax rate on capital income. This is supported by the correlation coefficients, which are insignificantly different from zero for most measures, and even negative for some.  

Some variation is due to fundamental differences in the approach taken, and some is due to differences in data. Before further analysing these differences, we briefly explain the assumptions made to calculate the measures shown in Figure 10.

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70 Because of different sample sizes due to limited data availability, care needs to be taken when comparing coefficients. For example, the correlation between ITR and ITR-COR suggests that the movements in these measures are significantly positively correlated. However, calculated over a longer time period of 27 observations using an approximate version of the ITR-COR (see section 5), the co-efficient drops to 0.39 and becomes insignificant.
Effective marginal tax rate (EMTR)

Effective average tax rate (EATR)

These two measures are shown for a general investment, using the approach set out above. We show the effective tax rate for an investment which is partly in plant and machinery and partly in buildings; it is financed partly by equity or retained earnings and partly by debt.\(^71\) For the EATR we assume a rate of economic profit of 20 per cent.\(^72\) At this stage we exclude personal taxes; in effect this could be seen as an overall effective tax rate for a non-tax-paying shareholder who did not receive any tax credit associated with dividend payments by UK companies. To make the measures more comparable to the others in Figure 10, we allow the economic parameters to vary over time. That is, the values of the real interest rate and the inflation rate are based on actual values observed in each year. In addition, the weights attributed to alternative assets and sources of finance also vary over time.\(^73\) However, we assume a constant economic depreciation rate for each asset.\(^74\)

Average tax rate, based on company accounting records (ATR)

This measure is based on individual company accounting records taken from Datastream – more details are provided in Section 4.1.2.3. Broadly, the measure shown here is based on the UK corporation tax liability of the company, expressed as a proportion of the total pre-tax profit (after interest payments and depreciation).

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\(^71\) That is, we consider only one investment, which is a weighted average of different assets and sources of finance. We do not compute effective tax rates for each type of asset and then find a weighted average of these.

\(^72\) This choice is somewhat arbitrary. The EATR as measured here lies between the EMTR and the statutory tax rate. An economic profit rate of around 20% generates an EATR which can differ from each of these extreme points.

\(^73\) These are based on data from company accounting records, taken from Thomson Financial Datastream. Further details are given in the Data Appendix. On average, these weights are: 57% plant and machinery; 43% buildings; 90% equity; 10% debt.

\(^74\) The rate for plant and machinery is 12.25%, and the rate of buildings is 3.61%. These rates are taken from OECD (1991).
Overall average tax rate on capital income, based on aggregate tax revenue data (ITR)

Average tax rate of the corporate sector (ITR-COR)

The first of these is the measure proposed by Mendoza et al (1994). It is based on the ratio of revenues from all taxes deemed to be on capital to a measure of the operating surplus of the economy. The second is a related measure developed here. It uses a similar methodology, but is restricted to the corporate sector of the economy, so that it is more comparable to the other measures. It is defined as corporation tax revenues divided by corporate income, including profits from financial property income.

Marginal tax rate of the corporate sector (GKS)

Finally, we also investigate the measure of the marginal tax rate proposed by Gordon et al (2004). For comparison with the other measures we do not include taxes levied at the personal level. This measure is based on the difference between actual tax revenue and the tax revenue which would be generated by an R-based cash flow tax levied in the corporate sector. The idea behind that measure is that neutral taxes, such as an R-based cash flow tax, do not tax marginal investments and hence have a marginal tax rate of 0. The difference between taxes raised by the current system and the neutral cash flow tax thus provides an estimate of the taxation of marginal investment. Dividing this difference by the marginal return on capital therefore gives an estimate of the effective marginal tax rate.

To compute the latter, we make four adjustments to actual taxable income: (1) add back net interest payments, (2) add back capital allowances, (3) deduct new investment expenditure, and (4) deduct changes in inventories. The precise definitions used are set out in the Data Appendix (section 4.5).

As might be expected, these measures give very different accounts of the development of taxes on capital income in the UK corporate sector over the last three decades. At the extreme, for example, in 1981, at the height of a recession, the EMTR was around 4 per cent, while the Mendoza et al (1994) approach - ITR
- generated a rate of slightly under 75 per cent. Of course, these two approaches are not attempting to measure the same thing: the first attempts to measure the impact of taxes on the cost of capital, while the second is based on tax revenues. It has long been known that marginal and average tax rates can be very different from each other. But these differences do imply that, for example, using the ITR as a measure of the impact of tax on investment at the margin could be seriously misleading.

However, even measures which might be thought to be comparable are very different from each other. Compare, for example, the ITR and the accounting measure - ATR. Both are measures of tax revenue – or liabilities – in a year, expressed as a proportion of pre-tax income in the same year. Yet the values of ATR are much lower than those of ITR. Further, they tend to move in opposite directions: the former tends to fall in recessions, while the latter tends to rise. In fact, the correlation between these two series is negative: -0.24.

Both of these measures generate different values and patterns compared to the measure of the effective average tax rate (EATR). By contrast, that is more stable over the period analysed. This reflects the fact that it is based on legal tax provisions, rather than tax revenues. In particular, it tends to be reasonably close to the statutory tax rate. But this helps to pinpoint why the other two measures differ so much. Tax liabilities are equal to the statutory tax rate multiplied by the tax base. The evidence from Figure 10 therefore suggests that the denominator of the ATR measure – accounting pre-tax profits – tends to be higher than taxable profit, while the denominator of the ITR measure tends to be smaller than taxable income. Of course, this is not the whole explanation; the ITR measure relates to a wide range of taxes, and not just to corporation tax.

For this reason we have used the aggregate data to develop an average tax rate measure for the corporate sector only (ITR-COR). This is more comparable to the other average tax rate measures, generally lying between the EATR and the ATR. We discuss it further in Section 4.1.2.4.

There is some similarity in the two measures which are aimed at investigating marginal tax rates: the EMTR and GKS. These both rise during the 1980s to a
peak in around 1989 before falling back. However, the decline in GKS in the 1990s is more dramatic: from about 44 per cent in 1989 to just below 19 per cent in 1993. In the second half of the 1990s there is a partial recovery. The EMTR falls from around 31 per cent, but much more slowly. In general, this follows the pattern that the measures based on observed tax liabilities or revenues tend to be rather more volatile than the measures based on legal tax provisions.

One of the important policy issues relating to this analysis is whether increasing globalisation is driving increasing tax competition between countries, and hence lower taxes on capital income. The European Commission (1997) has presented evidence (from the 1980s and first half of the 1990s) in favour of this view, based on a version of the ITR. As can be seen from Figure 10, the ITR in the UK does indeed fall over that time period. There was also a fall in the EATR in the first half of the 1980s – when the statutory tax rate was cut from 52 per cent to 35 per cent - and a smaller fall thereafter (the statutory tax rate has subsequently been gradually cut to 30 per cent).

However, the other measures in Figure 10 do not support this view. The accounting measure – ATR – has remained reasonably stable since 1980, and if anything, has increased. The EMTR increased as a result of the 1984 reforms, but has subsequently fallen a little. As noted above, the GKS measure has been quite volatile.

However, the aim of this section is not to evaluate whether taxes on capital income have fallen or not, the analysis of which follows below. It is rather to compare alternative measures, to try to identify the reasons for differences between them, and to discuss how they might be best measured in practice. In order to address this, we now turn to a closer look at some of the main measures.

4.1.2.2 Effective tax rates

Effective tax rates can only be calculated if one is willing to make strong assumptions. Devereux (2004) raises in particular issues concerning the role of personal taxes, alternative sources of finance, international taxes, and risk. Here we will briefly summarise the impact of different assumptions for the first two of these.
To begin, though, we first investigate the role played by alternative assumptions regarding the real interest rate and the inflation rate, and by assumptions about the weights corresponding to different assets and sources of finance used in the investment. In Figure 10, we used actual rates in the UK to generate measures of both the effective marginal and average tax rates. This gives some indication of the actual effective rate in any particular year. However, it gives a less clear picture of the degree to which effective tax rates have changed as a result of deliberate tax reform, as opposed to changes in underlying economic circumstances.

Figure 11: Effective tax rates, assuming fixed or actual inflation and interest rates

Notes: EATR: Effective average tax rate. (Economic profit rate 20%, assets: weighted average of plant & machinery and land & buildings, source of finance: weighted average of equity and debt, interest and inflation rates: as specified).


To investigate this, in Figure 11 we present series for the EATR and EMTR based on a constant real interest rate (10 per cent) and constant inflation rate (3.5 per cent). We also hold the weights reflecting the different forms of investment and finance constant over time. Variation in the resulting series therefore reflects only the impact of tax reforms. As can be seen from the Figure, these two series correspond closely to those in Figure 10 (which are reproduced here). The broad conclusions stated above are unchanged. Using constant values of these parameters removes much of the year-to-year volatility in the series, but the longer-term movement is not affected.
In Figure 12, we compute the same tax rates under the assumption that the relevant shareholder is a UK taxpayer who faces the highest rate of personal income tax and capital gains tax. Introducing personal taxes has several effects. Most centrally, the required post-tax rate of return from an investment in equity falls, since the post-tax return from the alternative – assumed to be an interest-bearing deposit – also falls as (nominal) interest received is now taxed. The dividend stream is also taxed, but for much of the period analysed, this tax was reduced by the tax credit available under the UK imputation system; and in any case, dividend taxation is only relevant for investment financed by new equity. It should be noted that the top personal income tax rate was very high in the 1970s; in fact, including an investment income surcharge, the rate reached 98 per cent between 1974 and 1978. It has since fallen considerably, and has been at 40 per cent since the late 1980s. Figure 12 is based on the case introduced in Figure 11: the real interest rate, inflation rate and weights are all fixed over time.
Introducing personal taxes has a dramatic effect on both the EATR and the EMTR\textsuperscript{75}. The very high personal tax rates in the 1970s have a striking effect on the EMTR: because nominal interest income was taxed at very high rates, the real post-tax income from lending was negative.\textsuperscript{76} As a result, the required pre-tax return from investment in equity is large and negative. As personal tax rates fell, the EMTR rose. By the end of the period it is close to zero.

For the EATR, there are offsetting effects. As with the EMTR, the high taxation of interest implies a lower discount rate, which raises the net present value of an investment with a given pre-tax return. This tends to reduce the EATR, as it reduced the EMTR. However, offsetting this, the return from the investment is also taxed at a higher level, reflecting the personal tax as well as the corporate tax; this second factor plays a more significant role for an investment which is profitable than for one which is marginal. Consequently, the EATR could move in either direction. In practice, in the presence of personal taxes, the EATR was higher in the 1970s, but fell at intervals through the period. By the 1990s, the EATR was lower than in the absence of personal taxes.

\textsuperscript{75} Without personal taxes it makes no difference whether equity finance represents new equity or retained earnings. With personal taxes the two differ. In Figure 11 we assume all equity finance is new equity.

\textsuperscript{76} We implicitly assume here that the tax system is symmetric: that is loss-making firms receive a tax rebate. In practice this is not generally true. Losses can be carried back to offset against earlier profit, but only in a very limited way. Beyond that, they can be carried forward indefinitely to set against future profit. But in doing so, the loss-making firms bears a cost of delay in receiving the tax credit.
Figure 13: Effective tax rates, effect of debt finance

Notes: EATR: Effective average tax rate. (Economic profit rate 20%, assets: weighted average of plant & machinery and land & buildings, source of finance: weighted average of equity and debt unless specified otherwise, interest and inflation rates: fixed).

Figure 13 again reproduces the series based on fixed interest and inflation rates from Figure 11. This time however we also add in a series calculated for investment financed only by debt. As might be expected, both the EATR and the EMTR are lower in this case, since the impact of interest deductibility is greater. However, the impact is noticeably different between the EMTR and the EATR. Since the latter is defined for a profitable investment, the impact of being allowed to deduct interest payments is fairly small, relative to the income generated from the investment. However, in the case of a marginal investment financed by debt, the interest payment is much more striking. In cases where depreciation allowances are close to 100 per cent (in the early 1980s, this was true for buildings as well as for plant and machinery), the EMTR had large negative values.

In sum, the EMTR depends crucially on assumptions about personal taxes and about the source of finance for the hypothetical investment. The EATR also depends on these factors, although the effects are not as dramatic.
4.1.2.3 Accounting data

A common approach in empirical work is to estimate measures of the taxation of income from capital using company accounting data. Such data are now fairly readily available in many countries. We make use of the data for all listed UK companies provided by Thomson Financial Datastream. These data are available from around 1969 onwards. The dataset contains just under 3,000 firms. The number of observations per firm ranges from 1 to 32. In total, the dataset contains around 38,000 observations.

The typical approach here is to take the ratio of tax liabilities to pre-tax profit as specified in the profit and loss account. Devereux (2004) analysed such an approach, and compared it to the effective average tax rate described above. Clearly there is a distinction in principle between the two approaches. The accounting ratio represents the impact of tax at a moment in time, and not over the life of a particular investment. Also, it reflects the past history of the company and the tax regime, since many items are carried forward from one year to the next. Nevertheless, it is instructive to compare the two approaches in practice to identify whether they produce similar estimates of an average tax rate.

In using such data, however, many accounting issues need to be considered. First, profit is generally computed on a historic cost basis, which typically overstates true profit in periods of reasonably high inflation. But the tax system, too, is sensitive to inflation. Thus the average tax rate may reflect this distortion to measuring both accounting profit and taxable profit.

Second, most readily available datasets containing accounting records refer to consolidated accounts — and, in particular, the consolidated accounts of multinational companies which reflect profits earned around the world and taxes paid around the world. It may be possible — and often is in the Datastream data — to identify separately home and foreign tax liabilities. But it is more difficult to identify separately profit generated at home and abroad. Depending on the

77 This is not always true. In some cases, tax liabilities which are clearly labelled as overseas tax in the published accounts, are not separately identified in Datastream. This would lead us to overstate the UK tax liability.

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relative size of the foreign activities of the company, this may pose considerable problems. If, for example, we want to find a measure relating to the UK corporation tax, then we would want to include only UK tax, and UK profit. Including all profit would understate the UK tax rate. Including all taxes paid by the company would result in a measure which is contaminated by taxes paid elsewhere.

A third problem arises in that the published tax charge may not represent the company’s current tax liability. Suppose, for example, that the tax regime is more generous than implied by accounting standards, since depreciation allowances are higher than accounting depreciation charges. Then in a period of investment, the recorded tax charge may exceed the actual tax liability, as accountants include a provision for additional tax to be paid in the future. At the extreme, the recorded tax provision may simply be the statutory rate multiplied by pre-tax profit. Any difference between this and the actual tax liability could be regarded as deferred tax. Of course, in this case, the tax rate generated using the recorded tax charge as a ratio of pre-tax profit would therefore simply be the statutory tax rate.

We can largely avoid the third of these problems, since our data identify deferred tax. In the series shown in Figure 10, we instead make use of an item which is closest to the full UK corporation tax charge.\textsuperscript{78} This is divided by pre-tax profit (after depreciation and interest payments) to generate the average tax rate measure.

\textsuperscript{78} Datastream account item 160, labelled “Corporation Tax”.

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For comparison, Figure 14 shows this together with three other definitions of taxation:

(i) UK corporation tax plus the overseas tax charge

(ii) Total tax charge as recorded in accounts (including deferred tax)

(iii) UK corporation tax, less advance corporation tax (ACT), but adding back irrecoverable ACT.\(^79\) This can be thought of as a measure of “mainstream” corporation tax before any income tax due on dividends.

In each case, an average tax rate is formed by taking the ratio of the tax liability to pre-tax profits. Because the four measures of the average tax rate in Figure 14 are all calculated with reference to the same measure of pre-tax profit, the differences between them reflect only differences in the measure of taxation. The differences are striking. First, in the early part of this period, the overseas tax

\(^{79}\) ACT can be thought of as a prepayment of the shareholders’ income tax due on dividend payments by the firm, and was paid by firms until 1999. Until 1997, it could be reclaimed by zero-rated shareholders. ACT payments by the firm could be offset against the full tax charge, but only to the extent that gross dividends did not exceed taxable profit. ACT which was unlikely to be offset within a reasonable period was charged against profit, and was known as irrecoverable ACT.
charge was very high, at times even greater than the UK tax charge. Measure (i) therefore results in average tax rates of around 60 per cent in the early 1970s. However, over time, this measure declines substantially. Broadly, by the second half of the 1990s, the base case UK average tax rate was just over 20 per cent, and including the overseas tax charge raised this to around 30 per cent. Measure (ii) – including overseas tax and deferred tax – results in a similar pattern: very high tax rates in the early 1970s, but dropping substantially over the period.

Although measure (i) does not relate only to UK taxation, arguably it gives a clearer picture of the impact of worldwide taxes, since both the numerator and denominator relate to worldwide activities. Based on this measure, then, there appears to have been a striking decline in the average tax rate. By far the biggest part of this occurred in the 1970s.80

The final measure (iii) in the Figure is close to mainstream corporation tax – before any income tax is charged to UK shareholders. As might be expected, this is much lower. It too fell in the 1970s, before partly recovering in the first half of the 1980s. In the 1990s it was fairly stable at around 10 per cent of pre-tax profit.

4.1.2.4 Measures based on macroeconomic data

The main outlier in Figure 10 is the overall average tax rate on capital income (ITR). This is based on a measure proposed by Mendoza et al (1994). A similar series was calculated by Eurostat (1998)81 and is presented alongside the Mendoza measure in Figure 16. In 1970 this measure was at a very high rate of 77 per cent. It moved considerably with the economic cycle in the 1970s, falling to 51 per cent in 1977, but rising to 73 per cent again in the recession of 1981. However, since 1981, it has fallen steadily to 32 per cent in 1994, before rising again slightly. By the mid 1990s, it was at a rate comparable to the statutory tax

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80 This may also be a more reliable measure, given the possible problems in under-recording overseas tax in Datastream.
81 OECD (2001) suggests some modifications to the Mendoza et al. measure. For the UK their changes reduce the estimate of the tax rate on capital income by on average 9 percentage points. However, the pattern over time is hardly affected, so we do not present this measure here. The proposed changes to the definition do not affect property taxes or petroleum taxes, so that the following analysis would equally apply to their measure.
rate on retained earnings. It is this dramatic fall in the 1980s and early 1990s which drew the attention of the European Commission (1997). It is therefore worth examining this measure in some detail.

The basic approach of this measure is first to classify all taxes as being on labour, consumption or capital. The last of these categories is, in effect, a sweep-up category; it includes taxes on capital income, such as corporation tax, and taxes on property income, but it also includes inheritance taxes and gift taxes. To turn this into a tax rate, these tax revenues are divided by a measure of capital income, taken as the aggregate operating surplus of the economy.

**Figure 15: Analysis of the numerator of the Eurostat implicit capital tax rate**

Within the group of taxes on “capital”, there are two large categories – corporate income taxes and taxes on ownership of land and property. There are a number

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82 In Eurostat terminology this is referred to as a tax rate on “factors of production other than employed labour” rather than “capital”. It is however usually interpreted as the tax rate on capital, so we stick to this simpler label.
of other smaller taxes grouped together. Figure 15A shows the overall development of these taxes over time, and Figure 15B shows the development of each group of taxes, both expressed as a proportion of GDP. Each of these groups has generated broadly similar revenue over the period, although all are fairly volatile. Most noticeably, revenue from all three groups has declined as a proportion of GDP since the end of the 1980s.

To examine these patterns further, the other parts of Figure 15 examine in turn the development of taxes on land and buildings and corporate income taxes.

Figure 15C investigates the development of taxes on land and buildings by examining its individual components, together with two other forms of property tax that are not included. The relatively constant factor in these taxes is a property tax on businesses, known as business rates. However, the end of the 1980s and early 1990s witnessed changes in the system of domestic property taxes. In 1989, the domestic property tax (domestic rates) was replaced by the Community Charge. This was based on the number of individuals resident in a property, and is not included by Eurostat (1998) as a tax on land and buildings. In 1993, this was replaced by the Council Tax, which is again levied primarily on the property. However, this is also not included by Eurostat (1998) as a tax on land and buildings. The effect is that the aggregate revenue from taxes on land and buildings (expressed again as a share of GDP) appears to fall sharply in 1990 when domestic rates were abolished. Yet the overall level of these local domestic taxes remained fairly constant over the entire period.

Figure 15D investigates the development of taxes on corporate income over the same period. Here we distinguish between corporation tax, and special taxes on the profits from North Sea oil and gas production (notably Petroleum Revenue Tax). These special taxes raised considerable amounts of revenue in the first half of the 1980s, but these revenues dropped away sharply after that period due to

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83 Council tax is based on the value of residential property, but it also depends on the circumstances of the residents of a property. There are discounts for second homes and properties inhabited by one person only. For some residents it is waived, e.g. for full-time students.

84 The Mendoza et al. tax rate excludes the Community Charge, but not the Council Tax.
lower oil prices and more costly production. By contrast, revenue from corporation tax\textsuperscript{85} rose sharply over the 1980s, before falling back in the first half of the 1990s. Abstracting from the oil sector, then, it is true that corporation tax revenues fell in the first half of the 1990s; however, the pattern over a longer period shows that this was merely bringing revenue (as a proportion of GDP) back down to its earlier levels. The pattern shown in Figure 15A is therefore rather misleading.

The lesson of the analysis of Figure 15 is that the interpretation of an aggregate average tax rate on capital can be problematic. In this case, the fall in the tax rate is caused by a move from a purely property-based tax to a tax that is less directly related to property, together with a fall in the oil price and hence the profitability of the off-shore oil extraction business. Clearly neither change has more than an indirect effect on the taxation of on-shore capital in the UK.

\textbf{Figure 16: Implicit tax rates}

![Figure 16: Implicit tax rates](image)

Notes: ITR are implicit tax rates on capital from different sources, ITR-COR are implicit tax rates for the corporate sector calculated under different assumptions.

For comparison with the other measures in this chapter, which analyse taxes on capital income generated in the corporate sector, it would be useful to have an average tax rate applying to income generated in the corporate sector. We

\textsuperscript{85} This includes corporation tax on North Sea activities.
therefore develop such a measure here.\footnote{There have been previous attempts to define such tax rates for the corporate sector, e.g. Bretschger and Hettich (2002), Nicodeme (2001), OECD (2001) and literature cited therein. None of them have however attempted to deal with taxable property income, including interest.} The numerator of this measure is in principle straightforward: total UK corporation tax receipts (before deducting ACT). However, the appropriate denominator is trickier. Broadly, we generate a measure of income generated by the corporate sector, net of interest payments to the personal sector, or abroad. Because of the deductibility of interest for tax purposes, interest payments from the corporate sector to the personal sector are taxed by the personal income tax system. As we do not include personal income taxes on interest in the numerator, our measure would be biased downwards if we did not make this adjustment.\footnote{See the Data Appendix for details. Note that these adjustments are even more important if one wished to calculate such a tax rate for a sub-sector of the economy, e.g. the manufacturing sector. The net interest flows from this sector to the financial sector would be substantial.} Figure 16 presents this series (labelled “ITR-COR, revenue based”) for the UK. Unfortunately, it is not possible to generate precise estimates of this measure back as far as 1970. We therefore also present an approximation to the measure (“labelled ITR-COR, approximate”), in which the denominator is not corrected for net interest payments by the corporate sector. These two series are fairly close during the period in which they are both available.

As can be seen, both are considerably lower than the original tax rate on capital proposed by Mendoza et al. and the version used by Eurostat. The corporate sector average tax rate does drop significantly in the first half the 1990s. However, it recovers in the second half of the 1990s, and the level by the end of the 1990s was around that at the beginning of the 1980s. We can thus conclude that an overall average tax rate on capital can be very misleading, certainly if it is taken to be an approximate measure of the average tax rate on income generated in the corporate sector.

We also take one further step in developing this measure, to offset volatility in the measure due to timing. As taxes are paid with a lag, the tax rate is procyclical: in a recession profits fall, but revenues do not (at least initially) since they are largely based on the previous year’s profits. The opposite happens in a
boom. We abstract from this effect by using a series on corporation tax accruals,\textsuperscript{88} rather than revenues. As a result, much of the volatility of the ITR measure disappears. It is also interesting to note that after all of those adjustments, the measure has become much more similar to the measure based on accounting data, the ATR.

The remaining measure of the group of measures based on macroeconomic data is the marginal tax rate of the corporate sector based on the approach by Gordon et al. (2004). Just as the ITR-COR (except for the accruals version) is more volatile than the effective average tax rate measures based on tax legislation, so the GKS measure is more volatile than the effective marginal tax rate. For the few years during which both are available, the correlation is however strong, with a co-efficient of correlation of 0.72.

4.1.2.5 Conclusions from the case study

This section has explored the properties of alternative measures of the taxation of income from capital, by applying them to data for the UK over the last thirty years. We have considered several types of measures, reflecting both average and marginal rates.

The main comparison between the broad measures shows that there is a significant difference between the measures, both in their level and in how they move over time. The implicit assumption in some empirical work that these measures are broadly comparable to each other is not justified. Rather it can make a substantial difference whether the measure is based on a hypothetical investment or observed tax liabilities or revenues; whether it is average or marginal; and whether data are derived from company accounts or aggregate revenue series.

The remaining analysis has considered the derivation of the measures in more detail, and documents how different values can be derived by making different assumptions, or using alternative forms of data. Effective tax rate measures based

\textsuperscript{88} From Inland Revenue Statistics.
on hypothetical investments depend crucially on assumptions regarding personal taxes; the source of finance used; and whether underlying economic parameters are allowed to vary over time. Alternative definitions of taxation from company accounts can give a markedly different picture of the development of taxes over time. Measures based on aggregate revenue data, particularly the very broad measures of taxes on “capital” depend crucially on what taxes are included in the measure. A more focused measure on corporate income is suggested.

In general, the broad conclusion is that appropriate choice of methodology and careful use of data are both vital in the construction and use of tax rates which are intended to summarise the taxation of income from capital. This should be borne in mind during the following discussion of the development of taxes systems.

4.2 Unilateral reforms

4.2.1 Stylised facts about tax reforms

We now proceed to consider developments at the international level using data on eighteen countries – the EU and the G7. We begin with a description of the development of source-based capital income taxes over the last two decades.\(^8^9\) A number of other studies have presented a description of corporate income taxes across countries in a particular year.\(^9^0\) However, there has been very little description of how they have developed over time, across a wide range of countries.\(^9^1\) Here, we therefore begin by presenting a systematic account of how such taxes have developed over time using measures described above. Using these measures, we describe a number of stylised facts about the development of corporate income taxes. We also comment on the recent moves towards international cooperation.

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\(^{89}\) The tax data used here are available at http://www.ifs.org.uk/data/internationaltaxdata.zip.


\(^{91}\) Chennells and Griffith (1997) present similar measures to those here, although for a smaller number of countries and years. Mendoza et al (1994) also present a time-series for taxes on “capital”; however, for reasons explained elsewhere, we do not believe that their measure adequately captures the incentives for investment created by corporate income taxes. Haufler, Klemm and Schjelderup (2006) consider the mix of profit and wage taxes over time.
Data on tax revenue are available from 1965, and we can therefore track the development of revenue over 35 years. However, data on the rules of tax systems are more difficult to collect. We present measures of effective tax rates based on sixteen of these countries (excluding Luxembourg and Denmark) from 1982 to 2001.

4.2.1.1 Measures based on tax legislation

From this group of measures we will consider statutory tax rates, the net present value of depreciation allowances and marginal and average effective tax rates.

The statutory tax rate

Figure 17: Statutory corporate income tax rates

Figure 17 shows the tax rate for each country for which data are available in 1982 and 2001. Over this period, the statutory tax rate fell in most of these 16 countries. Only Italy and Spain increased their tax rate, each by around two percentage points. The Irish rate remained unchanged. Between 1982 and 2001, the unweighted mean statutory tax rate for this group of countries fell from around 48 per cent to around 35 per cent. Throughout the period Ireland had the minimum rate at 10 per cent (Ireland had reduced the tax rate on manufacturing activities from 45 per cent to 10 per cent in 1981).
In Figure 18 we present the time series of the mean (weighted by GDP, measured in US dollars) and the median. The fall in tax rates was fairly continuous, though most pronounced in the late 80s. The unweighted mean (not shown) reveals a similar pattern, though with a slightly steeper fall and lower tax rates in every single year. The median falls by more than the weighted mean.

**Stylised fact 1: statutory tax rates fell over the 1980s and 1990s.**

As discussed above, the statutory rate is just one of the factors determining tax payments. We therefore now turn to the tax base. However, the tax rate may be important in its own right, since it is the marginal rate of tax applied to any additional income, given a level of allowances. It is therefore likely to be relevant in determining the incentive for firms to shift income between countries, conditional on where their real activity takes place. We return to this issue below.
The tax base

Figure 19: PDV of depreciation allowances

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 20: Average PDV of depreciation allowances

Notes: Allowances defined as in Figure 19, 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$. Denmark and Luxembourg have been excluded from the average in every year due to missing data in some years.

In Figure 19 and Figure 20 we present estimates of the PDV of allowances for investment in plant and machinery, expressed as a percentage of the initial cost of the asset.

In almost all countries, allowances are based on the original cost of an asset, and are not adjusted in line with inflation. To the extent that nominal interest rates
move in line with inflation, a reduction in the inflation rate (expected over the lifetime of the asset) would increase the PDV of (expected) allowances. This raises the issue of what is the appropriate way of comparing the value of allowances between countries and over time. Figure 19 shows the PDV for each country in 1982 and 2001, based on a single nominal discount rate for all countries and all years.\footnote{This Figure therefore reflects changes in the rates of allowance set by governments, and abstracts from changes in the inflation rate and the real interest rate. However, it is possible that governments have observed or expected changes in the inflation rate (which has generally fallen over the period analysed), and adjusted their allowance rates accordingly. To allow for this, in Figure 20, we present the two versions of the weighted average PDV of allowances. The first uses a constant nominal discount rate (as in Figure 19), while the second uses one 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 inflation rate actually observed in that country in period t.\footnote{The nominal discount rate is 13.9\%, based on inflation of around 3.5\% and a real discount rate of 10\%.\footnote{Data for inflation are annual percentage changes in the consumer price index over the year. Source: IMF (2001).}}

Of the 16 countries analysed in Figure 19, 10 cut their allowance rates for investment in plant and machinery between 1982 and 2001 - that is, they have broadened their tax bases. Most notably, the UK and Ireland decreased their allowances substantially from 100 per cent to 73 per cent and 71 per cent respectively. Five countries kept their allowances constant and only one country, Portugal, increased allowances.

Figure 20 presents the time series of the weighted mean with constant and actual inflation. Not surprisingly, given the evidence of Figure 19, when inflation is held constant, there has been a decline in the average PDV of allowances for plant and machinery; that is, the rates of allowance set by governments have become less generous. In fact, on this basis, the weighted mean fell nearly ten percentage points, from 83 per cent to 74 per cent. The largest part of this decline
was in the late 1980s; cuts were less pronounced in the 1990s. An unweighted average (not shown) reveals the same pattern, as does the median.

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, but the impact of the decline in the rates has been offset by the lower discount rates implied by lower inflation.

*Stylised fact 2: on average, tax bases were broadened between the early 1980s and the end of the 1990s; however, the impact of reduced rates of allowance was moderated by lower inflation.*

In the analysis above we have considered the PDV of allowances for an investment in plant and machinery. We have also calculated the PDV of allowances for investment in industrial buildings. These yield lower PDVs, corresponding to lower rates of allowances – which in turn reflect the lower economic depreciation rates of buildings. However, there was also a fall in the average PDV for buildings over the period considered.

**Effective tax rates**

Our base case for the effective tax rates is an investment in plant and machinery, financed by equity. We ignore any personal taxes paid by the marginal shareholder. These effective tax rates also 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 (at 10 per cent) and the economic depreciation rate for each asset (12.25 per cent for plant and machinery and 3.61 per cent for industrial buildings).

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94 We do not incorporate any forms of personal taxation, so there is no distinction between investment financed by new equity or retained earnings.
Figure 21: Effective marginal tax rates

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 22: Average effective marginal tax rates

Notes: Effective marginal tax rate defined as in Figure 21, 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$. Denmark and Luxembourg have been excluded from the average in every year due to missing data in some years.

Figure 21 and Figure 22 show the development of EMTRs over time, using the same format as in previous figures. In Figure 21 we follow the approach of Figure 19, in holding inflation constant across all years and countries. In Figure 22 we mirror the approach of Figure 20 in presenting the weighted average across countries both with inflation fixed, and using the inflation rate actually observed in the country and period in which the investment is assumed to take place. Note that these rates correspond to the EATR evaluated for a
marginal investment, that is, when the pre-tax rate of profit is equal to the cost of capital ($p = \tilde{p}$).

The development of the EMTR over time does not 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. Considering the rates under the constant inflation assumption (Figure 21) we see that in more than half of the countries the EMTR has decreased, although in many others it has increased. Figure 22 shows that, given fixed inflation, the weighted mean EMTR moved without trend over the period; it rose a little during the early and mid 1980s, but has since fallen back to its initial level. On the same basis, the unweighted mean fell by nearly 4 percentage points over the period, and the median by six percentage points; this is consistent with a greater fall in smaller countries, as reflected in Figure 21. There is also a slight fall between 1982 and 2001 in the weighted mean EMTR based on actual inflation rates in each country and year. Again, this measure rose slightly in the 1980s; however, its subsequent decline has been greater, leaving it around 3 percentage points lower than in 1982. This largely reflects the evidence shown in Figure 20; with lower inflation rates, a given allowance rate is more generous, leading to a lower EMTR.

**Figure 23: Effective average tax rates**

![Figure 23: Effective average tax rates](image)

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 24: Average effective average tax rates

Notes: Effective average tax rate defined as in Figure 23, 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$. Denmark and Luxembourg have been excluded from the average in every year due to missing data in some years.

Figure 23 and Figure 24 present evidence for the EATR, following the same approach as with the EMTR. In each case, the investment project is assumed to have an expected rate of economic profit of 10 per cent (i.e. \( p - r = 0.10 \)). Figure 23 shows that, given the fixed inflation assumption, the EATR fell in all but three of the countries. The pattern of reduction reflects the pattern seen in the development of the statutory tax rate in Figure 17 and Figure 18. The EATR for industrial buildings follows similar patterns.

Figure 24 shows that, on the basis of fixed inflation, the weighted mean EATR fell over the period from around 41 per cent to around 34 per cent. Based on actual inflation, the fall in the EATR was similar, from 42 per cent to 33 per cent. 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. Nevertheless, the two approaches give a similar qualitative picture of the development of effective tax rates.
Figure 25: Average effective average tax rates at different levels of profitability

Figure 25 shows the weighted mean EATR at different rates of economic profit, for the fixed inflation case. The lowest line is the weighted mean EMTR (equivalent to the EATR evaluated at zero economic profit, a marginal investment). The three higher lines represent the EATR for investments with increasing rates of profitability. The highest is simply the statutory tax rate (to which the EATR converges as profitability rises). This Figure confirms the previous discussion; the reduction in the EATR is greater the higher is the profitability of the investment. At one extreme, it is equal to the statutory rate, which has fallen significantly. At the other, it has remained fairly constant.

Notes: Effective average tax rate defined as in Figure 23. Average weighted by GDP in US$. Denmark and Luxembourg have been excluded from the average in every year due to missing data in some years.
Figure 26: Average effective tax rates at different levels of profitability

The difference in the effective tax rate at very low and very high levels of economic profit has fallen over time. This is shown in Figure 26, again for the fixed inflation case. The top line shows the weighted average effective average tax rate in 1982 at different levels of profitability. It rises sharply as economic profits rises from 0 per cent to 20 per cent and then flattens out, converging to the statutory tax rate. The lower line shows the same relationship in 2001. At the margin, the weighted mean EATR is very similar for the two years. However, in 2001, while the effective average tax rate still rises with profitability, it does so more slowly, and never reaches the higher rates seen in 1982.

Stylised fact 3: the effective marginal tax rate has moved without a trend over the 1980s and 1990s; effective average tax rates for projects earning positive economic profits have fallen over the 1980s and 1990s, and they have fallen more at higher levels of profitability; allowing for lower inflation implies a small reduction in the effective marginal tax rate, and a greater fall in the effective average tax rate.

4.2.1.2 Measures based on tax revenue

We now turn to a consideration of the second group of measures. For reasons given in section 4.1.2.4, we do not use the very broad measures of implicit tax rates on capital in the analysis here. While there may be case for using the
narrower measure for the corporate sector only, the data requirements are huge, and therefore such a measure can only be computed for a few countries and time periods. We therefore do not use revenue-based measures of tax rates here. However, in order to analyse the size of revenues raised from corporate income taxes we do present a description of the development of revenues from corporate income taxes.

Remember that these may 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.

Figure 27: Corporate income tax revenue (per cent of GDP)

![Graph showing corporate income tax revenue as a proportion of GDP from 1965 to 1999. The 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 most years it is within the interval from 2.5 per cent to 3.5 per cent of GDP. The median remains fairly constant until the early 1990s when it rises slightly.]

Notes: Average weighted by GDP in US$. Portugal has been excluded from the average in every year due to missing data in some years. All taxes levied on profits and capital gains of corporations are included. Source: OECD.

Figure 27 presents the time series of tax revenues from corporate income as a proportion of GDP from 1965 to 1999. We use data from OECD Revenue Statistics on tax revenues from corporate income and capital gains paid by corporations. The 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 most years it is within the interval from 2.5 per cent to 3.5 per cent of GDP. The median remains fairly constant until the early 1990s when it rises slightly.
Stylised fact 4: tax revenues on corporate income have remained broadly stable as a proportion of GDP since 1965.

Despite this general observation, it should be noted that developments vary strongly across countries. The unweighted mean (not shown) increases during the period, rising from around 2.3 per cent to 3.4 per cent, which suggests that revenues from corporate income taxes have grown in smaller countries.

This pattern of tax revenues may seem inconsistent with the stylised facts presented above, which indicate a fall in statutory tax rates and the EATR. It can be partly explained by changes in profitability. In some countries it may be partly due to the tax system itself. For example, Ireland has had a 10 per cent tax rate on manufacturing activity since the early 1980s. As a consequence there has been a dramatic increase in inward investment and, presumably, in profit shifting into Ireland. These two factors in turn have boosted corporate income tax receipts as a share of GDP, despite the continuing low tax rate.

Figure 28: Corporate income tax revenue (per cent of total tax revenue)

Notes: Same notes apply as in Figure 27.

Part of the explanation for the maintenance of the ratio of revenue to GDP is an increase in the size of government generally. To see this, we consider, in Figure 28, equivalent measures to Figure 27, but based on the ratio of taxes on

95 For a detailed discussion of how the UK has managed to raise high tax revenues from a low tax rate, see Devereux, Griffith and Klemm (2004).
corporate income to total tax revenue. This paints a rather different picture. Corporate income taxes have fallen on average as a share of total tax revenue. The weighted mean of the ratio of corporate income tax revenues to total tax revenues declined steadily until the mid 1980s. It then recovered in the late 1980s before falling back to the lower level. Combined with Figure 27, this suggests that taxes from sources other than corporate income have risen rather faster than GDP, and that – relative to other taxes - governments are relying rather less on corporate income taxes.

Stylised fact 5: tax revenues on corporate income have declined as a proportion of total tax revenue since 1965.

4.2.2 Interpretation of findings

The previous section established a number of stylised facts about the development of corporation taxes over the last two decades. Over roughly the same period of time, there has been a great deal of theoretical work on tax competition, as surveyed by Wilson (1999). In this section, we ask whether theory can explain the stylised facts.

The central results of the tax competition literature were established by Wilson (1986) and Zodrow and Mieszkowski (1986). In the context of perfectly mobile capital between many jurisdictions, the post-tax rate of return earned on capital must be equated between jurisdictions. As a result, any tax on capital levied within a jurisdiction will raise the required pre-tax rate of return and, in doing so, drive part of the capital stock elsewhere. This spillover effect between jurisdictions creates an additional cost to levying a source-based tax on capital. As a result, the optimal tax rate is lower than it otherwise would be, and if this is the only source of revenue, this leads to an underprovision of public goods. This canonical model is at the heart of concerns about capital tax competition within the EU.

In a closely related paper, Gordon (1986) also considers other tax-raising opportunities. He compares source-based and residence-based capital income taxes in a two period model of a small open economy. The source-based tax has the same effects as in the canonical model, driving up the pre-tax required rate of
return and driving away capital. However, the residence-based tax does not have these effects. Hence in this model, the source-based tax should not be used; instead revenue should be raised from a residence-based tax. This type of analysis\textsuperscript{96} has led to fears of a "race to the bottom", in which source-based capital income taxes disappear altogether.\textsuperscript{97}

Of course, there are considerable practical problems in levying a residence-based tax on capital income, especially if the tax is to apply to income earned but not repatriated. As a result, as the survey by Wilson (1999) suggests, the theoretical literature has generally investigated models where residence-based taxes are either limited or not available.

At first glance it seems that these models are a good starting place for understanding at least part of the stylised facts described in the previous section. Beginning with some degree of imperfect capital mobility, and allowing an exogenous increase in mobility over time, would result in the optimal tax rate on capital falling over time (as seen in the stylised facts).

However, the models in these papers – as with most others in the literature – do not specifically allow for the two broad instruments which governments have available for taxing capital income: the tax rate and the tax base. Instead the tax base is generally assumed to be equal to capital income net of true economic depreciation, but before any costs of financing investment. An advantage of this formulation is that it is tractable, since it becomes possible to write the required post-tax rate of return ($r$) as a simple function of the tax rate ($t$) and the pre-tax marginal product of capital ($F_K$): $F_K(1-t) = r$. But, clearly from this expression, $t$ is an effective marginal tax rate (EMTR): it reflects the difference between the required return on capital in the presence and absence of tax. Yet $t$ is typically assumed to be the statutory rate. In general, then, these models do not permit governments to choose separately the tax rate and tax base. But there are many

\textsuperscript{96} See also Razin and Sadka (1991).

\textsuperscript{97} Gordon and Mackie-Mason (1995) consider two tax instruments: corporation tax and personal income tax. They contrast the corporate income shifting between countries with income shifting between the personal and corporate sectors.
combinations of the rate and base which can generate a given EMTR. A tax base equal to net capital income is a special case.

In fact, it is straightforward to show that the key results of the canonical model do not survive if governments can choose the two instruments separately. As long as the revenue requirement is not too high, governments can use a cash flow tax, in which all capital expenditure is deductible in the period in which it is incurred. It is well known that such a tax generates an EMTR of zero. Revenue is generated from the infra-marginal returns, assumed in the canonical model to accrue to immobile domestic residents. In this case, an optimal tax rate can be set which generates the appropriate level of public good provision, without distorting capital flows. This is shown by Haufler and Schjelderup (2000).

However, this extension of the canonical model is clearly not sufficient to explain the pattern of existing corporate income taxes, since in fact, as shown above, the EMTR is typically not zero. One possible explanation of this is that the revenue requirement – determined by the preference for public goods - exceeds the immobile infra-marginal returns (which is certainly plausible if generally capital earns only a normal return). In this case, it may be necessary to raise revenue from a tax on capital as well – i.e. to have an EMTR greater than zero.

But whether this is the case depends also on the other tax instruments available to governments. One issue here is whether a labour income tax is more or less distorting than a tax on capital flows. In the canonical model, labour is typically assumed to be immobile. In this case, any taxes on capital are effectively borne by labour, so it is generally better to tax labour directly, than to distort the availability of capital by taxing capital. But the European Commission (1997) has argued that switching tax bases from capital to labour – as a result of increasing tax competition - has had serious implications for unemployment in Europe. Daveri and Tabellini (2000) present evidence that taxes on labour have impacted on unemployment rates. However, there have been no studies which investigate the impact of corporate income tax on unemployment that use detailed measures of taxes on corporate income that reflect both the rate and the base.
Another extension of the canonical model would consider the possibility that infra-marginal returns are mobile. In this case, imposing a tax on economic rent would also distort the location of capital; this is at the heart of the model discussed above, in which multinational firms make discrete location choices. In this case, the EMTR is not the only measure of taxation which affects location decisions; the EATR also matters.

This raises the question of the extent to which governments can rely on taxes on economic rent to raise revenue. There may be location-specific rents in a particular country — that is, economic rent over and above that which could be earned elsewhere. In principle, such location-specific rents could be taxed without distorting the location of firms and capital. The theoretical literature (see Huizinga and Nielsen 1997) concludes that such rents should be taxed as much as possible, and that investment taxes should vanish if the taxation of pure profits raises sufficient revenues.\(^9\) An example of a tax that taxed a specific location-specific rent is the UK Petroleum Revenue Tax, which raised substantial revenues from North Sea oil production. It is likely, however, that location-specific rents vary — across industries, firms and time. It is therefore difficult to capture location-specific rents with a general tax system which applies to all investment projects, while avoiding tax on rents which are not location-specific. In the model by Huizinga and Nielsen (1997) this difficulty does not arise, as all rents are location-specific.

But if all economic rents cannot be fully taxed, it will generally be optimal to tax different kinds of internationally mobile capital differently. All else equal, source-based tax rates should be lower, in terms of the pursuit of national welfare, on more mobile forms of capital. At one extreme, location-specific rents can still be taxed at 100 per cent. At the other extreme, if the same rent is available in another country, then such rents cannot be taxed at a higher rate than in the other country without causing the capital to locate there. If some location-specific rents, which accrue to foreigners, cannot be fully taxed, then it is

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\(^9\) Keen and Piekkola (1997) consider the case in which the taxation of pure profits is restricted and distorting taxes are therefore unavoidable. For these cases they derive a rule which optimally trades off distorting taxes on domestic and international capital income.
generally optimal for a small open economy to levy a distorting source-based capital income tax as a rent-shifting device. That is, setting a tax system to capture at least some of the location-specific rent will involve having a positive EMTR. We discuss these issues further below.

The theoretical literature has explored cases in which optimal tax rates may vary according to economic circumstances. For example, Bucovetsky (1991) and Wilson (1991) present models in which large countries maintain higher tax rates than small countries. The tax rate levied in large countries will have a greater effect on the equilibrium post-tax rate of return, and hence a smaller impact on the pre-tax required rate of return. Hence larger countries can maintain a higher source-based capital income tax rate.

Baldwin and Krugman (2004) present a model in which an agglomeration in one country creates a location-specific economic rent. Given the presence of an agglomeration, small changes in the source-based capital income tax rate may have little effect. However, larger changes may end up collapsing the agglomeration, which could have large welfare effects.

Our discussion in this chapter so far has implicitly assumed a benevolent welfare-maximising government. That is, we have been attempting to understand observed patterns of tax setting behaviour by identifying whether they are consistent with the optimisation of social welfare. But what if governments are not benevolent? Suppose, for example, that a Leviathan government puts greater weight on public goods than private goods, since the government itself gains some private benefit from the public provision. In a static model, that might lead the Leviathan government to set taxes on capital higher than a benevolent government; consequently there would be lower capital in the economy; and the lower welfare associated with the lower private consumption would exceed the greater welfare arising from higher public goods provision.

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99 Two papers which explore alternatives in this vein are Edwards and Keen (1996) and Wilson and Gordon (2001).
Suppose we start from such a situation and observe an increase in capital mobility. This changes the relative cost of public good provision - it becomes more expensive to provide public goods in terms of the amount of private consumption that must be given up. As long as the Leviathan government attaches some positive value to private goods for its citizens, then the higher "price" of public goods would lead to lower tax rates and public goods, just as with the benevolent government.

The relevant question here is not whether different types of government would set different tax rates, but how their chosen tax rates would respond to increases in mobility. We are not aware of any model which predicts that tax rates would increase as a result of increased mobility because the government is not welfare-maximising.100

4.2.2.1 Possible explanations of the stylised facts

The discussion above suggests that the canonical tax competition literature is not able to explain the observed behaviour of governments over the last two decades of cutting tax rates on corporate income as well as broadening the associated tax bases. In this section we discuss two possible explanations based on the notion of tax competition. Of course, there could be reasons, unconnected to tax competition, why governments have followed rate-cutting, base-broadening tax reforms. For example, they could simply be learning from each other about the construction of (more) optimal tax structures. The first major rate-cutting, base-broadening corporation tax reform was in the UK in 1984. The rationale for the reform given at the time was to reduce distortions to the investment and financial policy for UK firms, by reducing the dispersion in effective marginal tax rates across different forms of investment and sources of finance. A similar rationale was at least partly behind the corporation tax reforms included in the US Tax

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100 There is at least one model in which greater mobility leads to higher tax rates, but in a setting of a benevolent government. Janeba (1998) begins from a trade model in which two firms, resident in different countries, compete in an imperfectly competitive market in a third country. In this model, if the firms are immobile, each government has an incentive to subsidise its own firm in order to give it a competitive advantage. However, introducing capital mobility restricts this inefficient activity, since a high subsidy would attract the foreign firm, and would be captured by its non-resident owners. In this case, tax competition for mobile capital enhances efficiency, and reduces subsidies.
Reform Act of 1986. It is possible that other countries could have simply followed suit in an attempt to reduce distortions in the domestic economy. Indeed, anecdotally, there is some evidence of this occurring in the 1980s wave of reform. However, this seems less persuasive as an explanation of the continuing rate-cutting, base-broadening reforms, up to the German tax reform of 2001.

An alternative, but related explanation, has been offered by Sinn (1988, 1989). This explanation begins by noting that, given three conditions, the cost of capital is equal to the real interest rate. These conditions are: (i) that the personal tax rate of the marginal shareholder is equal to the corporate tax rate; (ii) that the marginal shareholder does not pay capital gains tax; and (iii) that capital allowances are set equal to the true economic depreciation rate. Compared to this, Sinn argues that, in the past, corporation taxes subsidised investment by being more generous in setting allowances. A tax cutting reform which cut personal and corporate tax rates equally would have only a small impact on the cost of capital. However, combining this with a reduction in allowances would reduce the subsidy to investment. A similar argument holds if the two tax rates are not exactly equal, but are both simultaneously cut.

However, a problem with this explanation is that it relies on the tax reform reducing both the corporate tax rate and the personal tax rate. While many countries did indeed institute such reforms, these taxes have rather different properties. The corporate tax is generally levied on a source basis – where activity takes place. The personal tax is generally levied on a residence basis – where the recipient of the income resides. If, in the context of an international capital market, the marginal shareholder of the firm resides in a different country, then the source country has no control over that shareholder’s personal tax rate. For the corporate and personal tax rate to be simultaneously cut requires either the marginal shareholder to be a domestic resident (which seems unlikely in the case of a capital-exporting country), or the two countries to co-ordinate on the

101 An extensive literature has analysed this reform. See, for example, Slemrod (1990), and Auerbach and Slemrod (1997).
rate cut. This does not seem a persuasive explanation of the stylised facts described above.

We consider two possible explanations of the stylised facts presented in Section 2. Both are based on forms of tax competition and both focus on the impact of taxes on economic profits on firms' investment behaviour. They differ, however, in that each considers some form of mobility other than capital. The first considers taxable profit to be mobile, independently of the location of capital. The second considers the mobility of firms (multinationals) with access to valuable proprietary assets (be these technological knowledge, management skills or brand name).

4.2.2.2 Income shifting

One possibility is that income shifting between jurisdictions is driving these reforms. Such income shifting can take simple forms: the manipulation of transfer prices on intermediate goods traded between members of the same group, for example, or lending from low tax countries to subsidiaries in high tax rate countries. Or it can take rather more complex forms, which may or may not use “special regimes” available in some countries, allowing taxpayers to reduce their overall tax liabilities. There is empirical evidence of income shifting behaviour by firms.102

One response governments can make to income shifting is to attempt to impose greater constraints on such activities. For example, one approach is to tighten and more rigorously enforce taxes on Controlled Foreign Companies (CFCs). This may drive firms to use more sophisticated, and more costly, techniques of income shifting, which in turn reduce the net benefit. This would imply less income shifting, although it may also be costly to governments in the form of administrative and compliance costs.

Income shifting itself might be seen as giving rise to competition between jurisdictions. Shifting income between jurisdictions creates spillovers just as

102 See Hines (1999) for a survey.
shifting capital does; in the case of movement of income, it is the tax base – and hence tax revenues – which move, as opposed to capital. But there is nothing to rule out countries also competing over such tax revenue. One theoretical paper, Haufler and Schjelderup (2000), has addressed the optimal choice of source-based capital income tax parameters in a model with profit shifting. This paper starts from what is essentially the canonical model described above, although in a two country setting. The paper begins by demonstrating the result referred to above: that if the government has two instruments at its disposal – the tax base and the tax rate – then it will define the tax base to be cash flow, ensuring an EMTR of zero.

Haufler and Schjelderup go on to consider the case in which firms can shift their profits between jurisdictions with some convex costs. They can do so by overpricing an input purchased from the other country. The higher the price given to this input, the lower the tax base in the home country and the higher the tax base in the foreign country. The amount of income shifted out of a jurisdiction depends on its tax rate relative to those in some lower taxed jurisdiction. Conditional on the foreign tax rate, the higher the home country tax rate, the greater the benefit of shifting income out of the home country. The firm will therefore increase the price of the input, in the process raising the marginal cost of doing so, until the marginal cost is equal to the difference in the tax rates.

This additional factor constrains the tax-setting of the home country government. The tax rate cannot be raised without a cost in terms of a smaller tax base due to greater income shifting. With a fixed revenue requirement, the government is forced to reduce allowances in order to recoup the tax revenue lost from being obliged to have a lower tax rate. In effect, the optimal policy is then to accept some distortion to capital flows in the form of lower allowances in order to reduce the incentives to shift capital out of the country.

Note that in this simple formulation, the amount of income shifted does not depend on the generosity of tax allowances; lower allowances have no direct effect on the degree of income shifting. The optimal tax rate depends on the degree of convexity of the cost of overpricing the input. It also depends, in
conjunction with the rate of allowances, on the sensitivity of the capital stock to
the EMTR.

Suppose now, in the context of this model, that there is an exogenous reduction
in the cost of profit shifting. In particular, suppose that, for any given difference
between the two tax rates, there is greater profit shifting. Other things being
equal, this would change the trade-off in the welfare costs of income shifting
compared to the distortion to capital. Since income shifting has become cheaper,
we would expect the tax rate to fall and allowances to fall as well. This is thus a
possible explanation of the rate-cutting, base-broadening reforms in the 1980s
and 1990s.\footnote{Haufler (2001) points out, that in the absence of income shifting, the optimal policy is to have
a cash flow tax. Introducing profit shifting implies lower allowances and hence raises the EMTR
from zero to some positive number. Beginning with no income shifting this model therefore
predicts a rise in the EMTR. However, this is not necessarily the case for all combinations of the
tax rate and tax base. Beginning from some positive value of the EMTR, a revenue-neutral fall in
allowances and fall in the tax rate may raise or lower the EMTR.}

\subsection*{4.2.2.3 Multinational firms}

Another possible explanation for these reforms is that governments are
particularly interested in attracting certain types of investment project – those
carried out by multinational firms. The theory of the multinational firm suggests
that they have access to proprietary assets, and that their projects will, on
average, be more profitable. These assets may, for example, be technological
knowledge, management skills or brand name. These investment projects may be
thought to be more desirable if they bring greater social benefits through positive
externalities. As shown above, the effect of rate-cutting, base-broadening reforms
has generally been to reduce the tax rate on profitable investments by more than
on less profitable investments.

In particular, while a revenue-neutral rate-cutting and base-broadening reform
may leave the EATR on the \textit{average} project unchanged, it will tend to lower the
EATR on projects of above-average profitability and raise the EATR of those of
below average profitability. Figure 26 illustrates the impact that reforms over the
past two decades have had on projects of varying levels of profitability. It
indicates that there has been a greater fall in the EATR at higher rates of profitability.

Given this non-linear pattern of the EATR, there are two plausible related reasons for the observed tax reforms. One possibility is simply that more profitable activities are thought to have greater benefits to the domestic economy. Hence, even if all activities were equally mobile, governments would want to attract more profitable activity. The second is that, irrespective of any such benefits, more profitable firms may also be more mobile.

It has been argued that multinational firms may increase productivity and generate positive externalities through technological spillovers or increases in competition. The introduction of new technologies benefits consumers (to the extent that the goods were not previously traded), workers (to the extent that they benefit from training, or capture some of the economic rent) and possibly also domestic firms (to the extent that they are able to copy the technically superior multinational to improve their own efficiency). Thus, to the extent to which multinational firms do generate positive externalities, it may be optimal to tax them at a lower rate. An alternative explanation would be that large multinationals might have more resources to lobby for lower taxes than less profitable local firms.

These factors may help explain the stylised facts of Section 4.2.1, if the cost of shifting profitable investment projects between countries has decreased over time. That is, if governments have undertaken tax reforms in order to attract higher profit firms, then the fact that they have done so suggests that the degree of competition has increased, which in turn is consistent with greater mobility. An alternative explanation is that the mobility of such firms has increased more sharply than that for lower profit firms. In this case, governments may have responded by reducing effective tax rates more quickly for such firms, even if all

\[^{104}\text{Empirical research is unclear on the sign, size or importance of these externalities. The early literature suggested that there were large positive spillovers or externalities from multinationals to other firms see, inter alia, Blomstrom (1989), Borensztein et al (1998), Caves (1974) and Globerman (1979). The more recent literature finds a much smaller impact, see Aitken and Harrison (1999), Griffith, Simpson and Redding (2001) and Criscuolo and Martin (2002).}\]
firms generated the same benefit to the domestic economy. What evidence is there to support these assertions?

There have been a number of policy reforms which can be expected to have led to an increase in the mobility of capital. These include the relaxation of capital controls and trade liberalisation across a broad range of countries. It is very difficult to document the increase in capital mobility or the mobility of certain types of firm or investment project over time. We cite several types of evidence here to give an indicative picture of the increase in cross-border corporate activity over the past few decades.

Figure 29: Foreign direct investment (per cent of GDP)

![Graph showing foreign direct investment (FDI) per cent of GDP from 1982 to 1998.]

Notes: Average weighted by GDP in US$. The following countries were excluded from the average due to missing data in some years: Austria, Belgium, Greece, Ireland, Luxembourg, Sweden. Source: OECD.

One indicator is the upward trend in foreign direct investment (FDI) across OECD countries. Figure 29 shows that in 1981 FDI was around 0.5 per cent of GDP (weighted average across OECD countries) and that this increased to around 3 per cent by 1999. FDI statistics capture flows of financial capital across borders.

Another indicator would be the real activity of firms. Griffith and Simpson (2001) show that the proportion of investment in physical assets in the UK production sector that was accounted for by foreign-owned firms rose from 20.9 per cent in 1980 to 39.3 per cent in 1996. Lipsey (2001) shows that the value of foreign non-official assets in the United States has risen from $188 bn in 1976 (current value) to $6,102 bn in 1999.
To provide further information, we use firm level data from Thomson Financial Datastream between 1975 and 1999 on 811 firms listed on the London Stock Exchange. We investigate the share of employees of these firms that were located abroad. This is clearly not a direct measure of mobility. Rather a measure of mobility would be more properly based on the elasticity of activity abroad with respect to, say, post-tax profitability. However, it seems plausible to suppose that more mobile firms would have a greater share of their employees located abroad, and that increased mobility is likely to be associated with a higher share of employees being located abroad.

In fact, the average share of employees located abroad rose from around 6 per cent in the mid 1970s to around 15 per cent by the late 1990s. In a regression of the share of workers located abroad on a time trend, allowing for individual firm effects, the time trend is positive and significant. The same data reveal a positive correlation between profitability and the share of employees located abroad. Splitting firms into those above and those below median profitability, less profitable firms have an average share of workers abroad of around 9 per cent, while amongst more profitable firms it is around 13 per cent. In a regression of the share on a time trend and profitability, allowing for individual effects, the coefficient on profitability is positive and significant. These facts suggest that activity abroad has increased and that there is a correlation between higher profitability and activity abroad.

The increase in mobility has been faster for more profitable firms. In the late 1970s lower profitability firms had on average around 6 per cent of employees located abroad while higher profitability firms had on average around 6.5 per cent. By the late 1990s the average for lower profitability firms had increased to 10 per cent while for higher profitability firms it had increased to 17 per cent. Separate regressions of the share of employees located abroad on a time trend for

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105 This is measured as 1-ds216/ds219, where ds216 is the number of domestic employees and ds219 is the total number of employees (and where the number refers to Datastream account items).

106 We measure profitability by earned for ordinary – full tax (ds182) over total sales (ds104).

107 The coefficient is 0.045 with a standard error of 0.025.
low and high profitability firms (split by the median) reveal a positive and
significant coefficient in both cases, but it is significantly larger for more
profitable firms.\footnote{The coefficient (standard error) is 0.049 (0.004) for lower profitability firms and 0.117 (0.005)
for more profitable firms.}

Using different data Bloom and Griffith (2001) show that UK firms are
increasingly conducting R&D abroad and that the share of R&D conducted by
foreign-owned firms in the UK has increased over time.

While these figures reflect the experience only for the UK, they are consistent
with the proposition that the mobility of projects of above-average profitability
has risen relative to other projects. This is also consistent with the literature on
the activities – and indeed existence – of multinational firms, which suggests
that they are more profitable than purely domestic firms. Theory suggests that
multinationals should have some superiority over domestic firms, based on the
presumption that, because there are costs to setting up production in a foreign
country, a multinational must have some other advantages\footnote{This is known as the OLI approach of Dunning (1977).}
to compete with
local firms (which do not face such costs). Such advantages may take a number
of forms. They may reflect lower production costs, higher quality products or a
better organised and managed structure. However, the advantage may also reflect
market power, due perhaps to advertising and branding.

There is one important caveat to the notion that multinational firms are more
mobile. That is that the capital owned by immobile firms may nevertheless be
mobile. In the canonical model described above, firms are immobile, but raise
finance on the world market. A higher domestic tax rate will reduce the demand
for finance for capital by domestic firms; the available capital will instead be
used elsewhere. Such immobile firms may be relatively unprofitable; indeed they
may make only a normal return. If so, then the relevant measure of taxation for
the movement of capital is the EMTR.

\footnotetext{108}{The coefficient (standard error) is 0.049 (0.004) for lower profitability firms and 0.117 (0.005)
for more profitable firms.}

\footnotetext{109}{This is known as the OLI approach of Dunning (1977).}
Nevertheless, one interpretation of recent corporation tax reforms may be that governments have aimed to attract investment by multinationals, by shifting the distribution of effective tax rates across levels of profitability, because they believe it brings access to valuable proprietary assets.

### 4.3 Multilateral initiatives

The discussion so far has focussed on the unilateral setting of taxes on corporate income by governments in different countries. In addition, there have also been recent international attempts to introduce some form of coordination of corporation taxes across countries. Two of these originated with the European Commission (1997 and 2001a), and one with the OECD (1998). The first European Commission initiative and the OECD initiative have much in common and they are rather different from the more recent approach of the European Commission. In recent years the European Court of Justice is also playing an increasingly important role in shaping tax systems. As this development is not driven by policy, but by the cases that happen to be referred to the court and its interpretation of the EU treaties, it will not be further discussed here.

The initiatives at the European level cannot be understood without first considering some of the institutional background of the European Union. EU treaties to date have not covered direct taxation, which is left to individual member states. Member states are however restricted by the provisions of the treaties that created the single market and the economic community. The main issues of relevance are that the free movement of capital must not be compromised and that firms or nationals from other member states must not be discriminated against. Direct taxation remains one of the areas not covered by majority voting, so that any directives or regulations can only be passed if there is unanimity.

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110 There is a long history of proposals from the European Union, dating back to the Neumark report in 1962.

111 See Gammie (2003) for a discussion of areas which current future ECJ judgements are likely to influence national tax policy.
While an extreme interpretation of the treaty provisions would lead to the conclusion that it is impossible to keep separate tax systems,\footnote{This is because any difference in tax rates will be a barrier to investing in a country with higher tax rates, as firms would prefer to simply export to that country.} the general view is that tax systems can be kept different, as long as there are provisions to avoid double-taxation, and as long as firms are taxed the same in the source country. Tax harmonisation is therefore not an automatic process that will follow from the enforcement of current EU law. Instead it requires new legislation or voluntary agreements. Following a long history of different initiatives,\footnote{See Chetcuti (2001) for a description of past EU initiatives.} the currently relevant ones are the Code of Conduct and the suggestion of tax base harmonisation, both discussed below.

Decisions at the OECD can also only be taken unanimously.

4.3.1 Description of initiatives

4.3.1.1 The Code of Conduct

In 1997 the EU Council of Ministers agreed on a “Code of Conduct” in business taxation, as part of a ‘package to tackle harmful tax competition’.\footnote{The other elements included measures on the taxation of savings income and cross-border interest, and the taxation of royalty payments between companies. The package was seen as necessary to achieve certain objectives, such as reducing continuing distortions in the single market, preventing excessive loss of tax revenue and encouraging tax structures to develop in a way that is thought to be more favourable for employment.} The Code of Conduct was apparently designed to curb “those business tax measures which affect, or may affect, in a significant way the location of business activity within the Community” (European Commission, 1998). Crucially, the Code specifies that only those tax measures that allow a significantly lower effective level of taxation (including paying no tax at all) than those levels that generally apply in the Member State should be regarded as harmful. In other words, the Code is not aimed at the overall rate or level of corporate taxation in individual Member States. It is aimed at specific, targeted measures that reduce the level of tax paid below the “usual” level. For example, the criteria used to determine whether a particular measure is “harmful” include whether the lower tax level applies only to non-residents, whether the tax advantages are ‘ring-fenced’ from the domestic
market, and whether advantages are granted without any associated real economic activity taking place.

Under the Code, countries commit not to introduce new harmful measures (under a 'standstill' provision) and to examine their existing laws with a view to eliminating any harmful measures (the 'rollback' provision). Member States were committed to removing any harmful measures by 1 January 2003, but this deadline was subsequently extended to 2010 for some measures. In any case the Code is not legally binding — Member States have instead made only a voluntary commitment to abide by it.

4.3.1.2 The OECD initiative against harmful tax competition

At the same time as the EU Code of Conduct group was developing its recommendations, the OECD was pursuing a similar project. In 1998, the OECD published a report (OECD, 1998) which contained 19 recommendations to counter what it saw as the "harmful" tax competition of capital income. Subsequently, it created the Forum on Harmful Tax Practices to oversee the implementation of the recommendations. The first main output of this work was published in June 2000, (OECD, 2000). The OECD distinguished two forms of "harmful" tax practice, essentially split between OECD members and non-members.

The first form is concerned with "harmful preferential regimes in member countries", which were defined in a broadly similar way to that used by the Code of Conduct, although lack of transparency and exchange of information were also cited as important factors.\textsuperscript{115} The 2000 Report listed 47 preferential regimes which were "potentially harmful".\textsuperscript{116} The Forum aims to verify by June 2003 whether member countries have eliminated "harmful" regimes, although the deadline for removing them is December 2005. However, there is no legally binding agreement between countries. The 2000 report does not outline any

\textsuperscript{115} The report and the recommendations were approved by the OECD Council with abstentions from Luxembourg and Switzerland.

\textsuperscript{116} These include regimes such as the Belgian Coordination Centres, and the Irish International Financial Services Centres.
action to be taken against countries which have not complied with eliminating such regimes, it merely states that “other countries may wish to take defensive measures”.

The second form of "harmful" tax practice identified by the 1998 report concerned jurisdictions outside the OECD identified as "tax havens". Here the focus was on jurisdictions, rather than on specific features of their tax regimes. The criteria for identifying tax havens were again broadly similar to that for identifying harmful regimes operated by OECD members: lack of transparency and exchange of information were again important. Again, the OECD emphasised that low taxation itself was not sufficient to identify a jurisdiction as a tax haven.

The 2000 report published a list of 34 "tax havens" meeting its criteria. Any jurisdiction deemed to be “uncooperative” – essentially by not agreeing to abandon the “harmful” aspects of their regimes by 2005 – were threatened with "defensive measures" outlined by the OECD in its 2000 report. These measures relate partly to the enforcement of existing tax regimes. However, the measures go beyond this, effectively introducing a penalty for dealing with such jurisdictions. They include proposals to impose withholding taxes on payments to their residents, deny the availability of tax credits associated with income received from them, and generally to disallow deductions, exemptions, credits or other allowances related to transactions with them. Governments are also invited to reconsider whether to direct non-essential economic assistance to "uncooperative tax havens". In the event, the OECD announced in April 2002 that the vast majority of "tax havens" named in the 2000 report have committed to abandoning their “harmful” practices, and committing to “principles of

117 Just prior to the publication of the report, 6 further jurisdictions made a public political commitment to eliminate their "harmful" tax practices and to comply with the principles of the 1998 report. As a result, they were not named in the 2000 report.

118 For example, they include the enhancement of auditing and enforcement activities, a requirement for comprehensive information reporting rules, and a recommendation to adopt controlled foreign corporation (CFC) rules, all with respect to uncooperative tax havens.
transparency and the effective exchange of information”. The current (March 2004) list of “tax havens” contains just 5 states.\textsuperscript{119}

One of the issues that remain unclear about this initiative is the question of what the consequences of non-compliance will be. So far the Forum has been rather silent on progress on member states’ harmful regimes, which should be abandoned by the end of 2005. In the case of tax havens, the 1998 report recommends not renewing tax treaties with them, but whether this is a strong threat is unclear. In the 2001 update, it was promised that any co-ordinated defensive measure would not be applied to tax havens any earlier than to member states. It thus remains a question of what form such measure might take and when they might be applied.

4.3.1.3 The European Commission proposals

A more recent initiative from the European Commission (2001a) is quite different to the previous policy initiatives. It is more broadly aimed at eliminating tax obstacles within the internal market. Under a two-track strategy, it encompasses smaller measures to address the most urgent problems, e.g. by extending the existing Merger and the Parent-Subsidiary Directives to cover a wider range of companies and transactions. It also covers the promotion of a more comprehensive approach to tax reform, by suggesting the introduction of an EU-wide consolidated tax base, and the use of formula apportionment. The current requirement to identify the profit earned in each separate country would be abandoned. Under the proposed system companies would need to compute profits only once for the whole of the EU, using just one set of rules. The obtained taxable profit would then be apportioned to member states, according to a pre-agreed formula, which could be based on factors such as capital, payroll or sales or a combination thereof.\textsuperscript{120} The tax rate at which these apportioned profits would be taxed, would remain under the sovereignty of each member state and would not be harmonised.

\textsuperscript{119} Andorra, Liberia, Liechtenstein, Marshall Islands and Monaco.

\textsuperscript{120} For a discussion of the economic issues of formula apportionment, see, \textit{inter alia}, Klemm (2001) or European Commission (2001b).
4.3.2 Interpretation

4.3.2.1 The OECD initiative and the Code of Conduct

At first sight these initiatives may seem rather different, with the Code of Conduct being concerned not only with tax avoidance, but also with the efficient location of capital. The argument is that if there are “special” low-tax regimes for some types of capital then this may not only lead to a reduction in revenue, but also distort the location of capital and investment choices within the EU.

Our interpretation of unilateral tax reforms above, suggests that countries indeed try to differentiate between profitable mobile and less profitable immobile capital. If this interpretation is true, then it would also seem attractive for countries to more directly cut taxes on mobile activities compared to others and hence creating special tax regimes. Keen (2002) points out, that if special regimes are eliminated, then the opportunity which governments have had to differentiate between different forms of capital investment (e.g. foreign-owned versus domestic-owned) through special regimes will be lost. To continue to compete for such activities will put additional downwards pressure on general levels of corporation tax and the Code of Conduct may thus be harmful.

However, a look at the actual workings of the Code suggests that this is not the case. When the Code was passed, a working group was set up to examine a list of over 200 potentially harmful regimes. The group concluded that 66 of the measures were in fact harmful, although not all decisions were unanimous. Most of the measures declared harmful affect financial services, offshore companies and services provided within multinational groups. That is, they concentrate on those tax measures that affect the location of financial functions, but which are less likely to affect the location of real economic activity. This suggests - despite claims to the contrary – that the main concern of the working group has been to prevent revenue erosion through shifting of profits, rather than to prevent the distortion of real economic activity.\(^\text{121}\)

\(^{121}\) E.g. tax advantages for the shipping industry were considered acceptable, because necessary in an internationally competitive environment. Many regimes in financial services were considered
In that sense then both the Code and the OECD initiatives appear not to be directed at affecting the broad nature of tax competition for capital, but instead aim to prevent tax avoidance by shifting taxable profits between jurisdictions. Special low-tax-rate regimes may be vehicles into which companies can shift their profits on other activities; reducing the scope for firms to do this is likely to reduce – although not eliminate – such tax avoidance.

Following the Haufler and Schjelderup (2000) model, if governments can increase the cost of income shifting, then they at least partially relax the constraints on their tax-setting behaviour. Hence this model can explain not only unilateral, but also these multilateral initiatives. The explanation based on multinationals is also consistent with these initiatives. If they had indeed attempted to limit the competition for mobile capital, then there would have been a contradiction between each member state’s individual behaviour and the participation in these initiatives, but as argued above, this was not the case.

### 4.3.2.2 The tax base harmonisation proposal

If the introduction of an EU-wide consolidated profits based in combination with formula apportionment is indeed achieved, then this would have wide-ranging effects. Apart from addressing the compliance costs of computing taxable profits in every European jurisdiction, this proposal would also eliminate the possibilities firms have to manipulate transfer prices to shift profits within the EU. While this initiative does not deal with profit shifting in and out of the EU, it would still raise the cost of tax avoidance considerably, particularly as transactions with non-EU states could be monitored with the resources freed up for intra-EU transactions.

On the other hand the effects of these proposals on tax competition are not clear. As firms would be able to affect their tax liabilities by reallocating the factors used in the apportionment, there would still be scope for tax competition, whether more or less than at the moment, would depend on the formula.

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harmful, e.g. Belgian co-ordination centres, even though these hardly affect the allocation of real capital.
While the current proposal does not envisage the harmonisation of tax rates, it fulfils a precondition for doing so at a later date, as argued in Klemm (2004). This is because a minimum tax rate without a common base would be likely to cause countries to use the tax base to compete instead. Based on the analysis above, this would mean that countries would have to cut taxes even on the less mobile activities (as reducing allowances reduces the EMTR disproportionately). Whether or not this could limit tax avoidance, depends on the extent to which this takes place with the EU or globally.

4.4 Summary and concluding remarks

In this chapter we have analysed the development of taxes on corporate income in EU and G7 countries over the 1980s and 1990s.

We have discussed measurement issues and, using the UK for a case study, concluded that empirical research needs to be very careful in its choice of measures, and that many commonly used measures can be misleading.

We then developed a number of stylised facts about the development of such taxes over this period:

- statutory tax rates fell over the 1980s and 1990s;
- tax bases were broadened between the early 1980s and the end of the 1990s;
- the effective marginal tax rate has moved without a trend over the 1980s and 1990s;
- effective average tax rates for projects earning positive economic profits have fallen over the 1980s and 1990s, and they have fallen more at higher levels of profitability;
- tax revenues on corporate income have remained broadly stable as a proportion of GDP since 1965; and
- tax revenues on corporate income have declined as a proportion of total tax revenue since 1965.
We have argued that the standard or canonical theoretical economic models of tax competition are not sufficient to explain these developments. The main reason is that such models typically do not model the tax rate and the tax base separately. Instead, they make assumptions about the tax base which imply that the tax rate is equal to the effective marginal tax rate. We have seen that such an assumption does not generally hold. And in any case, it is not possible to model the observed developments in corporate income tax if the tax base is assumed not to change. We have discussed two possible explanations of the past two decades of reform.

The first draws on a paper by Haufler and Schjelderup (2000), which considers the impact of income shifting by firms, and focuses on competition for capital and tax revenue. The two broad instruments available to governments – the rate and base – can be combined in an optimal combination to pursue both forms of competition. As income shifting becomes less costly, a likely response by governments is to reduce the rate and expand the base.

The second possible explanation begins by noting that the observed tax reforms have had different effects on projects of different profitability. Specifically, they have tended to reduce the effective average tax rate by more for more profitable projects. Governments may compete more intensely over such projects, either because they generate more social benefits, or because they are more mobile. We provided evidence that capital and firms have become more mobile and that more profitable firms have become more mobile relative to less profitable firms.

Finally we have considered recent multilateral initiatives. We have found that, despite claims to the contrary in some cases, these were mainly about combating tax avoidance and evasion in the form of shifting income between countries, and less about the location of real activities. Whether or not these measures will have any success at achieving even this aim remains unclear.
4.5 Data appendix

4.5.1 Effective tax rates

These are calculated as defined in Devereux and Griffith (2003). Weights for the use of alternative assets and sources of finance (only used in the UK case study) are based on the mean of the Datastream sample set out below, where:

Weight for plant and machinery = \( w_{pm} = \frac{328}{327+328} \),

weight for debt = \( w_D = \frac{321}{392} \),

and where the codes refer to the following Datastream variables:

- 321 total loan capital
- 327 gross value of land and buildings
- 328 gross value of plant and machinery
- 392 total capital employed

These weights are applied within each hypothetical investment. Thus, instead of computing the effective tax rate for a single hypothetical investment – say in plant and machinery financed by debt – we consider an investment which consists partly of plant and machinery and partly of buildings, financed by debt and equity. We then compute one effective tax for the combined investment.

The real interest rate and inflation rate are either assumed to be fixed at 10 per cent and 3.5 per cent respectively, or in cases where they are allowed to vary, National Statistics data are used. The real interest rate then is the 20-year government bond rate (AJLX) plus an 8 per cent premium and inflation is the GDP deflator calculated using GDP in nominal (YBHA) and 1995 (ABMI) prices.

4.5.2 Accounting data tax measures

The measure in Figure 10 is \( \text{ATR}=\frac{160}{154} \).

The other measures in Section 4 are (i) \( \frac{(160+167)}{154} \); (ii) \( \frac{172}{154} \); (iii) \( \frac{(160-ACT+164)}{154} \), where ACT is \( \frac{(181+187)s}{(1-s)} \) and where s is the net ACT rate. The numbers refer to the following Datastream account items:
The dataset was obtained by downloading data on all UK quoted firms (including dead firms) from Thomson Financial Datastream. From an initial dataset of nearly 4000 firms, we dropped all observations with accounting periods that differed by more than 30 days from a year. We also dropped observations lacking core data such as sales (104) and cash-flow (182+136). Finally we dropped all firms for which we had less than four consecutive observations. This left us with a sample of nearly 3000 firms and 38000 observations.


This measure is defined as:

\[
GKS = \frac{\text{Tax revenue current system} - \text{tax revenue R-base tax}}{\text{Tax revenue current system} - \text{tax revenue under R-base} + (1 - \tau)r \text{capital stock}_{t-1}}
\]

where:

\[
\text{Tax revenue current system} - \text{tax revenue R-base tax} = \Box (EABC + NHCK - (NHCM + EABG) - \text{CAPALL} + \text{NHCJ} + \text{DBGP} + \text{DBGM} + \text{NHCI})
\]

\[
\text{Lagged capital stock} = (\text{CIXH} + \text{CIXJ} + \text{CIXI})_{t-1}
\]

\(\Box\) is the statutory corporation tax rate, and \(r\) is the real interest rate as defined above. The letter codes represent are National Statistics data series.
EABC  interest received (non-financial corporations)
NHCK  interest received (financial corporations)
EABG  interest paid by (non-financial corporations)
NHCM  interest paid by (financial corporations)
DBGP  gross fixed capital formation (non-financial corporations)
NH CJ  gross fixed capital formation (financial corporations)
DBGM  changes in inventories (non-financial corporations)
NHCI  changes in inventories (financial corporations)
CIXH  net capital stock (private non-financial corporations)
CIXJ  net capital stock (public non-financial corporations)
CIXI  net capital stock (financial corporations)
CAPALL capital allowances of corporations in financial year (Inland Revenue Statistics)

4.5.4 Measures based on aggregate tax revenues

The Mendoza et al. measure was taken from E. Mendoza’s personal web page (http://www.econ.duke.edu/~mendozae/). The Eurostat measure was constructed as described in Eurostat (1998) using Eurostat data.

Our average tax rate for the corporate sector, based on tax revenue, is defined as:

\[
\frac{\text{ACCD} + \text{ACCJ}}{\text{Gross operating surplus} - \text{depreciation} + \text{net taxable property income}}
\]

where:

Gross operating surplus = NQBE + NQN - NSRV - EAXB

Depreciation = \(1 - \frac{\text{EAXB}}{\text{NQBE + EABC + FAOG - EABG - FBXO}}\)DBGF + NHCE

Net taxable property income = EABC + NHCK + FAOG + NHDH - EABG - NHCM - FBXO - NHDK

The four letter codes represent the following National Statistics data series:
NQBE: Gross operating surplus, non-financial corporations
NQNV: Gross operating surplus, financial corporations
NSRV: Adjustment to property income (FISIM), financial corporations
EAXB: Gross trading profit of quasi-corporations
EABC: Interest received, non-financial corporations
NHCK: Interest received, financial corporations
FAOG: Rent received, non-financial corporations
NHDH: Rent received, financial corporations
EABG: Interest paid, non-financial corporations
NHCM: Interest paid, financial corporations
FBXO: Rent paid, non-financial corporations
NHDK: Rent paid, financial corporations
ACCD: Corporation tax revenues
ACCJ: Petroleum revenue tax revenues
DBGF: Capital consumption, non-financial corporations
NHCE: Capital consumption, financial corporations

The approximate measure is defined in a similar way, with the difference that net taxable property income is not deducted from the denominator:

\[(\text{ACCD} + \text{ACCJ}) / (\text{Gross operating surplus} - \text{depreciation})\]

The accruals based tax rate is defined as:

\[
\frac{\text{Tax liability} + \text{ACT set-off}}{\text{gross operating surplus} - \text{depreciation} + \text{net taxable property income}}
\]

where the “tax liability” and “ACT set-off” are taken from Inland Revenue Statistics, table 11.4, various years.

The ratios of taxes to GDP and total taxation were constructing using OECD Revenue Statistics tax class 1200 (Taxes on corporate on incomes, profits and capital gains).
5 Conclusion

While the preceding chapters already contained conclusions on their specific findings, we will now turn to overall conclusions that can be drawn from our research on tax reforms.

One common theme is that in all cases first impressions can be misleading, and detailed empirical analysis is necessary for a clear understanding of a reform's impact. Consider first the reform of dividend taxation, which increased dividend taxes for pension funds. A first look at the data suggested that pension funds own an important share of UK equities. Hence an obvious conclusion would be that this tax increase should lead to a fall in stock markets. That this did not happen, provided a reason for further investigation, and indeed the result of our analysis suggests a much more complicated mechanism. Similarly, in the case of the Russian income tax reform, a first analysis of the data suggested, that a tax cut had led to an enormous revenue boom. Only a more detailed analysis of individual taxpayers and the changes they faced revealed that the boom was caused by something other than the reform. Turning to international tax reforms, the first impression is that tax rates have been cut under the pressure of international tax competition. More detailed analysis reveals that the issue is much more complicated, with countries changing many aspects of their tax system rather than just rates, leading to very different effects on tax rates faced by marginal domestic investment and profitable footloose investments. The implication of this is that even policy advice based on empirical evidence is not necessarily straightforward, but requires careful background work and even more careful wording.

Another common theme is that the ultimate strength of the results is always limited by the quality and quantity of availability of data. When working with public company data, such as in chapter 2, this problem is least severe, as there are statutory requirements for data reporting. Moreover, because of the great interest in such data by the financial industry, commercial data sets can be easily obtained and their coverage is broad. Worries are greater in case of survey data, as in chapter 3. Participation is likely not to be fully representative of the population. In the worst case, some data may not be genuine, if either
interviewers or respondents may choose not to fill in questionnaires truthfully. Finally, a fine line always needs to drawn between completeness and simplification when summarising the result of complex financing and tax planning choices in one-dimensional measures of tax rates. In the worst case, all the tax rules may not be worth much, if—as apparently is practice in some jurisdictions—some companies manage to negotiate their tax payments directly with the authorities.

While tax reforms provide excellent opportunities for empirical research, the ultimate aim is not only to understand the mechanisms behind the behavioural effects of past reforms, but to use this knowledge to provide policy advice on future reforms. And despite the difficulties described in the previous paragraphs, there are some clear lessons to be learned from these analyses.

First, all tax reforms considered have had real and measurable effect on the behaviour of economic agents. Hence the evaluation of any planned tax reform should be carefully take account of expected behavioural effect.

Unfortunately this does not always seem to be the case. Despite the failure to find a causal effect between the Russian tax reform and the revenue boom, numerous countries have followed suit and are continuing to do so. While none of the other countries has been studied so far to ascertain to what extent the results of chapter 3 where specific to Russia, more caution in the speedy implementation of reforms that may be difficult to reverse would be advisable.

Trends in international dividend taxation reform seem more in line with the findings described in chapter 2. With the notable exception of the USA, many industrialized countries have increased dividend taxation for their resident shareholders by replacing tax credits with other forms of shareholder relief. While the ultimate driving force behind this reform may have been legal rather than economic—as European non-discrimination provisions make it difficult to keep domestic tax credits—these reforms do not seem to have been accompanied by fears of falls is stock markets.

On international corporate taxation issues, trends towards lower tax rates and broader bases seem to continue. There is however one interesting exception. It
appears that the pattern described in this thesis is not found in developing countries, which appear to be reducing both their tax bases and their rates as argued in Keen and Simone (2004).

This leads to the another lesson: while empirical results are informative, care has to be taken when applying them to a different context. Regarding the reforms considered in this thesis, one could then suppose that developing countries may face different types of tax competition, countries with smaller informal sectors may have different reactions to tax cuts and large or closed economies may face different responses to changes in dividend taxation.

As mentioned in the introduction, tax reform is an ongoing process. None of the reforms discussed in this thesis have led to a final stable tax system, and all of them have been followed by further reform. While it is hoped that the findings presented in this thesis will contribute to the planning of future reforms, their analysis in turn allows further research, which may refine—or possibly refute—some of the findings presented here. While good research is always useful for the design of future reforms, the opposite is not always true though: A useful reform process may involve transparent consultation with affected parties. For the researcher however, an unannounced sudden change, ideally implemented only on a randomly selected pilot group, would be preferable. However, even when this is impossible, important findings can be obtained from the analysis of tax reforms.
6 References


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