



International Tax Policy Forum

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**INTERNATIONAL TAX POLICY FORUM/  
THE URBAN-BROOKINGS TAX POLICY CENTER  
CONFERENCE**

# **Tax Reform in an Open Economy**

**December 2, 2005**



**THE BROOKINGS INSTITUTION**



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## Tax reform in an Open Economy

December 2, 2005

### *Table of Contents*

I. Agenda .....	3
II. About the International Tax Policy Forum .....	4
III. Michael P. Devereux, "Tax Reform and Foreign Direct and Portfolio Investment" (Conference Presentation, December 2005) .....	5
IV. Stephen R. Bond, Michael P. Devereux, Alexander Klemm, "The Effects of Dividend Taxes on Equity Prices: A Re-Examination of the 1997 UK Tax Reform" (November 2005) .....	16
V. Gary C. Hufbauer and Paul L. E. Grieco, "Reforming the US Corporate Tax," <i>Institute for International Economics</i> (September 2005) [Excerpt].....	51
VI. Michael Keen and Murtaza Syed, "Domestic Taxes and International Trade: Some Evidence" (October 2005).....	65
 BIOGRAPHIES OF PARTICIPANTS .....	 91

Note: The contents of this book, as well as conference presentations, can be found on the International Tax Policy Forum website at [www.itpf.org](http://www.itpf.org)



The Brookings Institution



## Tax Reform in an Open Economy

With a Keynote Address by Edward Lazear,

Member of the President's Advisory Panel on Federal Tax Reform

Date: Friday, December 2, 2005, 8:30 a.m.–1:30 p.m.

Location: The Brookings Institution, 1775 Massachusetts Avenue, N.W. Washington, DC 20036-2188

*Description of conference: Three panels of public finance and trade experts discuss implications of U.S. tax reform on international trade, investment, capital markets, and tax treaties. A keynote address follows by Edward Lazear, who served on the President's Advisory Panel on Federal Income Tax Reform. The Panel issued its recommendations to Treasury Secretary Snow on November 1, 2005.*

- 8:30 a.m.      **Registration**
- 8:50 a.m.      **Introductory Remarks**  
John Samuels (General Electric) and Bill Gale (Brookings Institution)
- 9:00 a.m.      **International Aspects of Federal Income Tax Reform Recommendations**  
*Presenter:* Rosanne Altshuler (Rutgers University)
- 9:30 a.m.      **Effects of Tax Reform on Foreign Direct Investment**  
*Moderator:* Glenn Hubbard (Columbia University)  
*Presenters:* James Hines (University of Michigan)  
Michael Devereux (University of Warwick)
- 10:20 a.m.     **Transition Issues in International Tax Reform**  
*Moderator:* Michael Graetz (Yale University)  
*Presenters:* Alan Auerbach (University of California-Berkeley)  
Gary Hufbauer (Institute for International Economics)  
William Randolph (Congressional Budget Office)
- 11:00-11:15   **Break**
- 11:15 a.m.     **Effects of Tax Reform on International Trade Flows**  
*Moderator:* James Hines (University of Michigan)  
*Presenters:* Mihir Desai (Harvard University)  
Michael Keen (International Monetary Fund)  
Matthew Slaughter (Dartmouth College)
- Noon            **Luncheon Address**  
Introduction: Glenn Hubbard (Columbia University)  
Keynote Address: Edward P. Lazear, Stanford University and Hoover Institution
- 1:30 pm        **Adjourn**





# International Tax Policy Forum

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## About the International Tax Policy Forum

Founded in 1992, the International Tax Policy Forum is an independent group of 35 major U.S. multinationals with a diverse industry representation. The Forum's mission is to promote research and education on the taxation of multinational companies. Although the Forum is not a lobbying organization, it has testified before the Congressional tax-writing committees on the effects of various tax proposals on U.S. competitiveness. The ITPF also briefs Congressional staff periodically and sponsors public seminars on major international tax policy issues. Most recently, in December 2004, the ITPF co-sponsored a conference on "Domestic Effects of Foreign Direct Investment" with the American Enterprise Institute.

On the research front, the Forum has commissioned over 20 papers on international tax policy topics such as the effects of the interest allocation rules on the competitiveness of U.S. firms, the compliance costs of taxing foreign source income, and differences in effective tax rates faced by U.S. domestics and U.S. multinationals (*see* [www.ITPF.org](http://www.ITPF.org)).

Members of the Forum meet three times a year in Washington, DC to discuss key international tax policy issues with leading experts in government, academia, and private practice.

PricewaterhouseCoopers LLP serves as staff to the Forum. **John Samuels**, Vice President and Senior Counsel for Tax Policy and Planning with General Electric Company, chairs the Forum. The ITPF's *Board of Academic Advisors* is chaired by Prof. **Glenn Hubbard** (Columbia University) and includes Prof. **James Hines** (University of Michigan) who also directs the ITPF research program, Prof. **Michael Graetz** (Yale), Prof. **Alan Auerbach** (University of California, Berkeley), and Prof. **Mihir Desai** (Harvard).

### **ITPF Mission Statement**

The primary purpose of the Forum is to promote research and education on U.S. taxation of income from cross-border investment. To this end, the Forum sponsors research and conferences on international tax issues and meets periodically with academic and government experts. The Forum does not take positions on specific legislative proposals.



# TAX REFORM AND FOREIGN DIRECT AND PORTFOLIO INVESTMENT

Michael P. Devereux  
University of Warwick

# ISSUES

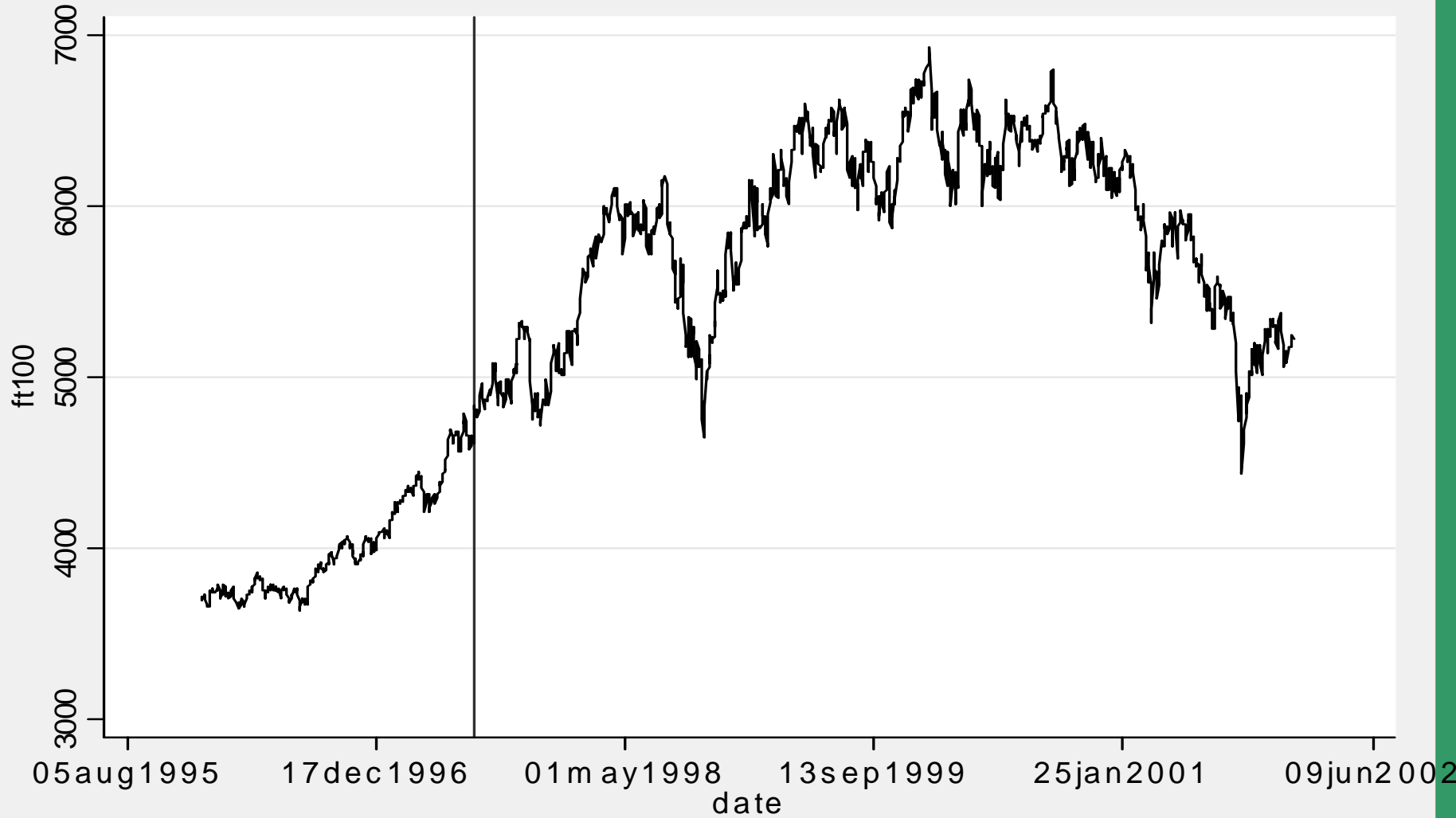
1. Closed-economy traditional concerns:  
minimise economic distortions to investment,  
financial policy, incorporation
    - low effective marginal tax rate – preferably zero, as with cash flow tax
  2. Open economy – distortions to location of capital and profit
    - depends on effective average tax rates and statutory rates
    - optimal policy for outbound investment?
    - tax competition for inbound investment
    - or a destination-base
- Role of personal taxes?

# Taxation of dividends: a lesson from the UK ?

- In 1997, UK pension funds owned 22% of UK equities
- They received tax rebate of £25 per £100 cash dividends from UK companies
- Broadly, offsetting tax (ACT) levied at company level if dividends paid out of foreign income

In 1997, rebate was abolished. What happened?

# FTSE 100 Index



# Why no effect ?

- Theory says effect depends on average tax rate of *all* investors who own some UK equities
- UK pension funds represent a small share of wealth of *all* such investors
- Removal of subsidy induced UK pension funds to sell UK equities; but price at which others were willing to buy was unchanged

# Changes to Portfolio composition

	1997	2000
% of UK pension funds assets held in UK equities	76.5	68.8
% of UK equities owned by UK pension funds	22.1	17.7
% of UK equities owned by non-UK investors	24.0	32.4

# Effects on dividends and investment

- Change in form of dividends (to foreign income dividends)
- No evidence of:
  - an increase in total funds used to pay dividends (is current US increase in dividends per share because low tax rate is temporary ?)
  - a decrease in investment

# Territoriality, tax competition and dividend taxes

- No clear guide from theory to compare territorial and worldwide systems

But

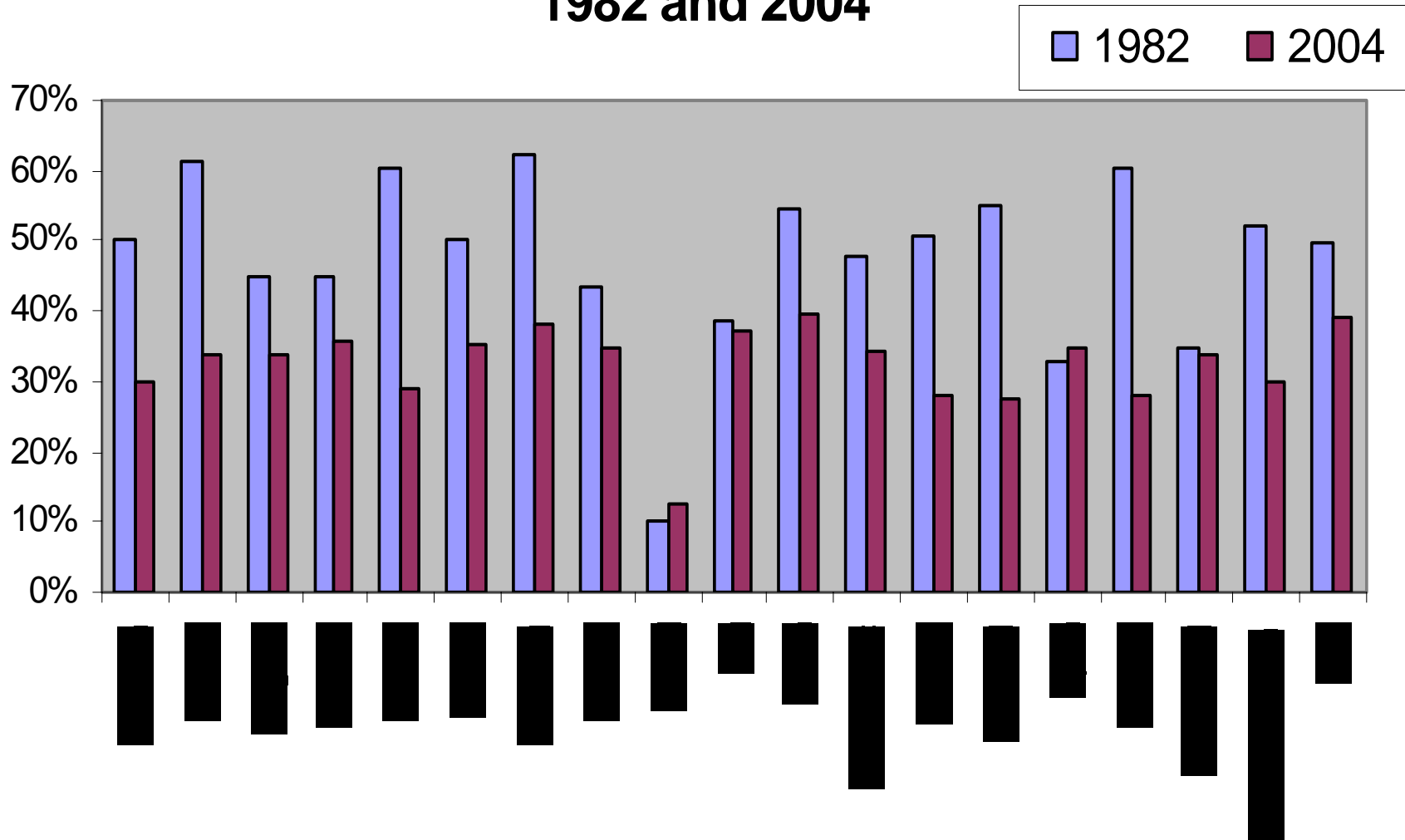
- US credit system may affect tax rates set elsewhere
- Is territoriality consistent with personal taxes only on dividends from foreign source income?



# Territorial v Worldwide

Territorial	Worldwide
Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden	Greece, Ireland, UK USA

# Statutory Corporation Tax Rates 1982 and 2004



# To briefly sum up, I'm

- Sceptical that reductions in dividend taxes have much effect
- Not (very) alarmed by move to territorial system
- Puzzled that dividends from domestic and foreign sources should be treated differently
- Enthusiastic about developing the destination-basis approach

# The effects of dividend taxes on equity prices: a re-examination of the 1997 UK tax reform

Stephen R. Bond

(Nuffield College, Oxford and Institute for Fiscal Studies)

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(University of Warwick and Institute for Fiscal Studies)

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(Institute for Fiscal Studies and University College London)

November 2005

## Abstract

We re-examine the impact on UK equity prices of the 1997 UK dividend tax reform, which removed a tax credit for an important group of investors: UK pension funds. The tax-adjusted CAPM suggests that the impact should depend on an average of tax rates across all investors, and that pension funds should reduce their holdings of the tax-favoured asset, UK equities. Given that UK pension funds are small relative to the total size of the world capital market, a small open economy-type argument implies that the main effect of the reform would be to reduce UK pension funds' ownership of UK equities, with little impact on the price of UK equities. We present evidence which is consistent with these hypotheses. We discuss why previous research (Bell and Jenkinson, 2002) reached the different conclusion that this tax reform had a large negative impact on UK share prices.

**Acknowledgement:** This paper is part of the research of the Large Business Tax Programme at the Institute for Fiscal Studies, supported by the Hundred Group, the Inland Revenue, and the ESRC Centre for Public Policy. We thank Tim Besley and Jim Poterba for helpful comments.

# 1 Introduction

We re-investigate the impact of dividend taxes on equity prices, using evidence based on an important tax reform in the UK in 1997. Before 1997, UK pension funds, and UK insurance companies managing pension-related assets, received an effective subsidy on dividend income, equal to 20% of all cash dividends received from UK companies. This subsidy cost around £5 billion per annum, equivalent to approximately 20% of UK corporation tax revenue. Before 1997, UK pension funds owned around 30% of all UK equities, and held approximately three quarters of their equity holdings in UK companies. This dividend subsidy was removed by the new Labour government in its first budget in 1997. We investigate the impact that this tax reform had on UK equity prices.

In an earlier paper, Bell and Jenkinson (2002) (BJ henceforth) used this tax reform to examine whether UK pension funds were “the marginal investors” in UK equities, implying that UK equity prices should reflect the post-tax and post-subsidy valuation of UK pension funds. Ignoring other factors, the value to a UK pension fund of a cash dividend of £100 from a UK company fell from £125 before the reform to £100 after the reform. If UK pension funds were “the” marginal investors, then the ex-day fall in the market value of the company on payment of £100 of cash dividends should have been £125 before the reform and £100 after the reform; that is the drop-off ratio (the change in the market value expressed as a proportion of the cash dividend) should have fallen from 1.25 to 1 - a fall of 20%. BJ did find a large fall, especially for large companies, although their central estimate is from around 1.05 to 0.85. They argued that this is consistent with the prices of UK equities being determined by the valuations of UK pension funds. They also presented evidence that the change in drop-off ratios was greater for companies with higher dividend yields, consistent with the proposition that UK pension funds were the marginal shareholders principally for UK companies which paid high dividends.

The contribution of this paper is twofold. First, we note that the dominant role given to the tax treatment of UK pension funds in the discussion of BJ is inconsistent with standard asset pricing theories when different investors have

different tax rates. In models such as those based on Brennan (1970), there is no unique marginal investor. Rather, the effect of dividend taxes on share prices depends on an average of tax rates across all investors. Moreover, given the size of UK pension funds relative to the world capital market, there is little reason to expect a large impact on UK share prices from a tax reform that affected only this class of investors. Second, we present a more detailed empirical analysis of the behavior of ex-day drop-off ratios in the UK, both around the 1997 tax reform and over a longer period. While the mean drop-off ratio did fall in the UK in the second half of the 1990s, we show that this was associated with an increase in the proportion of observations with very high implied tax rates on dividends, not with a fall in the proportion of observations with very low implied tax rates on dividends - as would be expected if the elimination of a uniquely favorable tax treatment of dividend income for UK pension funds was the main explanation. Similar fluctuations in the mean drop-off ratio are also observed in earlier periods, when there were no changes to the tax treatment of UK pension funds. This evidence on mean drop-off ratios in the UK thus suggests that fluctuations associated with non-tax influences are too large to allow reliable conclusions about the impact of dividend taxes on share prices to be based on changes in the mean drop-off ratio during short periods around tax reforms.<sup>1</sup>

The theoretical problem with BJ's conclusion is that in the presence of heterogeneous tax treatments, there is no reason to suppose that any one group of investors should be "the" marginal investors. We take a marginal investor to be any investor who is just willing to hold an asset at its prevailing price. That is, given the portfolio of the investor and the risk characteristics of two assets, the investor will hold both assets at the prevailing prices only if the risk-adjusted rate of return from the two assets is equal. If the risk-adjusted rate of return from asset A exceeded that of asset B, then the investor would sell B and buy A. This would continue up to the point at which the two risk-adjusted rates of return are

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<sup>1</sup>Chetty, Rosenberg and Saez (2005) document similar volatility over time in the behaviour of the mean drop-off ratio in the US, and draw the same conclusion. Interestingly their estimates show that there was also a sharp fall in the mean drop-off ratio in the US in the second half of the 1990s, although there was no similar tax change in the US that would explain this development.

equalized, or until some other constraint intervenes. The most likely constraint is a short-selling constraint; the investor cannot have unlimited negative holdings of asset B. If there is a constraint that holdings cannot be negative, then it is possible that the investor will hold only asset A.<sup>2</sup> In this case, the investor is not marginal; small changes in the price of A will not necessarily induce any change in the investor's portfolio allocation between A and B. But if the investor does hold both A and B, then he is a marginal investor; small changes in the price of A will affect the portfolio allocation. BJ's characterization of UK pension funds being "the" marginal investors in UK equities therefore implies that all other investors are at a corner solution in their portfolio allocations: either they are completely specialized in UK equities or they hold no UK equities. This is clearly false.<sup>3</sup>

Fortunately, we do not have to go far to find an alternative model. The simple tax-adjusted capital asset pricing model (CAPM), first set out by Brennan (1970), and used in numerous studies since,<sup>4</sup> suggests that many investors with different tax rates can nevertheless all be marginal investors. To follow the example above, as the investor switches his portfolio more and more towards specialization in asset A, the benefits of diversification are reduced: his portfolio becomes more risky. The investor needs to balance this increased risk against the higher expected return from A; the increase in risk is likely to generate an outcome in which the investor holds positive amounts of both assets. Extending this, suppose that there are two investors, with different tax rates; investor  $i$  has a higher tax rate on B and investor  $j$  has a higher tax rate on A. Then we should expect some, but not complete specialization. Investor  $i$  will hold a larger proportion of his portfolio in A, and  $j$  will hold a larger proportion of his portfolio in B. However, both remain marginal investors. According to the Brennan (1970) model, the impact of the taxes on the prices of A and B should depend on an average of tax rates across

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<sup>2</sup>Litzenberger and Ramaswamy (1980) present a version of the tax-adjusted capital asset pricing model (CAPM), described below, with short-selling constraints, which also generates tax clientele effects.

<sup>3</sup>Another possibility is that some investors face high trading costs, and therefore do not respond to small changes in the price of an asset.

<sup>4</sup>A large literature has examined the implication that that the required return on a stock depends on the dividend yield. See, for example: Litzenberger and Ramaswamy (1979, 1980, 1982), Black and Scholes (1974), Miller and Scholes (1982), Kalay and Michaely (2000).

all investors. In Section 3 we briefly sketch a version of this model.

What does this imply about the impact of the tax treatment of UK pension funds on the price of UK equities? First, note that before 1997 UK pension funds were subsidized only on dividends from UK equities. The pre-1997 tax regime therefore created a strong incentive for UK pension funds to switch away from a well-diversified portfolio to one which was disproportionately made up of UK equities.<sup>5</sup> As they made this switch, their portfolios would become more risky since some benefits of diversification would be lost. Meanwhile, other investors would also lose some benefits of diversification, since the availability of UK equities for the purposes of their diversification would be reduced. This may imply that other investors would only sell UK equities to UK pension funds at a premium. The existence of this premium would also reduce the ultimate holding of UK equities by UK pension funds.

But in practice what would be the likely size of this premium? UK equities are traded in an international market. In world terms, UK pension funds are small investors. Also in world terms, UK equities are a small class of assets. Thus, as UK pension funds sought to increase their holdings of UK equities, there would be a large number of other investors willing to sell these assets. Also these assets represent only a small proportion of the total assets in the world available for diversifying risks. That is, the reduction in opportunities for diversification available to other investors would be small. As a first approximation, the premium which UK pension funds would have to pay to acquire additional UK equities would be close to zero.

But if this is correct, then the tax treatment of UK pension funds would be essentially irrelevant in determining the price of UK equities. Effectively, UK pension funds could buy as many UK equities as they wanted, at a price unaffected by this tax distortion. What limited the holdings of UK equities by UK pension funds was not a premium on the price, but the cost of bearing higher risk.

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<sup>5</sup>There may of course be other, non-tax reasons for domestic institutions to favour portfolios that are overweight in domestic assets, or to have a 'home bias'. This does not alter the basic argument we are making here. By a 'well-diversified' portfolio, we simply mean the allocation that would be optimal in the absence of this tax distortion.



In turn then, what would be the effect of the 1997 tax reform? Since UK pension funds no longer benefited from this subsidy on UK dividends, they would no longer want to distort their portfolio allocations towards UK equities for this reason. After 1997, they would be expected to reduce their holdings of UK equities, in order to reduce their overall risk, but there is no reason to expect a large effect on the price of UK equities, since the valuation of UK equities by all other investors was essentially unchanged. This asset pricing theory thus predicts that there could be large effects on the portfolio allocations of UK pension funds, but not on UK equity prices. Note that this would be the case even if UK pension funds previously owned a large proportion of UK equities - as long as they and many other investors were not at corner solutions in which they were completely specialized in particular assets.

Now consider how BJ's conclusion fits into this framework. Essentially, BJ claim that - before 1997 - a UK company worth £100 in the absence of tax would have a market value of £125, since that was its value to UK pension funds. But if this were true, then why were such assets also held by other shareholders? Prior to 1997, about one sixth of all UK equities were held by non-UK investors. None of these investors could have valued this company at £125.<sup>6</sup> It is hard to believe that the benefits of diversification arising from holding UK equities could have been so great as to induce other investors to pay such a huge premium.

As a first step towards considering more detailed empirical evidence, it is useful to review movements in the UK stock market index on and after the announcement of the 1997 tax reform. The FTSE 100 index is presented in Figure 1, between 1995 and 2002. As is well known, there was considerable variation in the index during this period, with the index almost doubling between 1995 and 1999 before falling back. The date of the 1997 tax reform is marked by the vertical line. If equity valuations had followed the BJ prediction, then, *ceteris paribus*, there would have been a 20% fall in the value of the index on the announcement of the reform. Clearly, this did not happen. Instead the index continued to rise. It is conceivable

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<sup>6</sup>Some investors in countries which had a tax treaty with the UK also received a tax credit associated with the cash dividend, but at most this amounted only to around 6%, implying a valuation of £106.

that other announcements in Gordon Brown's first budget may have overshadowed the dividend tax reform. However, it is difficult to think of precedents for announcements of changes in economic policy producing the required 20% rise in the stock market, at least in developed countries.

Further analysis of the behavior of UK drop-off ratios reveals that the fall in the mean drop-off ratio emphasized by BJ was associated with a sharp increase in the proportion of observations where share prices *rose* on the ex-div day, generating a negative value for the measured drop-off ratio. It is not clear how this development could be related to the dividend tax reform. A similar pattern was observed in the late 1980s, with the mean drop-off ratio being low and the proportion of observations with negative values being high in the period after the 1987 stock market crash. We are aware of no tax explanation for these patterns in the late 1980s. In line with similar evidence presented for the US by Chetty, Rosenberg and Saez (2005), we conclude that the mean drop-off ratio in the UK is too volatile for short term fluctuations around tax reforms to provide reliable evidence on the effects of dividend taxation on the stock market valuation of firms.

In the next section we present a brief summary of the UK dividend tax regime before and after the 1997 reform. Following that, in Section 3 we outline a simple version of the Brennan (1970) tax-adjusted CAPM model, which serves to highlight the features of the market which are important in determining prices. In Section 4, we summarize the empirical predictions of the model and set out how we implement empirical tests. Section 5 presents the data, and Section 6 the results. We conclude in Section 7.

## 2 The Taxation of Dividends in the UK

The 1997 UK tax reform has already been described by BJ; here we briefly summarize the main elements of the dividend tax regime both before and after 1997.<sup>7</sup> From the early 1970s until 1999, the UK operated a partial imputation system. On paying a cash dividend, UK firms were obliged to pay a proportion of the

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<sup>7</sup>A more detailed description of the tax system is provided in Bond et al (2005), where we investigate the impact of the 1997 reform on company dividend payments and investment.

dividend in tax: Advance Corporation Tax (ACT). Subject to restrictions (principally that the dividend did not exceed UK taxable profit), the ACT could be credited against the main corporation tax charge, and thus generally only affected the timing of corporation tax payments. In addition, however, UK shareholders could also claim a credit against the UK income tax due on the receipt of the dividend. In general, ACT was charged at the basic rate of income tax (20% for dividend income in 1997) on the grossed-up dividend (i.e. the cash dividend plus the ACT). Hence basic rate shareholders were deemed to have paid tax in full on any dividends received, and consequently did not have to pay any further tax. Higher rate taxpayers, whose marginal tax rate was 40%, had to pay additional tax. For a £100 cash dividend, they had to pay tax on the grossed-up value of £125, i.e. a total of £50, but they could offset against that the £25 tax credit, leaving them with another £25 to pay.

The crucial element of the tax regime for our purposes is that tax-exempt UK shareholders were entitled to claim a tax rebate equal to the ACT paid by the firm. Just before the tax reform in 1997, this was worth 25% of the cash dividend (equivalent to 20% of the grossed-up dividend). As noted earlier, the cost of paying this rebate prior to 1997 was around £5 billion per year, around 20% of UK corporation tax revenue.

The 1997 tax reform abolished this cash rebate for UK pension funds, and the pension-related assets of UK insurance companies. Other tax-exempt shareholders - charities, non-tax-paying individuals, and holders of tax-advantaged personal equity plans - were unaffected. Some tax treaties also provided for non-UK shareholders to receive part of the tax credit - worth approximately 6% of the cash dividend. They too were unaffected by the 1997 reform.

In 1999 the system was further reformed. The cash rebate was now abolished for most other non-tax-paying individuals,<sup>8</sup> including those foreign shareholders that used to receive some benefit.<sup>9</sup> The credit rate was halved to 10%, but UK

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<sup>8</sup>Charities received temporary compensation for this loss. Holders of 'Individual Savings Accounts' continued to receive credits until 2004.

<sup>9</sup>For foreign shareholders this was achieved by halving the tax credit to 10% and applying a withholding tax of 10%, rather than by formally abolishing the credit.

tax-paying shareholders were unaffected, as income tax rates on dividend income were also reduced. At this time, ACT was also abolished, and new payment arrangements were introduced for companies paying corporation tax.

### 3 A Simple Portfolio Model

We present a simple version of the one period tax-adjusted CAPM model of Brennan (1970) which has been widely used to study the case of shareholders with heterogeneous tax rates.<sup>10</sup> The aim here is to identify the effects of differences in tax rates, not only across investors, but also across assets for an individual investor.

There are a large number,  $N$ , of investors. Investor  $i$  has an endowment of  $X_i$ , which is divided between two risky assets,  $H$  and  $W$ , and a risk-free asset. Investor  $i$  holds  $H_i$  shares at price  $p$  in asset  $H$ ,  $W_i$  shares at price  $q$  in  $W$ , and the remainder,  $B_i = X_i - pH_i - qW_i$ , in the risk-free asset. Dividends from  $H$  and  $W$ , denoted  $D^H$  and  $D^W$ , are taxed at rates  $m_i^H$  and  $m_i^W$  respectively, net of any dividend tax credits. Capital gains are taxed at rate  $z_i$  for both assets. Interest income from the risk-free asset is taxed at rate  $m_i$ . Dividends are assumed to be known, but the prices of the risky assets at the end of the period, denoted  $\tilde{P}^H$  and  $\tilde{P}^W$ , are stochastic. Random variables are denoted with a tilde - their expected values at the start of the period are shown without the tilde.

The end-of-period wealth of investor  $i$  is  $\tilde{Z}_i$ , where

$$\begin{aligned} \tilde{Z}_i &= (1 + r(1 - m_i)) B_i \\ &\quad + \left( \tilde{P}^H + (1 - m_i^H) D^H - z_i (\tilde{P}^H - p) \right) H_i \\ &\quad + \left( \tilde{P}^W + (1 - m_i^W) D^W - z_i (\tilde{P}^W - q) \right) W_i \\ &= X_i + (1 - z_i) \left\{ \rho_i B_i + \left[ \tilde{G}^H + \gamma_i^H D^H \right] H_i + \left[ \tilde{G}^W + \gamma_i^W D^W \right] W_i \right\} \quad (1) \end{aligned}$$

where  $\tilde{G}^i$  is the stochastic capital gain on asset  $i$  eg.  $\tilde{G}^H = \tilde{P}^H - p$ , where  $r$  is the

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<sup>10</sup>See, for example, Litzenberger and Ramaswamy (1979, 1980, 1982), Gordon and Bradford (1980), Auerbach (1983) and Michaely and Villa (1995).

risk-free interest rate,

$$\rho_i = \frac{(1 - m_i)r}{(1 - z_i)} \quad (2)$$

is the tax-adjusted discount rate of investor  $i$ , and

$$\gamma_i^H = \frac{(1 - m_i^H)}{(1 - z_i)} \text{ and } \gamma_i^W = \frac{(1 - m_i^W)}{(1 - z_i)} \quad (3)$$

are the tax discrimination variables of investor  $i$  for assets  $H$  and  $W$  respectively.

Investors choose  $H$  and  $W$  to maximise

$$V_i = Z_i - \frac{\varphi_i}{2} \text{var}(\tilde{Z}_i) \quad (4)$$

where  $\varphi_i$  is a risk aversion parameter. The form of  $\varphi_i$  is important: we discuss two special cases below.

The expected value of  $\tilde{Z}_i$ , denoted  $Z_i$ , is equal to the expression in (1), with the stochastic capital gains terms replaced by their expected values. The variance of  $\tilde{Z}_i$  is

$$\text{var}(\tilde{Z}_i) = (1 - z_i)^2 (H_i^2 \sigma_H^2 + W_i^2 \sigma_W^2 + 2H_i W_i \sigma_{HW}) \quad (5)$$

where  $\sigma_H^2$ , and  $\sigma_W^2$  are, respectively, the variances of  $\tilde{P}^H$  and  $\tilde{P}^W$ , and  $\sigma_{HW}$  is the covariance.

Assuming an interior solution in which the investor simultaneously holds all three assets, the investor's demand for each asset can be derived from the first order conditions for  $H_i$  and  $W_i$ , which are:

$$\begin{aligned} H_i &= \frac{G^H + \gamma_i^H D^H - p\rho_i}{\varphi_i(1 - z_i)\sigma_H^2} - \frac{W_i\sigma_{HW}}{\sigma_H^2} \\ \text{and } W_i &= \frac{G^W + \gamma_i^W D^W - q\rho_i}{\varphi_i(1 - z_i)\sigma_W^2} - \frac{H_i\sigma_{HW}}{\sigma_W^2} \end{aligned} \quad (6)$$

We can use these demand equations to solve for the equilibrium prices, and rates of return. Suppose there are, in aggregate,  $H$  and  $W$  shares in the two risky assets respectively. Define  $\lambda_i = 1/(1 - z_i)\varphi_i$  so that a higher  $\lambda_i$  implies either lower risk aversion or a higher capital gains tax rate. Aggregating the first expression

for  $H_i$  over  $N$  investors and rearranging implies

$$\begin{aligned} H &= \sum_{i=1}^N H_i = \frac{G^H \sum \lambda_i + D^H \sum \lambda_i \gamma_i^H - p \sum \rho_i \lambda_i}{\sigma_H^2} - \frac{\sigma_{HW} W}{\sigma_H^2} \\ &= \frac{\sum \lambda_i [G^H + \bar{\gamma}^H D^H - p \bar{\rho}]}{\sigma_H^2} - \frac{\sigma_{HW} W}{\sigma_H^2} \end{aligned} \quad (7)$$

where  $\bar{\gamma}^H$  and  $\bar{\rho}$  are weighted averages:

$$\bar{\gamma}^H = \frac{\sum \gamma_i^H \lambda_i}{\sum \lambda_i} \quad (8)$$

$$\text{and } \bar{\rho} = \frac{\sum \rho_i \lambda_i}{\sum \lambda_i} \quad (9)$$

An equivalent expression holds for asset  $W$ . Alternatively, we can express the equilibrium expected return to purchasing a share in  $H$ , as

$$\frac{G^H + \bar{\gamma}^H D^H}{p} = \bar{\rho} + \frac{[\sigma_H^2 H + \sigma_{HW} W]}{p \sum \lambda_i}. \quad (10)$$

This takes a familiar form: the expected return is equal to the weighted average return on the risk-free asset, plus an adjustment for risk. The definition of the weighted average return is discussed below. The risk adjustment depends on the variance of the end-of-period price of the asset itself and the covariance with the end-of-period price of the other risky asset, where the weights on these two terms depend on their relative size in the overall market. If asset  $H$  is sufficiently small relative to  $W$ , then only the covariance term matters. This expression is consistent with Brennan's (1970) model of the CAPM with personal taxes and has been the subject of extensive empirical testing.<sup>11</sup>

The portfolio choice of investor  $i$  depends on his own tax rates relative to that of other investors. Specifically,

$$H_i = \frac{\lambda_i H}{\sum \lambda_i} + \frac{\lambda_i}{(\sigma_W^2 \sigma_H^2 - \sigma_{HW}^2)} \left\{ \begin{array}{l} (\gamma_i^H - \bar{\gamma}^H) \sigma_W^2 D^H - (\gamma_i^W - \bar{\gamma}^W) \sigma_{HW} D^W \\ - (\rho_i - \bar{\rho}) (p \sigma_W^2 - q \sigma_{HW}) \end{array} \right\}. \quad (11)$$

Clearly, investor  $i$  will tend to hold more or less of  $H$ , depending on whether his tax parameter,  $\gamma_i^H$  is above or below the weighted average,  $\bar{\gamma}^H$ . If, for example,

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<sup>11</sup>See, for example, Litzenberger and Ramaswamy (1979, 1980, 1982), Black and Scholes (1974), Miller and Scholes (1982), Kalay and Michaely (2000).

$\gamma_i^H=1.25$  and  $\bar{\gamma}^H = 1$ , as was broadly the case for UK pension funds holding UK equities before 1997, then pension funds would hold more of this asset. How much more depends on the risk of the two assets and the investor's risk aversion,  $\lambda_i$ . For example, the more risk averse is the investor (the lower  $\lambda_i$ ), the less would be the tendency to have additional holdings of this asset in response to favorable tax treatment. Of course, the tax treatment of the other assets also affect the holdings of  $H$ . Advantageous tax treatment of the return from  $W$  or the risk-free asset relative to a weighted average of other investors (ie.  $\gamma_i^W > \bar{\gamma}^W$  or  $\rho_i > \bar{\rho}$ ) would reduce holdings of  $H$  by investor  $i$ .

To examine the effects of differential taxation further, it is necessary to examine the weighted average tax rates. It is useful to simplify by assuming that all investors face the same rate of capital gains tax on all assets, in which case the weighted averages depend only on the risk aversion parameter,  $\varphi_i$ :

$$\bar{\gamma}^H = \frac{\sum \gamma_i^H / \varphi_i}{\sum 1 / \varphi_i} \quad \text{and} \quad \bar{\rho} = \frac{\sum \rho_i / \varphi_i}{\sum 1 / \varphi_i} \quad (12)$$

Now consider two special cases:

(i) all investors have the same degree of risk aversion:  $\varphi_i = \varphi$  for all  $i$ . In this case,  $\sum \lambda_i = N/(1-z)\varphi$  and  $\bar{\gamma}^H$  and  $\bar{\rho}$  reduce to unweighted averages across all investors. One implication of this is that individual holdings of the risky assets do not depend on the initial endowment. Consider (11), but setting the tax rates faced by all investors on each asset to be the same. Then the second term is zero and  $H_i = H/N$ : all investors hold the same number of shares in  $H$ . Any difference in endowments is reflected only in the holding of the risk-free asset. Of course, holdings of the risky assets are affected by tax rates; but the fact that holdings differ across investors is not reflected in the construction of the average tax rates, which are unweighted. This is because each investor is at a margin and is equally likely to trade part of the the holding.

A simple alternative to this is:

(ii) risk aversion differs only across endowments:  $\varphi_i = \varphi/X_i$ .<sup>12</sup> In this case,

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<sup>12</sup>Of course it is straightforward to allow for differences in preferences as well as endowments. For example,  $\varphi_i = \theta_i/X_i$  where  $\theta_i$  represents individual preferences.

the weights for  $\bar{\gamma}^H$  and  $\bar{\rho}$  are initial endowments:

$$\bar{\gamma}^H = \frac{\sum \gamma_i^H X_i}{\sum X_i} \quad \text{and} \quad \bar{\rho} = \frac{\sum \rho_i X_i}{\sum X_i}. \quad (13)$$

This is more intuitive; abstracting from differences in taxes again, holdings of risky assets are exactly proportional to the endowment since  $\lambda_i / \sum \lambda_i = X_i / \sum X_i$ . Note though that again the weighted tax rates do *not* depend on the holdings of each asset: indeed, the weights for  $H$  and  $W$  are the same. Suppose investor  $i$  has a tax advantage from  $H$  and hence holds a greater proportion of his investment in  $H$  compared to other investors. It is not the case that the weighted average tax rate for  $H$  disproportionately reflects  $i$ 's tax rate. As in the previous case, all investors are at the margin; the difference from the previous case is that since holdings are proportional to the endowment, then a wealthier investor would trade more in response to a change in, say, the expected end-of-period price. As a result, his tax rate is weighted more.

It is interesting to note the consequences of taxes varying only across investors, so that  $m_i = m_i^H = m_i^W$  and hence  $(\gamma_i^H - \bar{\gamma}^H) = (\gamma_i^W - \bar{\gamma}^W) = (\rho_i - \bar{\rho})$  for all investors. In this case, investor  $i$  would hold more or less than the weighted average ( $\lambda_i H / \sum \lambda_i$ ) holding, depending on whether he faced a relatively high tax rate (that is, whether  $\gamma_i^H \geq \bar{\gamma}^H$ ), and on the sign of  $\sigma_W^2 D^H - \sigma_{HW} D^W - (p\sigma_W^2 - q\sigma_{HW})$ . Even in this case, it is therefore generally not true that all investors would divide their portfolio across assets in the same way. Hence the weights for constructing the average tax rates would still not be equal to relative holdings of the individual assets.

However, finally note that from (10), the market valuation of each asset depends only on the tax rates applied to that asset. An implication of this is that expression (10) is equally valid in considering the price implications of the recent US dividend tax reform, even though that tax reform applied to dividends from all equities. The US tax reform reduced the dividend tax rate for US personal investors. The effect of this on US equity prices depends on how the average tax rate across all investors in US equities was affected. If the group of US taxpayers affected was sufficiently small, relative to tax-exempt US investors and non-US investors, then again as a first approximation, there would be little or no impact



on US equity prices.<sup>13</sup>

We note three qualifications to this simple model. First, we have assumed an internal solution in which all investors hold all assets. Consider the introduction of a subsidy to a group of investors on the income from asset  $H$ . This will induce those investors to switch their holdings in favour of  $H$ . They will continue to do so either up to the point at which, at the margin, the gain from the subsidy is exactly offset by the additional risk they bear by moving away from an optimally diversified portfolio - this is characterized by (6) - or until those investors have switched all their holdings to asset  $H$ . In practice we do not observe investors holding only one form of asset, and so (6) seems the most likely equilibrium.

Second, as argued by Miller and Scholes (1978), it may be the case that trading costs deter some investors responding to small changes in the prices or expected returns from particular assets. If only a subset of all investors respond to new information, then at the margin, it is only the tax rates of those "marginal" investors which will be reflected in the weighted average tax rates. The relevance of this observation for examining the UK tax reform depends on whether the weight of UK pension funds should be higher than if all investors were taken into account. This is a key empirical issue which we address below.

Third, this model ignores trading around the ex-div day. To prevent a tax-favoured investor holding only asset  $H$  cum-div and then diversifying ex-div, it is necessary to introduce some cost to this trading strategy. For example, there may be transaction costs, or a risk of unfavorable underlying price movements around the ex-div day. Michaely and Villa (1995) develop a theoretical model in which ex-div day trading is allowed but is endogenously limited. Lasfer (1995) presents empirical evidence that ex-day returns in the UK are not significantly affected by short-term trading. We follow BJ in assuming that an analysis of UK ex-day returns can in principle identify the impact of dividend taxation.

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<sup>13</sup>Chetty, Saez and Rosenberg (2005) provide more detail on this US tax reform, and empirical evidence on its impact on US equity prices.

## 4 Empirical Implications

This model suggests two empirical hypotheses about the impact of dividend taxes.

First, the overall effect of dividend taxes on share prices reflects the weighted average tax rate of all investors,  $\bar{\gamma}^H$ . What does this suggest about the impact of the 1997 UK dividend tax reform on UK share prices? Even taking the second special case above, UK pension funds control only small proportion of the total wealth invested in all markets. Any change in their tax rate is therefore likely to have a negligible effect on UK equity prices. Thus:

**Proposition 1** *The 1997 tax reform should have little or no effect on the prices of UK equities.*

We test this proposition below using the standard technique of analyzing drop-off ratios. When a share goes ex-dividend, marginal shareholders are indifferent between either selling the share at the cum-dividend price, thus forgoing the dividend, or keeping the share and thus receiving the dividend. Denote the cum-div price by  $P_c$ , the ex-div price by  $P_{ex}$ , and the dividend by  $D$ . Then following Elton and Gruber (1970), and using (10), we have

$$P_c - P_{ex} = \bar{\gamma}D \quad (14)$$

or

$$\frac{P_c - P_{ex}}{D} = \bar{\gamma}. \quad (15)$$

The term on the left hand side of this expression is the drop-off ratio (DOR): the fall in the price expressed as a proportion of the dividend. The term on the right hand side is the tax discrimination variable, described above. The DOR can therefore be used to estimate the average value of the tax discrimination parameter  $\gamma$  - which determines the share price.

In practice, we measure  $P_c$  at the end of trading on the last day the share trades cum-dividend, and  $P_{ex}$  at the end of trading on the first day the share trades ex-dividend. Clearly, the difference between these two prices will reflect not only the dividend payment, but all other news about the value of the firm that emerges on

the ex-div day. Averaging across a large number of independent observations on DORs is therefore required to obtain a useful estimate of  $\bar{\gamma}$ . Adjustments can also be made for market movements on ex-div days (see below).

For comparison with BJ, we follow their approach in estimating  $\bar{\gamma}$ . Briefly, assume, following Lakonishok and Vermaelen (1983), that the price changes are random variables which can be written as

$$P_c - P_{ex} = \theta D + \epsilon \quad (16)$$

where the  $\epsilon$  are independently distributed with

$$E(\epsilon) = 0 \quad \text{and} \quad \text{var}(\epsilon) = P_c^2 \sigma^2; \quad (17)$$

that is the standard deviation of the unexplained price change is assumed to be proportional to the share price. As proposed by Boyd and Jagannathan (1994), an efficient estimate of  $\bar{\gamma}$ , before and after the tax reform, can then be found by estimating

$$\frac{P_c - P_{ex}}{P_c} = \theta_1 \frac{D}{P_c} + \theta_2 F \frac{D}{P_c} + e \quad (18)$$

where

$$e = \frac{\epsilon}{P_c} \quad \text{and hence} \quad \text{var}(e) = \sigma^2. \quad (19)$$

In (18),  $\theta_1$  provides an estimate of  $\bar{\gamma}$  prior to the tax reform.  $F$  is a dummy variable which takes the value of 0 for observations before the tax reform and 1 for observations after the tax reform; hence  $\theta_2$  is an estimate of the change in  $\bar{\gamma}$  following the tax reform. Following BJ, and 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 constant term may also be included.

A further common adjustment is to account for market movements on the ex-div day multiplied by a historic estimate of the correlation between the return on the share and the return on the market. That is, we replace  $P_{ex}$  with  $P_{ex}^* = P_{ex} - P_c \beta R^m$  where  $R^m$  is the return on the market on the ex-day, and  $\beta$  is the CAPM measure of risk of that equity.

The second empirical prediction concerns holdings of UK equities. Expression (11) makes clear that, ceteris paribus, any investor will tend to hold more of a given asset - say  $H$  - when his tax discrimination variable for that asset ( $\gamma_i^H$ ) is above the average of all investors ( $\bar{\gamma}^H$ ). As is clear from the discussion above, until 1997 the value of  $\gamma$  for UK pension funds holding UK equities was 1.25 and therefore significantly above the average value across all investors. However, after 1997, this value fell to 1. This implies that:

**Proposition 2** *UK pension funds should hold a disproportionately high share of UK equities before 1997, but this share should fall after 1997. By contrast, other investors should hold a disproportionately low share of UK equities before 1997, but should increase their share after 1997.*

To investigate this proposition, we report evidence on the composition of equity portfolios before and after 1997 for UK pension funds and other institutional investors, and we report evidence on the share of UK equities held by different classes of investors.

## 5 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 samples.

Specifically, we use data from Thomson Financial Datastream on dividend payments of quoted UK companies. This data set contains one observation per payment, i.e. typically two observations per firm per year, as most UK firms pay an interim and a final dividend in each accounting year. We merge daily data on share prices and return indices into this data set, keeping in each case the observation on the day when the share first trades ex-dividend and on the day before, i.e. the ex-dividend and cum-dividend prices.

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 observation 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 information from company accounts. After matching the data with company accounts, we drop all firms for which the sum of individual dividend payments over the year does not match up with the total dividend payment reported in the accounts. Then we drop all dividend payments that were designated as Foreign Income Dividends, as the tax treatment for this form of dividends was different. We also drop any observation for which the share price did not move on the ex-dividend date, which suggests that there was no trading. Finally we drop outliers, which we define as DORs in excess of 5.

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 ( $\beta$ ). We thus run separate regressions of each share's monthly return (including capital gains and dividends) on the monthly return of the FTSE All-Share index during the 5 years preceding the tax reform. We only keep shares with at least 36 historical observations.

The cleaning procedure used by BJ is virtually the same as ours, except that they did not delete data where the sum of dividend payments differed from the figure reported in company accounts, and they did not drop outliers as defined above. Hence our sample is slightly smaller than theirs, with data on 7966 dividend payments by 1275 firms.

**[ADD DISCUSSION OF SAMPLE DESCRIPTIVE STATISTICS  
HERE IF POSSIBLE]**

## 6 Results

This section first presents empirical evidence on the behavior of drop-off ratios in the UK. It then briefly considers evidence on UK equity ownership.

## 6.1 Bell and Jenkinson (2002) replication

The recent paper by BJ uses the 1997 reform to test whether taxes affect the valuation of dividends and to attempt to find the identity of what they refer to as “the” marginal shareholder. We first replicate their main findings using our sample, confirming that the mean drop-off ratio did fall significantly in the UK in the late 1990s. We then look in more detail at the nature and timing of this change in the distribution of drop-off ratios, and consider fluctuations in the mean drop-off ratio over a longer horizon.

Table 1 presents the results obtained from estimating mean drop-off ratios for pre-reform and post-reform periods in a similar way to BJ, based on OLS estimation of equation (18). Columns 1 and 2 reproduce the results from BJ; columns 3 and 4 present our replications. Like BJ, we compare the 30 month period before the 1997 tax reform with the 30 month period after the reform. Following BJ, we report results for the sample of all firms and for the sub-sample of the largest 250 firms. Our results are very similar to those obtained by BJ. While we estimate a smaller fall than BJ, we confirm that there was a significant fall in the mean drop-off ratio in the UK after July 1997, particularly for larger firms.

We implemented a number of robustness checks, which suggested that these results are robust. Specifically, we considered the following alternative specifications. (a) Including a constant term to allow for certain ex-dividend day trading behavior as suggested by microstructure models in Boyd and Jagannathan (1994) and Frank and Jagannathan (1998): this does not affect the estimated coefficients. (b) Not correcting the ex-div price ( $P_{ex}$ ) for market movements: this hardly affects the coefficients and leads to slightly more significant falls in the mean 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 for the sample of large firms. For the full sample, this reduces the estimated fall in the mean DOR by half. The estimated fall in this case is only significant at the 13% level.

Before extending the investigation, it is worth discussing the interpretation of these results. It is true that the estimated *change* in the mean DOR, at least

for the larger companies, is close to the theoretical drop in the value of  $\gamma$  for UK pension funds: 20% (BJ) or 17% (our results) as against 20% in theory. However, if pension funds were “the” marginal shareholders, then the estimated *levels* of these mean DORs are not as expected. If pension funds were the marginal shareholders, the mean DOR should be around 1.25 before the reform and 1 after the reform. For the largest firms, the empirical results suggest a mean DOR of around 1 before the reform and around 0.8 after the reform.

Of course, based on the asset pricing model set out in Section 3, we would not expect the mean DOR to reflect only the tax rates of UK pension funds, but rather an average across all investors in UK equities. While the levels of the mean DORs before and after the reform could reflect an average across investors, from this perspective, the significant fall in the mean DOR is more surprising.

## 6.2 Drop-off ratios and dividend yields

BJ also consider changes in the mean DOR for sub-samples divided by dividend yields. The 1997 tax reform affected those shareholders with the highest valuation of UK company dividends. In the presence of clientele effects, highly taxed investors would be expected to hold shares in low-dividend-paying firms, and lightly taxed (or subsidized) investors would be expected to hold shares in high-dividend-paying firms. This suggests that, before 1997, UK pension funds were more likely to be “the” marginal shareholders for UK firms with relatively high dividend yields. If this were the case, then the 1997 reform is expected to have most impact on the mean DOR for high-dividend-paying firms.

BJ report results that appear to support such clientele effects. Specifically they use annual data on dividend yields to divide their observations in the pre-reform and post-reform periods, separately, into quintiles. They then compare the mean drop-off ratio for each quintile in the pre-reform period with the mean drop-off ratio for the corresponding quintile in the post-reform period. We replicate these results in Table 2.<sup>14</sup> Like BJ, we find that the mean DOR fell significantly only

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<sup>14</sup>Unlike BJ, we present results based on individual dividend payments, rather than artificial portfolios made up of all dividend payments on the same day. BJ state that results were similar in both cases.

when comparing observations with relatively high dividend yields, although it is not the case that observations in the top quintile had the largest or most significant drop.

Given that the rationale for splitting the sample by dividend yields is based on the tax preference of UK pension funds for a high dividend yield in the pre-reform period, it would seem more appropriate to divide the full sample into quintiles based on dividend yields in the pre-reform period only. We use data on average dividend yields in the pre-reform period to divide our sample of firms into quintiles. We then compare the mean drop-off ratio for each quintile in the pre-reform period with the mean drop-off ratio for the same sub-sample in the post-reform period. Unlike the procedure used by BJ, this ensures that we are comparing mean drop-off ratios *for the same firms* in the two sub-periods.

Table 3 presents these results. When the samples are classified in this way, it is notable that the fall in the mean drop-off ratio becomes small and statistically insignificant for the sub-sample with the highest dividend yields in the pre-reform period. The clear pattern in the behavior of drop-off ratios by dividend yields reported by BJ is thus quite sensitive to the precise way in which their sub-samples were chosen. Moreover, and regardless of the method used to select the sub-samples, we can note that the pattern of estimated mean drop-off ratios in the pre-reform period provides little support for the view that the tax treatment of UK pension funds was particularly important for the stock market valuation of UK firms with relatively high dividend yields.<sup>15</sup>

### 6.3 Evidence on the distribution of DORs

To investigate the behavior of DORs further, we now consider the distribution of DORs. The 1997 tax reform reduced the tax discrimination parameter  $\gamma_i$  for the class of shareholders which previously had the highest valuation of dividends. If UK pension funds were indeed “the” marginal investors for certain types of UK firms, the fall in the mean DOR reported in Table 1 should be associated with compression in the upper part of the distribution of DORs. Essentially, the

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<sup>15</sup>Consistent with this, we find that the simple correlation coefficient between the DOR and the dividend yield in the pre-reform period is less than 1%.



highest values of  $\gamma_i$  were eliminated by the tax reform, while lower values of  $\gamma_i$  were unaffected.

To examine this prediction, Figure 2 plots various quantiles of the distribution of DORs over the same sample period used in Table 1. In fact we see the opposite pattern, with the fall in the mean DOR after 1997 being associated with a fall in drop-off ratios at the bottom end of the distribution. The upper quartile *increases* from 1.3 in 1995 to 1.4 in 1999, with no sign of any reduction following the 1997 tax reform. In contrast, the bottom decile falls steadily throughout this period, from 0.1 in 1995 to -0.6 in 1999. This indicates that there was a considerable increase in the proportion of observations with negative drop-off ratios. A negative drop-off ratio is found when the firm's share price increases (relative to the market) on the ex-dividend day, notwithstanding the loss of the entitlement to the dividend payment. We discuss this development further below, but note that shifts at the bottom end of the distribution of DORs are not easily explained by the change in the tax treatment of UK pension funds. More generally, Figure 3 shows that the distribution of DORs widened after 1997, while differences in the tax treatment of different classes of investors were reduced. This suggests that developments other than the 1997 tax reform may have been the dominant influence on the behavior of UK drop-off ratios during this period.

## 6.4 Further evidence on timing

We now extend the analysis to consider more carefully the timing of these changes in the mean drop-off ratio, and the longer term evidence. Following BJ, our regression analysis in Tables 1-3 neglected precise timing issues, as there was just one post-reform dummy: the test compared a 30 month period before the reform with a 30 month period after the reform. In order to see more precisely when the fall in the mean DOR occurred, we can estimate the mean DOR for 6 month and 12 month periods. To maintain comparability with the previous results, we again use the GLS estimation procedure explained in Section 4. Table 4 presents these estimates of mean DORs for each year and half-year from 1995 to 1999.

The annual estimates suggest that the mean DOR did not fall significantly until

1999, although the tax reform was implemented in July 1997. The six monthly estimates suggest that there was a marked fall in the second half of 1997. However they also show that there was a larger increase in the mean DOR in the second half of 1998, which stops this showing up in the annual estimate for 1998. Indeed the mean DOR in the second half of 1998 is the highest found for any of these six-month periods. This indicates that there are substantial fluctuations in these estimates of mean DORs, which may have little to do with tax changes.

To explore this further, we consider longer term evidence. Figure 2 plots annual and six-monthly estimates of mean DORs between 1988 and 2000.<sup>16</sup> Our original sample period is marked here by the two vertical bars, with the tax reform occurring in the middle of that period.

This evidence confirms that the behavior of the mean DOR in the UK is indeed erratic. There is a sharp increase from 1988 to 1991, which is not explained by any change in the tax treatment of UK pension funds. Both the fraction of equity owned by tax-exempt institutions (see below) and their tax treatment were stable over this period. The tax discrimination parameter  $\gamma$  for UK pension funds fell from 1.33 in 1992 to 1.25 in 1994, when the rate of the refundable dividend tax credit was reduced from 25% to 20%. However we see that there was no fall in the mean drop-off ratio for UK companies over this period. The period studied by BJ is thus unique in showing an association between a significant fall in the mean DOR and an increase in dividend taxation for UK pension funds. Furthermore, the mean DOR at the end of this period, in the second half of 2000, is very similar to that at the start of the period, in the first half of 1988, although the relevant tax discrimination parameter for UK pension funds had fallen from 1.33 to 1.

These fluctuations in the mean drop-off ratio appear to be associated with changes at the bottom end of the distribution, and in particular with the fraction of observations where the drop-off ratio is negative. Table 5 reports annual figures for the share of observations with negative drop-off ratios. This fraction falls sharply from 1988 to 1991 and increases sharply towards the end of the 1990s, mirroring the fluctuations in the mean drop-off ratio shown in Figure 2. Negative

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<sup>16</sup>Unfortunately we do not have the required data on dividend payments to calculate DORs before 1988.

values for the drop-off ratio - observations where the share price increases despite the share going ex-dividend - seem to be most common in periods when the stock market is both volatile and rising. This was the case immediately after the 1987 stock market crash, and again during the dot com bubble period of the late 1990s. These developments in the tail of the distribution of drop-off ratios appear to exert a strong influence on the behavior of the estimated mean.

The behavior of the mean drop-off ratio in the US provides further grounds for doubting whether the fall in the UK emphasized by BJ was related to the 1997 UK dividend tax reform. Estimates presented in Chetty, Rosenberg and Saez (2005) show that the mean DOR in the US also fell sharply over the period studied by BJ, from around 0.8 in 1994 to around 0.4 in 2000, with the sharpest fall also occurring from 1999 to 2000. Using data over the period 1963-2004, Chetty, Rosenberg and Saez show that such fluctuations in the mean DOR in the US are not uncommon, and display little relationship with changes in dividend taxation. Our evidence for the UK supports their conclusion: estimates of mean drop-off ratios are too volatile to provide reliable evidence about the impact of dividend taxes on the stock market valuation of firms.

## 6.5 Equity ownership

The second proposition discussed in Section 4 concerned the share of UK equities in the portfolios of UK pension funds. This share is expected to fall after the July 1997 tax reform eliminated a major tax advantage for UK pension funds of dividends from UK companies. This prediction also applies to the holdings of UK insurance companies insofar as they relate to the provision of pension plans, although not to the provision of life insurance.

Table 6 reports the proportion of UK equities in the total equity holdings of UK pension funds, insurance companies and unit trusts between 1990 and 2001. The UK share of pension fund equity portfolios did indeed fall sharply, from around three quarters at the end of 1996 to around two thirds by the end of 2001, having been quite stable during the first half of the 1990s. The UK share of insurance company equity portfolios also fell, from around 80% to around 75%, having also

been stable in the period before this tax reform. In contrast, for unit trusts - mutual funds whose tax treatment did not change at all in 1997 - there was a temporary *increase* in the UK share of their equity holdings immediately after the tax reform, although this has since returned to its pre-reform level. This indicates that the change in the composition of equity portfolios observed for UK pension providers was not common to all UK institutional investors during this period. The smaller fall for insurance companies relative to pension funds is consistent with the tax change affecting only part of insurance company portfolios.

Table 7 reports estimates of the fraction of total UK quoted equity owned by different types of shareholders, for the years between 1990 and 2000 for which these estimates are available. The last observation before the July 1997 tax reform refers to the end of 1994, when UK pension funds owned 28% of equity quoted on the London stock exchange. This share fell to 18% by the end of 2000, although it is not possible to date precisely the timing of this fall. The share owned by UK insurance companies has been much more stable. This suggests that the fall in UK equity as a share of insurance company total equity holdings, shown in Table 6, reflected an increase in the total size of their portfolios rather than a fall in their holdings of UK equity. The fall in the share of UK equity owned by UK pension funds was accompanied by an increase in the share of UK equity owned by foreign shareholders, which rose from 16% at the end of 1994 to 32% by the end of 2000. While this was partly a continuation of a longer term trend, it seems likely that this increase in foreign ownership of UK equity was given further impetus by the reduced attractiveness of UK equity to UK pension funds after the abolition of refundable dividend tax credits in July 1997.

As we discussed in Section 3, the effect on the valuation of UK equities would depend on the size of the premium required by foreign investors to increase their exposure to UK-specific risks. A negligible change in this risk premium is consistent with the absence of any noticeable effect on the level of the UK stock market (Figure 1). At first sight this is inconsistent with the change in the mean drop-off ratio after 1997 emphasized by BJ, but as discussed earlier in this section, there are reasonable grounds for doubting whether this fall in the mean drop-off ratio

was driven by the change in the tax treatment of UK pension providers.

## 7 Conclusions

The abolition of refundable dividend tax credits in July 1997 represented a substantial increase in the taxation of dividends paid by UK companies for an important group of shareholders: UK pension funds, and UK insurance companies providing pension plans. Bell and Jenkinson (2002) argued that this tax reform had a substantial impact on the stock market valuation of dividends paid by UK firms, implying that UK pension providers were “the” marginal investors in UK equity, at least in the period before the tax reform.

We question this conclusion on both theoretical and empirical grounds. When different investors are subject to different tax rates, the Capital Asset Pricing Model suggests that the market valuation of dividends should depend on an average of tax rates across all investors holding UK equities. While this gives some weight to the tax treatment of UK pension funds, it is not consistent with the dominant role suggested by Bell and Jenkinson. In this model, all investors that hold both UK equities and other assets are marginal, with differences in tax treatments just offset by differences in exposure to risks at the optimal portfolio allocations. Moreover, since the wealth invested by UK pension providers is small relative to the size of the world capital market, as a first approximation we would expect a change in the tax treatment of UK pension funds to have little or no effect on the pricing of UK equities. The first-order effects of this tax reform should be seen in a shift in the composition of pension providers’ portfolios away from UK equities. This affects equity prices only to the extent that other investors - notably foreign investors - require a higher risk premium to take up additional holdings of UK equity.

Bell and Jenkinson (2002) base their empirical conclusion principally on a fall in the mean drop-off ratio in the UK after July 1997. We confirm that this fall occurred, but question whether it can confidently be attributed to the abolition of refundable dividend tax credits for UK pension funds. The largest fall occurred in 1999, some eighteen months after the tax reform. While the tax change affected

investors with the highest valuation of UK dividends, the main change occurred in the lower tail of the distribution of drop-off ratios. As in the US, the mean drop-off ratio in the UK is shown to fluctuate erratically over a longer time period. Indeed the period studied by Bell and Jenkinson (2002) appears to be unique in showing an association with changes to the tax treatment of UK pension funds. Interestingly, Chetty, Rosenberg and Saez (2005) have shown that there was also a sharp fall in the mean drop-off ratio in the US in late 1990s. Presumably this fall in the US was not driven by the tax treatment of UK pension funds; though it may have been driven by factors that were common to the US and the UK stock markets during this dot com bubble period.

We share the skepticism of Chetty, Rosenberg and Saez (2005) about the use of mean drop-off ratios to test hypotheses about the impact of dividend taxation. Mean drop-off ratios are simply too volatile to attach causal significance to short-run fluctuations around tax reforms.

We report evidence on the ownership of UK equities that are consistent with the predicted changes to the composition of UK pension fund portfolios after this tax reform in 1997. UK pension funds have reduced their exposure to UK-specific risks following the abolition of a uniquely favorable tax treatment of UK dividends. Foreign shareholders have increased their holdings of UK equities over the same period. Noting the relative size of UK and foreign investors, asset pricing theory does not suggest that this should have had a major impact on the market valuation of UK equity. This is consistent with the absence of a crash in the UK stock market on the announcement of this tax reform; and, in our view, it is also consistent with a closer examination of the available empirical evidence.

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**Table 1: Regression results obtained by BJ and replication**

	<i>BJ</i> <i>all firms</i>	<i>BJ</i> <i>largest 250</i>	<i>Replication</i> <i>all firms</i>	<i>Replication</i> <i>largest 250</i>
Observations	8837	2348	7966	1565
pre 07/97	0.890** (0.018)	1.028** (0.027)	0.904** (0.013)	0.978** (0.024)
$\Delta$ post 07/97	-0.106** (0.029)	-0.204** (0.041)	-0.080** (0.024)	-0.168** (0.050)

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%).

**Table 2: Regression results by dividend yield quintiles**

	(1)	(2)	(3)	(4)	(5)
Observations	1594	1593	1594	1593	1592
pre 07/97	0.821 (0.050)**	0.834 (0.033)**	0.912 (0.028)**	0.927 (0.025)**	0.917 (0.023)**
$\Delta$ post 07/97	-0.021 (0.086)	0.007 (0.053)	-0.114 (0.051)**	-0.114 (0.040)**	-0.078 (0.043)*

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%).

**Table 3: Regression results by pre-reform dividend yield quintiles**

	(1)	(2)	(3)	(4)	(5)
Observations	1387	1649	1633	1598	1525
pre 07/97	0.765 (0.058)**	0.859 (0.035)**	0.908 (0.025)**	0.935 (0.025)**	0.910 (0.023)**
$\Delta$ post 07/97	0.014 (0.081)	-0.041 (0.057)	-0.086 (0.040)**	-0.122 (0.046)**	-0.032 (0.044)

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 pre-reform dividend yield quintiles, where (5) is the top quintile. Stars indicate the level of significance (\*: 10%, \*\*: 5%).

**Table 4: Estimated drop-off ratios by year / half-year**

<i>Half year</i>	<i>Yearly</i>	<i>Half-yearly</i>
1995h1		.92
	.91	(.02)
1995h2	(.02)	.88
		(.03)
1996h1		.87
	.89	(.03)
1996h2	(.02)	.91
		(.03)
1997h1		.92
	.89	(.03)
1997h2	(.02)	.84
		(.04)
1998h1		.80
	.88	(.04)
1998h2	(.03)	.95
		(.04)
1999h1		.77
	.76	(.06)
1999h2	(.04)	.76
		(.04)

Notes: Heteroskedasticity-robust standard errors in parentheses. Results obtained by regressing DORs multiplied by D/Pc on D/Pc for each year and half-year using the full sample of firms.

**Table 5: Share of negative DORs**

<i>Year</i>	88	89	90	91	92	93	94	95	96	97	98	99	00
Share of negative DORs (%)	21	14	13	9	15	12	12	9	10	13	15	16	20

Notes: Calculated for full sample of firms.

**Table 6: Share of UK equities in total equity holdings of pension funds, long-term insurance companies and unit trusts**

	<i>Pension Funds</i>	<i>Insurance Companies</i>	<i>Unit trusts</i>
1990	75.0%	80.9%	64.9%
1991	74.2%	79.6%	62.0%
1992	76.2%	80.3%	60.4%
1993	74.9%	78.2%	60.1%
1994	74.6%	77.9%	56.4%
1995	75.7%	77.7%	62.1%
1996	76.6%	79.0%	58.8%
1997	76.5%	80.5%	66.9%
1998	75.5%	80.6%	64.6%
1999	70.7%	76.7%	63.0%
2000	68.8%	78.6%	59.5%
2001	67.1%	75.1%	59.2%

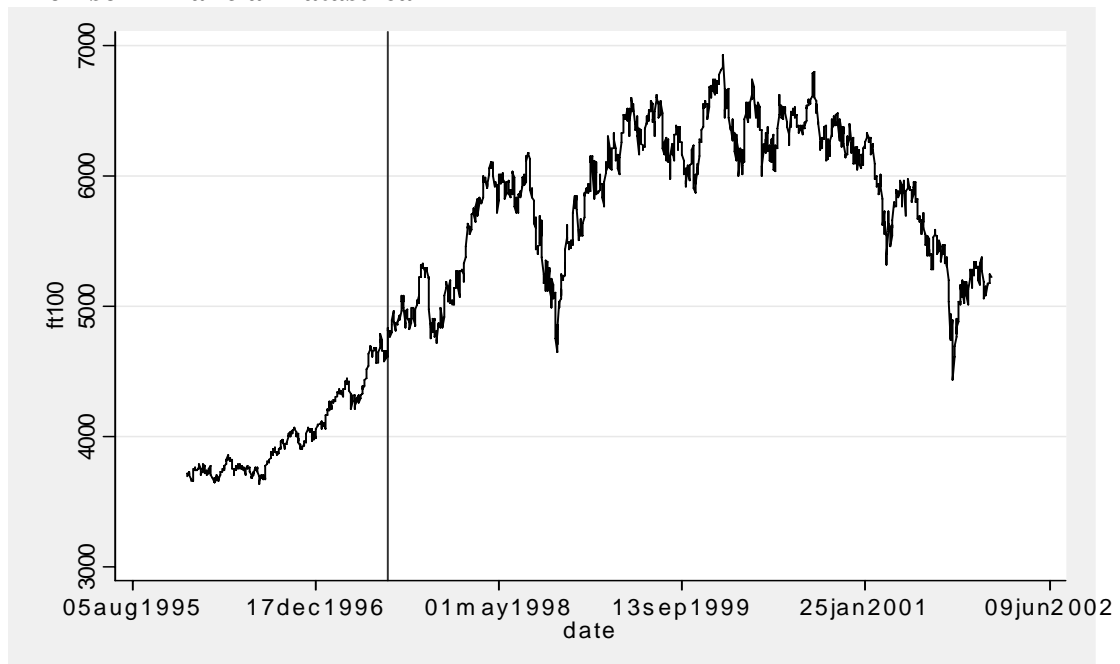
Source: Financial Statistics, tables 5.1A and 5.1B.

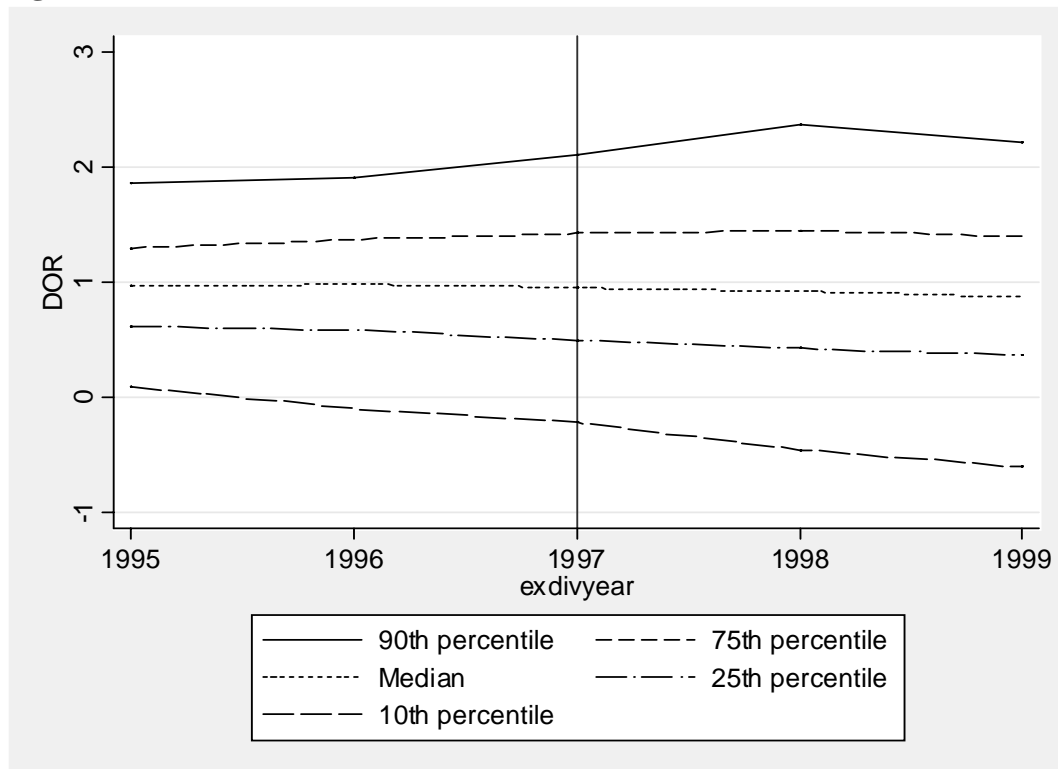
**Table 7: Beneficial Ownership of UK equities**

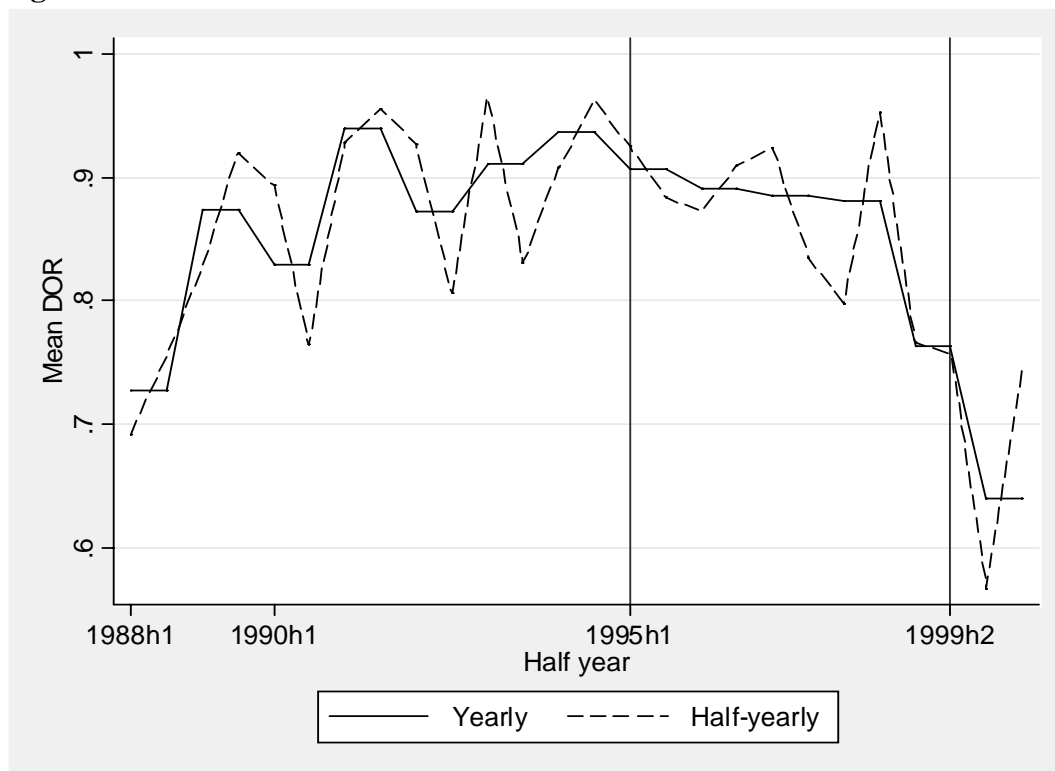
	<i>1990</i>	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>
UK Pension Funds	31.7	31.3	32.4	31.7	27.8	22.1	21.7	19.6	17.7
UK Insurance Companies	20.4	20.8	19.5	20	21.9	23.5	21.6	21.6	21.0
Foreign Shareholders	11.8	12.8	13.1	16.3	16.3	24	27.6	29.3	32.4

Source: National Statistics (2003), table A; end of year figures. No data available for 1995 and 1996.

**Figure 1: FTSE 100 index, 2nd of July 1997 indicated by vertical line. Source: Thomson Financial Datastream**



**Figure 2: The distribution of estimated DORs**

**Figure 3: DORs from 1988 to 2000**

Notes: Results obtained by regressing DORs multiplied by  $D/P_c$  on  $D/P_c$  for each year and half-year using the full sample of firms.

Excerpt from "Reforming the US Corporate Tax," Gary Clyde Hufbauer and Paul L. E. Grieco, September 2005

# 5

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## Replacing the Corporate Income Tax

The tension between meeting the demands of the growing federal deficit and minimizing the potential damage to businesses through corporate taxes requires a new workhorse for federal business taxation. We recommend going further than simply adding a new tax. The current corporate income tax, with its multiple loopholes and jagged profile, should be removed and replaced by a relatively flat business tax. We consider two replacement models: a national retail sales tax (NRST) and a corporate activity tax (CAT) modeled after the VAT.

### Option 1: National Retail Sales Tax

For many years, the proposal of an NRST to replace the entire income tax system has circulated among a small but devoted group of members of Congress. Senator Richard Lugar (R-IN) and Representative Bill Archer (R-TX) put forth the initial proposal in 1994. In 1998, Representative Billy Tauzin (R-LA) published a book that contained the proposal introduced by himself and Representative Dan Schaefer (R-CO). The current manifestation of the NRST, backed by Americans for Fair Taxation (AFT), is the Fair Tax Act of 2005 (HR 25), sponsored by Representative John Linder (R-GA) with 37 co-sponsors. The Fair Tax Act would abolish all federal income taxes, including individual, corporate, and payroll taxes, and replace them with the NRST. House Speaker Dennis Hastert (R-IL) favors this approach.

The Fair Tax Act proposes a tax-inclusive rate of 23 percent, equivalent to a sales tax of 30 percent on the tax-exclusive price of goods sold.<sup>1</sup> However, few outside observers take this rate estimate seriously.<sup>2</sup> Jorgenson and Yun (2005) note that “it is well known that the ST [Schaefer-Tauzin] and AFT [the Fair Tax Act] proposals fail to achieve revenue neutrality and tax rates must be increased substantially above the levels proposed by the authors.”<sup>3</sup>

A more modest proposal, but still a dramatic break with US tax history, is to use the NRST to replace only the corporate income tax. This switch is the focus of our analysis. In table 5.1, we adapt Gale’s methodology (1999) to calculate the rate required of an NRST first to replace the federal corporate income tax, which collected 2.1 percent of GDP in 2000, and then to raise the additional 1.9 percent of GDP that we estimate will be needed over a period of several decades.<sup>4</sup> Then, we calculate the NRST rate that would raise sufficient revenue to address the regressivity problem for households at the lowest income level. Each estimate begins with total personal consumption expenditure as the base, and then makes several adjustments.

Gale and other scholars assume that the effect of the NRST on currently untaxed government transfers to individuals—mainly Social Security—will be neutralized by household grants or other means (Gale 1999, Gale et al. 1998, Graetz 2002a). They argue that political realities will require maintaining the real value of transfers to households. This argument might be convincing if all federal income taxes were replaced by an NRST. It has less force since we are replacing only the corporate income tax, which accounted for only 11 percent of federal income taxes, including payroll taxes, in 2000 (OECD 2003). Our calculations do not contain a markup to maintain the real value of government transfers.

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1. Sales tax rates are generally assessed exclusive of the tax. A tax that collects 23 percent of gross receipts must collect a 30 percent tax on top of the untaxed price, calculated as  $0.23/(1-0.23) = 0.30$ .

2. In analyzing this proposal William G. Gale (2004) calculates that the revenue-neutral rate required to replace all federal income taxes would be 38 percent tax-inclusive, or 60 percent on a tax-exclusive basis. Gale calculates such a high sales tax rate because in his view, the sales tax base would inevitably be eroded by evasion and the exemption of many services. Dale Jorgenson and Kun-Young Yun (2001, table 8.4) perform several simulations in which the sales tax rate is altered to achieve steady-state revenue neutrality. To completely eliminate income and payroll taxes, they calculate that a flat NRST of about 29 percent (a tax-exclusive sales tax rate of 41 percent) would be required, assuming no tax base erosion.

3. Dale Jorgenson is cited on the Web site of Americans for Fair Taxation ([www.fairtax.org](http://www.fairtax.org)) and in Tauzin (1998) in support of their proposals.

4. Based on our earlier analysis of the federal spending trajectory and our model of tax shares. In 2000, all federal business taxes (including excise taxes and tariffs) amounted to 3.1 percent of GDP.



**Table 5.1 Possible NRST rates for replacing the corporate income tax, 2000**

Calculation	Base (billions of dollars)	Revenue (billions of dollars)	Tax- inclusive rate (percent)	Tax- exclusive rate (percent)
<b>Personal consumption expenditure (PCE) base</b>	6,739	208	3.1	3.2
Subtract 20 percent of PCE for legislated erosion	(1,348) 5,391	208	3.9	4.0
Subtract 5 percent of PCE for avoidance/evasion erosion	(337) 5,054	208	4.1	4.3
Add revenue to rebate consumption to poverty level	5,054	79 287	5.7	6.0
Or				
Raise revenue 1.9 percent of GDP (over several decades)	5,054	187 395	7.8	8.5
And add revenue to rebate consumption to poverty level <sup>a</sup>	5,054	152 547	10.8	12.1

NRST = national retail sales tax

Note: Removes all household spending below the poverty line from the NRST tax base, effectively reducing the tax base by \$1,390 billion. As revenue rises, the cost of this provision will rise in dollar terms.

Sources: BEA (2004a, table 2.1) and authors' calculations.

Next, we consider the likely erosion of the tax base. Erosion comes from two main sources. One is the legislated exclusion of "merit goods," such as housing rents,<sup>5</sup> food, pharmaceuticals, medical care, education, and several other services, from the tax base. In its evaluation of the likely tax base for a potential NRST or VAT, the CBO (1997, table 8) chose to exclude 20 percent of personal consumption expenditure for a "broad" base calculation and 40 percent for a "narrow" one.<sup>6</sup> Optimistically, we adopt the 20 percent figure for legislated erosion.

5. This would include rent on tenant housing and imputed rent on owner-occupied housing, both of which are components of personal expenditure. Merit goods are a way of addressing regressivity, but they are also a reflection of a political consensus that certain necessities should be free of tax, regardless of income.

6. The primary exclusions in the CBO calculation of a broad base were tenant-paid rent and imputed rent on owner-occupied housing. Examples of items included in the broad base, but excluded in the narrow base, are food purchases, medical care, brokerage and banking services, and education.

Avoidance and evasion will also erode the tax base. Business firms may purchase consumption items for their senior employees, and some retailers may claim that sales actually made to households were made to other businesses. Very conservatively, we calculate that 5 percent of the base will be lost to avoidance and evasion, and add this to the “broad” CBO base to calculate total erosion of 25 percent of personal consumption expenditure. We regard this base as extremely optimistic.

A flat NRST is inherently regressive with respect to income; without progressive adjustments, it will face extreme political objections. Conceptually, it is simple to redress the NRST’s regressive impact on low-income households by first increasing the tax rate beyond the bare amount needed to replace the corporate tax, and then distributing the excess in a manner that compensates the poorest households. Some advocates favor “demogrants,” literally an NRST rebate check mailed to all individual households.<sup>7</sup> However, adjusting the individual income tax system could achieve much the same effect with far less churning of tax payments and refunds, and consequently less potential for fraud. One way is to legislate refundable tax credits for estimated NRST payments on a poverty level of consumption.<sup>8</sup>

As tax revenues will need to increase in the coming decades, we also calculate the NRST rate needed to raise business tax revenue by 1.9 percent of GDP. This is the amount projected by our model of OECD tax shares in the event that federal spending, driven by entitlements, rises by 9 percent of GDP over several decades.

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7. Drawing on the experience of US states, some will argue that the regressive character of the NRST can be entirely addressed through the use of merit goods rather than demogrants. This may be true, but we are skeptical. Because the anticipated tax rate of the NRST is much higher than any state RST rate, there will be more concern about the progressive nature of the tax system. For the purposes of exposition, we approximated a very narrow exclusion for legislated base erosion. The goods we excluded—primarily rent and imputed rent on owner-occupied housing—are political and administrative necessities for reasons that go beyond a progressive tax code. (In fact, the very popular exemption for owner-occupied housing is regressive in nature.) If merit goods alone were used to address regressivity, legislated exclusions would be much broader. As a result, the initial tax base would be smaller, so that, even without the need to pay demogrants, the required tax rate would be roughly the same. However, the market would be further distorted toward the production of the anointed merit goods.

8. Currently, the EITC already pays tax rebates greater than the amount of income tax paid. However, the system is controversial and prone to fraud. We choose not to get sidetracked by how money is disbursed to alleviate the regressive character of the NRST or CAT. However, we assume that enough money will be raised to ensure that household consumption up to the poverty line is not taxed. Once this money is raised, a key part of the political fight will be who gets it: whether it should go to every household, or specifically to low-income households identified through a means test. If the money were to go to low-income households exclusively, the system would rebate a higher level of their consumption tax payments.

We estimate that the tax base of an NRST would have been \$5 trillion in 2000, or 51 percent of GDP (alternatively 75 percent of personal consumption expenditure, PCE).<sup>9</sup> By this estimate, the rate required of the NRST to replace the corporate income tax would be 5.7 percent. To accommodate the projected increase in business taxation, the rate would have to rise to 10.8 percent. Both rates are tax inclusive, and include the cost of alleviating the regressive character of the tax for low-income households, which requires an additional \$79 billion of revenue in the pure replacement case (adding 1.6 percent to the NRST rate) and \$152 billion of revenue in the higher business tax case (adding 3.0 percent to the NRST rate).

To collect the NRST, the federal tax system would have to be expanded to cover all retail sales outlets in the United States. Currently, no federal sales tax system exists, although most states have their own systems for collecting state sales tax.<sup>10</sup> It is unclear whether NRST advocates propose an enforced harmonization of state RST tax bases with the NRST (a clear federal intrusion into a domain historically reserved to the states), or whether retailers would be forced to keep track of the separate federal and state definitions of the RST base. In any event, from data reported by California, Texas, and Illinois, we estimate there are some 6.7 million potential NRST collection points in the United States. Most states require each collection point to file RST returns on a monthly basis so retail outlets do not fall behind in remitting taxes to the state treasury. If the federal government follows the same model, NRST collection will entail a substantial administrative undertaking, for states, retail outlets, and the federal government.

To mesh the federal NRST and state RSTs, and possibly alleviate the administrative burden, the government could set a higher rate for the federal tax and allow a credit for state RST. The credit would have to be capped at, say, 6 percent to prevent state governments from cannibalizing federal revenue. Replacing the federal corporate income tax and state retail tax would require a combined federal-state rate of about 12 percent. One advantage of the credit method is that it would be likely to encourage states to harmonize their sales tax base with the federal definition, but not require them to do so.

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9. This base is probably optimistic. Edwards (2005) calculated that the average state RST base was only 36 percent of gross state product (GSP), although the RST bases vary across a wide range, 26 to 71 percent of GSP.

10. NRST advocates suggest that states should collect the NRST and forward the proceeds to the federal government. Tauzin (1998, 105), for example, suggests allowing states to charge a "commission" of 1 percentage point on the NRST; he would also permit retail sales outlets to collect a commission of 0.5 percentage point. We have not included these compliance incentives in our calculation of NRST rates. As mentioned earlier, we question whether the federal government can delegate its tax-collecting function to the states.

## Option 2: Subtraction-Method VAT or Corporate Activity Tax

Following Senator William Roth (R-DE) and Representative Richard Schulze (R-PA) in 1985, Representative Sam Gibbons (D-FL) in 1993, and Senators John Danforth (R-MO) and David Boren (D-OK) in 1994, we analyze the subtraction-method VAT as an alternative template for US business taxation.<sup>11</sup>

Although it has no current champions in Congress, the subtraction-method VAT has attracted support in the past for four reasons.<sup>12</sup> First, as an entity tax, it more closely resembles the corporate income tax than a credit-invoice VAT or the NRST, which are akin to transaction taxes. *At a political and conceptual level, it would be far easier to transform the corporate income tax into a subtraction-method VAT than to start over with the complex transaction-tracing rules entailed by a credit-invoice tax.*<sup>13</sup>

Second, the subtraction-method VAT avoids many of the political problems of the credit-invoice VAT and the NRST. The credit-invoice VAT visibly overlaps with the retail sales tax because it appears on every retail (and nonretail) sale. Thus, a federal business tax modeled on the credit-invoice VAT would intrude on tax space historically occupied only by states and cities.<sup>14</sup> The NRST, of course, also suffers from this political liability.

Third, the subtraction-method VAT would probably impose less of an administrative burden on tax collection agencies. A credit-invoice tax would entail approximately 8.4 million collection points, encompassing business firms of almost every description. By comparison, the current number of corporate returns is about 6 million. The larger number of credit-invoice

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11. Charls E. Walker, a deputy secretary of the Treasury during the Nixon administration, was the intellectual father of the business transfer tax (BTT, a version of the subtraction VAT) and largely responsible for sparking reform in the 1980s and early 1990s. Ernest Christian, working with Walker, drafted the proposed BTT legislation and subsequent variations, such as the unlimited savings allowance (USA) tax.

12. Ways and Means Chairman Bill Thomas (R-CA) has spoken favorably of a VAT but has not yet spelled out a VAT proposal; see box 4.1.

13. Of course, similarity also brings disadvantages. For example, it is very easy for corporations to "count the beans" to determine whether they win or lose from replacing the corporate income tax with CAT and lobby appropriately. However, most firms have the sophistication to perform this exercise on any proposed tax reform. It is the creation of winners and losers, and not the difficulty of determining who is which, that brings the greatest resistance to any tax reform program.

14. In Europe, many of the VAT systems were introduced to replace a tangle of cascading manufacturing sales taxes and turnover taxes. In that context, it was natural to select a credit-invoice VAT because it took advantage of established systems of tax reporting. For similar reasons, but in a different tax context, we endorse the subtraction-method VAT for the United States.

returns comes about because partnerships would also become tax collection points (IRS 2003c).<sup>15</sup>

Fourth, the subtraction-method VAT is more prone to a single tax rate than the credit-invoice VAT. It can be jiggered to result in multiple rates, but the burden of persuasion falls on legislators who depart from the single-rate premise.<sup>16</sup> The mechanical structure of the credit-invoice VAT shouts an invitation for multiple tax rates—exactly the opposite of tax reform.

Considering just the realm of VATs, these four considerations lead us to recommend a tax modeled after the subtraction-method VAT rather than the credit-invoice VAT. Our proposal is a CAT, broadly structured to include labor, capital, and technology income in the tax base. Leaving aside transition rules, we envisage several basic features.

CAT should be designed to apply to medium and large corporations, those with annual receipts of \$10 million or more.<sup>17</sup> There were about 131,000 such firms in 2000 (IRS 2004). This is a small fraction of total taxpaying business entities: In 2000, there were 4.9 million corporations with receipts of less than \$10 million, 2.1 million partnerships, and 17.9 million nonfarm proprietorships. To be conservative, we estimate that the number of firms subject to CAT liability—in other words, the number of tax collection points—would be around 200,000.

CAT would not apply to Subchapter S corporations (usually small firms) or noncorporate business firms (partnerships and proprietorships).<sup>18</sup> This would retain the current distinction between taxable firms (normal Subchapter C corporations) and pass-through firms (Subchapter S corporations, partnerships, and proprietorships). Under current law, business entities that are organized as Subchapter S corporations, partnerships, or proprietorships are not taxed on their business income. Instead, their income (or loss) is attributed to their owners and taxed as individual income.<sup>19</sup>

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15. We assume that a minimum revenue threshold for VAT registration would largely exempt sole proprietorships.

16. To operate a subtraction-method VAT with multiple rates, all inputs must be allocated into separate rate baskets, making administration and enforcement much more complex. Japan, the most important country with a subtraction-method VAT, uses two VAT rates in addition to zero-rating exports (Ebrill et al. 2001, table 1.3). The United States should resist this temptation.

17. The rules defining a CAT payer should be such that large publicly traded partnerships would also be required to pay CAT. CAT should be envisioned as a conventional VAT with a very high minimum revenue threshold (\$10 million). For reference, the UK VAT registration threshold is £60,000 (\$110,000).

18. We do envision that CAT would apply to large publicly traded partnerships. However, for simplicity of exposition, we do not include them in our statistical analysis. Including these firms will broaden the tax base and lower the required CAT rates.

19. Pass-through firms would calculate their profits and losses as under current law, but reformed (if possible) so that taxable income matched financial income under generally accepted accounting principles (GAAP).

The CAT base would be domestic sales of goods and services, with exceptions for capital and technology income noted below, minus purchases from other US firms, *but* only if those vendors are themselves subject to CAT. Purchases of raw materials, utilities, components, and inventory from US firms subject to CAT would all be eligible deductions. So would purchases of equipment and software—the functional equivalent under the present corporate tax law of immediate expensing.<sup>20</sup> However—and this is important—purchases from US firms not subject to CAT could not be deducted by firms subject to CAT. In this way, CAT would be indirectly collected on business-to-business sales from pass-through firms (mainly small firms) to large firms, because large firms would include such purchases in their CAT base. By this mechanism, the distortion between corporate and noncorporate taxation would be substantially alleviated, although not entirely eliminated.<sup>21</sup>

Since CAT would be adjustable at the border, exports of goods and services would be zero-rated (the details of border adjustment are discussed in appendix C). Production abroad by US-based MNEs for local or third-country markets would not be subject to CAT.<sup>22</sup> The employer's portion of Social Security (currently 6.2 percent) and Medicare (1.45 percent) taxes—essentially business taxes on the use of labor inputs—would be credited against CAT.<sup>23</sup> However, no refund would be permitted for excess credits. This credit mechanism has three objectives: not to disturb the time-tested arrangements for financing Social Security and Medicare; not to discourage employment; and to ensure that payroll taxes are collected on US exports, even when no CAT is collected.<sup>24</sup> In appendix D,

20. This means firms could not deduct depreciation of equipment from the CAT base. Moreover, to preserve revenue, we envisage that investment in long-lived assets (such as structures) would not be deductible from CAT. However, when these assets were sold (or retired), capital losses could be deducted, while capital gains could be taxed. Alternatively, annual depreciation on long-lived assets could be claimed as a deduction from the base, with a supplementary calculation of capital losses or gains when the asset is sold. This alternative would likely erode the revenue collected by CAT.

21. Strictly speaking, CAT would be collected on all value added up to the final stage of production that involves a CAT-registered company. Hence, the tax base would be larger than we have estimated in table 5.2, in which we exclude all value added from non-CAT payers (about 30 percent of total private industry value added). Industries in which a substantial portion of value added would *not* be subject to CAT would include: real estate leasing (which averaged 13 percent of private industry value added between 2000 and 2004), health services (8 percent), food services and drinking places (2 percent), legal services (2 percent), and educational services (1 percent).

22. If US-based MNEs produced goods and services abroad for export to the United States, they would be subject to CAT in the same manner as all other imports.

23. The Social Security tax is assessed on each employee's compensation up to \$90,000, while the Medicare tax is uncapped.

24. CAT, like any consumption tax, is intended to uniformly tax primary inputs: labor and capital. Allowing a credit for the payroll tax merely counteracts the distortion against

**Table 5.2 Illustrative calculation of CAT base, 2000**  
(billions of dollars)

<b>Total private industry value added:</b>	8,607
Minus value added by partnerships and nonfarm proprietorships	(1,253)
Minus value added by corporations with receipts under \$10 million	(1,178)
Plus repeal of depreciation allowances for large corporations <sup>a</sup>	516
Minus expenditures for equipment and software by large corporations	(659)
Plus imports of goods and services	1,445
Minus exports of goods and services	(1,070)
<b>Equals tax base for CAT: Corporations with receipts of \$10 million and over</b>	<b>6,408</b>
<i>Memorandum:</i>	
GDP in 2000	9,828
Corporate income tax revenue in 2000	208
As percent of GDP	2.1

CAT = corporate activity tax

a. A capital consumption adjustment is a negative component of private industry value added. Instead of allowing a depreciation deduction, the CAT will expense equipment and software in the year they are purchased.

Sources: US Census Bureau (2003), BEA (2004a), and authors' calculations.

we outline in greater detail how CAT would apply to imports and exports, financial receipts and payments, and capital expenditures.

Table 5.2 illustrates the base to which CAT would apply. To construct estimates, we assume that approximately 200,000 medium and large corporations with annual receipts of \$10 million or more are subject to CAT, and that all other business firms are exempt. By taxing only medium and large corporations, and therefore reducing the number of collection points, CAT avoids many of the evasion and enforcement problems of the NRST. Elements of the estimation process, spelled out in table 5.2, track the basic features laid out above.

In table 5.3, we use the base derived above to calculate the rates required to replace the federal corporate income tax with CAT, and to raise an additional 1.9 percent of GDP in business tax revenue. According to these calculations, the revenue-neutral rate would be 7.8 percent, and the rate required to meet our forecast of additional business tax revenue over several decades is 11.5 percent. These rates provide for the amounts required to alleviate the tax burden on all households up to the

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labor imposed by this long-standing and politically invincible tax. We do not include a similar credit for the NRST owing to its conception as a transaction tax, although one could be considered.

**Table 5.3 Possible CAT revenue and rates for replacing the corporate income tax, 2000 (billions of dollars)**

Revenues	Replace existing corporate income tax	Replace existing corporate tax and raise 1.9 percent of GDP
Revenue goal	208	395
Plus payroll credit <sup>a</sup>	181	181
Equals total collected revenue	389	576
CAT rate (flat, percent)	6.1	9.0
Plus revenue to finance progressivity <sup>b</sup>	108	160
Equals total revenue raised	497	736
CAT rate (progressive, percent)	7.8	11.5
<i>Memorandum:</i>		
CAT base	6,408	

CAT = corporate activity tax

a. Revenue amount required to meet revenue goal and allow \$181 billion tax credit for payroll taxes to large corporations.

b. Amount of revenue required to rebate CAT rate to all households for purchases up to the poverty line. This effectively removes \$1.4 trillion from the tax base.

Note: Since CAT is an entity tax, we report only the tax-inclusive rate.

Source: Authors' calculations.

poverty line for household income (the same rebates we used in our NRST calculation). As described above, we assume corporations would be allowed a tax credit to cover the employer share of Social Security and Medicare payroll taxes.

### Conclusion: Contrasting the NRST and CAT

The fiscal outlook is not so dire, nor is global tax competition so severe, that the corporate income tax needs to be replaced immediately by a new system. Nevertheless, the administration, working with Congress, should launch the reform process by enacting the legal structure for the NRST, CAT, or a similar broad-based tax. To ease the transition to the new tax system, CAT could be phased in by 1.5 percentage points each year for the first five years starting in 2010, while the federal corporate income tax could be phased out by cutting the statutory rate by about 7 percentage points each year.<sup>25</sup> A similar approach could be used for the NRST.

25. For manufacturing firms that benefit from the American Jobs Creation Act of 2004, the statutory rate would be cut by 6.4 percentage points per year.



If, as we expect, the fiscal gap continues to grow and requires more revenue, the CAT rate could be raised, say, 1 percent every 5 years for the next 25 years. If by some miracle the gap in the federal budget ceases to grow, the reforms are still worthwhile for the considerable benefits the United States would derive from consigning the jagged corporate income tax to history. As argued in previous chapters, collecting business taxes through CAT or the NRST would inflict far less distortion on the US economy than current corporate income taxes do.

Implementing either the NRST or CAT would require a major overhaul of the US business tax system. If the experiment with broad-based taxation proves successful, the new system might be extended over time to shoulder part of the revenue load from the individual income tax. In box 2.3, we briefly contemplate a more ambitious tax reform agenda, designed to encompass the individual income tax as well as the business tax system. Such a proposal might well have political appeal. We are concerned, however, that trying to do too much in a single step would sink the entire reform effort.

And business tax reform is needed. The corporate income tax badly serves the United States. It hobbles the country in global competition; it does little or nothing to promote equality, its original and still commonly recited justification; it is rife with distortions that erode efficiency; and it promises to get much worse in the future. The NRST and CAT, both strong candidates to replace the corporate income tax, are closely related, and it is tempting to consider them nearly equivalent. But tax details conceal many devils. If a consensus emerges in favor of a broad-based tax, the final shape will depend as much on political as economic considerations. To conclude, we offer several direct comparisons between the NRST and CAT.

### **Macroeconomic Effects**

In macroeconomic terms, the NRST and CAT are similar in efficiency and distributional impacts. Both systems would improve the efficiency of the US economy enormously compared with the corporate income tax. Both can be tailored to eliminate the regressive impact on poor households. With respect to border adjustment, which we examine more closely in appendix C, the two systems are likely to achieve similar results, albeit through different paths. Both would put the US traded goods and services sectors on the same tax footing as their global competition: business taxes would be imposed on imports and exempted on exports.

### **Simplicity, Evasion, and Avoidance**

The NRST is a simpler tax than CAT. Its tax base is gross retail sales with no deductions. Exemptions are only permitted for “merit” goods

and services, and for foreign sales. The NRST is also an extension of the familiar RST, whereas CAT, like all VAT systems, is strange and unfamiliar to most Americans.<sup>26</sup> However, elements of both CAT and the NRST are easy to evade. Like all VATs, CAT is self-enforcing on business-to-business transactions (because auditors can check the buying firm's reported purchases of inputs against the selling firm's reported sales), but there is no good way of verifying the final sale from businesses to households. Still, examples from other countries have shown that VAT rates of up to 25 percent can be enforced. For the NRST, the entire tax must be collected on business-to-household sales. State RST rates are generally in the range of 5 to 7 percent. If federal rates exceed 15 percent, the incentive to evade the NRST might pose a more severe enforcement problem. Moreover, it has proven politically difficult to extend the NRST to a wide range of services transactions—but that would be required if rates are to be kept at the levels we present in table 4.6.

### Tax Elasticity and the Budget

A premise of the NRST is to “starve the beast.” Advocates believe that the political difficulty of raising RST rates, or expanding the tax base to cover “merit” goods and services, will force the federal government to curtail spending, especially entitlement spending. This may be true, although evidence is severely lacking. It might well be more difficult for Congress to raise NRST than VAT rates. Our regression equations indicate that RST revenues roughly keep pace with GDP growth, but exhibit a very weak time trend. By comparison, VAT systems appear on average to collect more revenue year by year, which may reflect the lesser political difficulty of raising VAT rates or expanding the VAT base.

None of this says anything about government spending. In recent years, tax cuts have led not to lower spending, but rather to larger public deficits. Earlier, we argued that the enormous public support for Social Security and Medicare will require higher taxes in future decades, even as future entitlement expenditures are capped. Given this situation, after fiscal stability, our primary goal is to minimize the potential distortion of higher business taxes. If the NRST can accomplish this goal more readily than CAT, fine. But we question whether “starve the beast” logic would succeed in achieving fiscal balance; instead, it might lead to the retention or reinvention of the corporate income tax.<sup>27</sup>

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26. Tax history in other industrial countries differs sharply from the United States. While the VAT has become the system of choice in OECD countries, no OECD country maintains an NRST. Between 1967 and 1995, 19 OECD countries moved from a retail, wholesale, or turnover taxes to the VAT (Gale 1999).

27. The “starve the beast” strategy essentially entails a game of chicken within US fiscal policy. Low-tax advocates and high public spending advocates deliberately steer the budget

## Transparency

Related to these debates is the question of transparency. Conservative proponents of the NRST generally characterize the VAT as a “hidden” tax (Tauzin 1998, 67). They argue that if citizens knew the cost of taxation, political sentiment would hold federal spending at a lower level. This appeals to common sense, but Norman Gemmill, Oliver Morrissey, and Abuzer Pinar (2003) use survey data from the United Kingdom to suggest it may not hold up empirically. They find that taxpayers tend to overestimate their VAT burden rather than underestimate it, both absolutely and in relation to the individual income tax. In any case, if there are strong public demands for government transfers or services, the “solution” may be found in less visible forms of taxation (back to the corporate income tax) or new regulations, such as mandated corporate pension and health care plans for employees and retirees.

In Canada, as opposed to many other countries, the goods and services tax (GST), a cousin of the VAT, lists the tax paid on each invoice. This is all that is required to remove the “hidden” nature of the VAT, and while it is more natural to the credit-invoice method, it can be implemented with the subtraction-method VAT, such as CAT, as well.<sup>28</sup>

## Reporting Burden

From the taxpayer’s standpoint, CAT liability far more closely resembles the corporate income tax than does the NRST. CAT is paid by businesses throughout the production chain, while the NRST is assessed on goods and services only when purchased by households. It would also be comparatively simple to convert the current corporate reporting system into a CAT system. We estimate that CAT would require less than 200,000 entities to file tax returns, a substantial decline from the 6 million corporate tax returns filed in 2004 (IRS 2003c). By contrast, the NRST would require a new federal system of taxing retail sales, requiring perhaps 6.7 million returns filed monthly.

## Federal-State Tax Relations

Past federal gestures at enacting a broad-based tax aroused a very hostile response from state governors and big-city mayors, and were dropped

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toward unsustainable debt levels in hopes that the other side will blink first. Steuerle (2004, 251) offers this comment on the “spend it first” dynamic of modern fiscal policy (referring to both tax cuts and spending increases): “this practice is equivalent to dictating to our children a list of what they can and cannot consume for decades to come.”

28. Chris Edwards (2005, 24), a conservative commentator, argues that presenting the final consumer with a figure for total VAT paid should be a necessary condition for conservative support of any VAT-variant proposal.

(box 4.1). Put simply, state and city officials regard the federal retail sales tax, and anything that looks like a federal sales tax, such as the VAT, as an encroachment into "their" tax dominion.

On this score, we think CAT has a marginal advantage over the NRST, because the reporting and paying burdens under CAT closely resemble the corporate income tax. However, in the final analysis, acceptance or rejection by subfederal officials may depend more on federal inducements than the particular form of broad-based business taxation.

### **Complementary Expenditure Caps**

If business taxes are going to be raised, whether through an NRST, CAT, or something else, complementary political bargains will be needed not only to cap the growth of entitlement benefits, but also to raise payroll and individual income taxes. None of this can be done quickly or easily. But better for the next administration to start the difficult task of reforming tax and spending than bequeath the entire burden to its successors and continue the march toward an inevitable crisis.

## DOMESTIC TAXES AND INTERNATIONAL TRADE: SOME EVIDENCE

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**Abstract:** The impact of corporate taxes and the VAT on trade performance continues to excite controversy, but has received little empirical attention. This paper uses panel data for the OECD countries from 1967 to 2003 to examine the effects of these taxes on export performance, paying particular attention to the potentially complex dynamic effects to which theory points. Increased reliance on VAT revenue tends to be associated with a sharp reduction in net exports, which quickly fades. This though may reflect unrelated movements in consumption, and our preferred specifications point to no effect in either the short or the long run. The results also point, however, to powerful effects from the corporate tax, of a kind that theory would predict from a source-based tax of this kind. Increases in corporate taxation—whether measured by revenues or the statutory rate—are associated with sharp short run increases in net exports (consistent with induced capital flows abroad); these are then subsequently reversed, leaving an increase in net exports (consistent with increased income from investments abroad) that converges to zero.

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## I. INTRODUCTION

As explicit taxes on international trade have diminished, so the potential impact of domestic taxes on international trade has become more apparent and controversial. In the early days of the European Union, for example, the elimination of internal customs barriers led to sharp disagreements, especially between France and Germany, as to the trade impact of the differing forms, levels and balance between direct and indirect taxes in the various member states (Sinn, 1990). That same debate has rumbled on for many years in the United States, where it is quite commonly argued that the remission of VAT on exports places foreign countries at an unfair competitive advantage in world markets relative to those (notably of course the US) more reliant on the corporate income tax. This view underlay the long-running dispute at the WTO over the Foreign Sales Corporation (and predecessor DISC and Successor EITI) legislation of the United States. Although (perhaps because) this scheme and its successors have now been removed, the same concern continues to be expressed, and indeed has left its mark on the current tax reform debate. A recent example is the argument of Hartman (2004) that the US suffers strongly from the lack of border tax adjustment to the corporate tax, relative to firms located in countries heavily reliant on the border-adjusted VAT.

These arguments are commonly treated with some contempt by theorists, who point to the trade-neutrality of a destination-based VAT levied at a uniform rate, and downplay the potential impact of reliance on origin-based taxes by invoking equivalence results between source and origin-based taxes: see for example the response to Hartman by Viard (2004). But (as indeed Viard stresses, and will be seen below), the scope of these results is limited, so that at a theoretical level the issue remains unresolved. Perhaps even more fundamentally, it seems clear, after fifty years or so of this debate, that many (perhaps mainly non-economists) simply find these arguments of principle unpersuasive, and continue to believe that the structure of the domestic tax system, particularly in relation to corporate taxes and the VAT, affects export performance.

Against this background of strongly held views and some theoretical ambiguity, this paper seeks to establish some stylized empirical facts. Using panel data for 27 OECD countries over the period 1967-2003 (somewhat less, for some regressions, given data limitations), we ask: Do countries that rely more on value added taxes, and/or less on corporate taxation, tend to have higher or lower net exports? The focus here is on net exports, it should be noted, rather than on export or trade intensity (meaning exports or the sum of exports and imports relative to GDP)—which have been the focus of the few previous studies in this area—because one key route by which the corporate tax may affect trade is through the capital account. This then requires an inherently dynamic analysis, because of the intertemporal budget constraints linking net exports over time.<sup>1</sup>

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<sup>1</sup> Having said this, we should note too that we obtain broadly the same results as below using instead export intensity as the dependent variable, as is reported in the Appendix.

Surprisingly, given the heat of the debate, these questions have received almost no empirical attention. The impact of the VAT on export and trade intensity has recently been considered by Desai and Hines (2005), who find, for high-income countries, somewhat mixed results: in the presence of fixed effects, a simple dummy representing the presence or absence of a VAT has no effect on either export or trade intensity; the share of VAT in total tax revenue in 2000,<sup>2</sup> however, is significantly, negatively related to both.<sup>3</sup> On the trade impact of the corporate tax, closest to the concerns here is a recent result of Slemrod (2004). Investigating (for about 100 countries at different income levels, observed in four years), not the impact but the determinants of the corporate tax, he finds a significant positive association between corporate tax revenues relative to GDP and trade intensity. This paper takes a different tack from these in focusing on net exports, and on the potential dynamics of tax effects, in using a full time series of data for VAT revenues and rates, and in addressing the tax mix argument directly by including both corporate tax and the VAT.

The plan of the paper is as follows. Section II provides a simple framework that brings out some key theoretical considerations and guides the empirics. A preliminary investigation of the properties of our sample is presented in Section III. Section IV then describes our empirical strategy and reports results. Section V concludes. An appendix describes the dataset and variables used in the estimation, and presents some subsidiary empirical results.

## II. TAX STRUCTURE AND NET EXPORTS: ANALYTICS

This section considers the ways in which tax structure might affect exports, using as framework for this a simple model that will also guide the empirical analysis to follow.

### A. A simple model

The analysis focuses on a small, open, two-period economy. This ‘home’ country is inhabited by a representative consumer with preferences  $U(C_1, C_2)$  defined over consumption in the two periods. There is a single produced good, which can be used either for consumption or investment; all nominal prices, including the exchange rate in both periods, are normalized at unity.<sup>4</sup> In the first period, there is an endowment  $Y$ —which can be thought of as the sum of current production and accumulated assets, both fixed by past decisions—that can be

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<sup>2</sup> With revenue data available to them only for a single year, note that this is a country-specific constant throughout the post-VAT introduction period of the panel. Observations in which no VAT is present, so that VAT revenue is necessarily zero, are also included in these regressions.

<sup>3</sup> For the full set of countries in their sample, in contrast, both the VAT dummy and reliance on VAT revenue are significantly and negatively associated with both trade intensity and the export share.

<sup>4</sup> Thus any movements in general price level or the exchange rate are effectively absorbed into the interest rate; and the interest arbitrage condition below implicitly encompasses an exchange parity condition.

supplemented by borrowing an amount  $b$  from the rest of the world, with these resources then either consumed, invested in amount  $K$  in domestic production, or lent abroad in amount  $B$ . Thus, in the absence of tax,  $C_1 = Y + b - B$ . In period 2 the investment yields output  $F(K)$ , with  $F$  assumed strictly concave, and interest is paid at the gross rate  $R$  on amounts invested at home and received at the rate  $r$  (gross of home country taxes) on loans to the rest of the world. Capital does not depreciate, so that, still in the absence of tax,  $C_2 = K + F(K) - (1 + R)b + (1 + r)B$ . There is assumed to be no cross-ownership of domestic fixed factors, so that all rents accrue to the home country.

To capture the issues raised in the introduction, allowance is made for four types of tax.<sup>5</sup> The home country taxes consumption on a destination-basis (that is, irrespective of whether domestically-produced or imported) at the (tax-exclusive) ad valorem rate  $T_v$ —this corresponds to a single-rate broad-based VAT—and on an origin basis (on all consumed commodities, whether the consumption is at home or abroad) at the (tax-inclusive) ad valorem rate  $T_o$ . There is also a source-based tax on the return  $(1 - T_o)F(K)$  to home investment at the rate of  $T_s$ , and a residence-based tax on all the home resident's savings, whether left at home or put abroad, at the rate  $T_r$  (both rates tax-inclusive, and any production tax paid assumed to be deductible). There is no explicit taxation of rents to the domestic fixed factor, a point to which we return later. All tax revenue in period  $i$  is returned to the consumer as a lump sum amount  $\bar{T}_i$  which they take as given in their own decision-making.

The budget constraint in period 1 is thus

$$(1 + T_v)C_1 = (1 - T_o)(Y - K) + b - B + \bar{T}_1, \quad (1)$$

where  $\bar{T}_1 = T_v C_1 + T_o (Y - K)$ , while in period 2 it is

$$(1 + T_v)C_2 = (1 - T_o)(K + (1 - T_s)(1 - T_r)F(K)) - (1 + R)b + (1 + r(1 - T_r))B + \bar{T}_2, \quad (2)$$

where  $\bar{T}_2 = T_v C_2 + T_o K + [1 - (1 - T_s)(1 - T_r)(1 - T_o)]F(K)K + T_s Rb + T_r rB$ . Since the home investor can either invest at home for a net return of  $R(1 - T_s)(1 - T_r)$  or abroad for a net return of  $r(1 - T_r)$  (and similarly the foreign investor can take either  $r$  or  $R(1 - T_s)$ , before paying foreign taxes) arbitrage ensures that in equilibrium:

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<sup>5</sup> Allowing for all four to be levied simultaneously is a matter of brevity rather than realism. While the model implies, for example, that capital may be subject to both source and residence-based taxes, this is to capture conveniently situations in which only one or the other is levied.



$$R(1 - T_s) = r. \quad (3)$$

Combining (1)-(3) and using the definition of  $\bar{T}_i$ , gives:

$$C_1 + \frac{C_2}{1+r} = Y + \frac{F(K) - RK}{1+r} \equiv Y^*, \quad (4)$$

which equates the present value of consumption to that of the endowment and rents (the latter denoted by  $Y^*$ ). This, it should be stressed, is the intertemporal budget constraint of the overall economy, not that perceived by the representative citizen (which will reflect the various taxes and transfers in operation, though these wash out in aggregate).

As a final preliminary, note that net exports, on which interest here focuses, are

$$E_1 \equiv Y - C_1 = B - b \quad (5)$$

in period 1 (the equality coming from (1) and the definition of  $\bar{T}_1$ ), while in period 2 they are (from (2) and the definition of  $\bar{T}_2$ )

$$E_2 \equiv K + F(K) - C_2 = (1+r)b - (1 + R(1 - T_s))B. \quad (6)$$

In present value, combining (5) and (6) and using (3) gives

$$E_1 + \frac{E_2}{1+r} = 0, \quad (7)$$

so that the present value of net exports is zero.

Substituting from (1) and (2) for consumption in each period, the problem solved by the consumer is to choose  $K$  and  $B$  to maximize

$$U \left( \frac{(1 - T_o)(Y - K) + b - B + \bar{T}_1}{1 + T_v}, \frac{(1 - T_o)(K + (1 - T_s)(1 - T_R)F(K)) - (1 + R)b + (1 + (1 - T_R)r)B + \bar{T}_2}{1 + T_v} \right) \quad (8)$$

with  $r$  being taken as given (the small country assumption) and borrowing from abroad  $b$  correspondingly determined as a residual, given the infinitely elastic supply of funds from the rest of the world, and with the  $\bar{T}_i$  also taken as parametric. The necessary conditions for this are

$$B: \quad -U_1(C_1, C_2) + U_2(C_1, C_2)(1 + (1 - T_R)r) = 0 \quad (9)$$

$$K: \quad -U_1(C_1, C_1) + U_2(C_1, C_2)(1 + (1 - T_s)(1 - T_r)F'(K)) = 0 \quad (10)$$

where derivatives are indicated by primes, except that  $U_i$  denotes  $\partial U / \partial C_i$ .

## B. Trade and indirect taxation

Consider first the impact of the commodity taxes,  $T_v$  and  $T_o$ . This is simple: each cancels out of the necessary conditions and so neither has any effect on the real equilibrium, an irrelevance result related to but distinct from the equivalence results on which much has been written.<sup>6</sup> In particular, neither commodity tax has any effect on the level of exports in any period. The reason for this irrelevance is straightforward. Neither tax affects production decisions, since both bear only on items of final consumption. Thus the present value of lifetime consumption, being equal to the present value of lifetime income, is also unaffected; and thus each tax is effectively lump sum, being levied on the consumption side in the case of the destination-based tax and the income side in the case of the origin tax.

This irrelevance of both destination and origin based consumption taxes to export behavior rests on a number of assumptions. The first, evident from the analysis above, is that the rates at which they are applied do not change over time. A fully anticipated increase in the rate of VAT, for example, has effects akin to those of an increase in the rate of residence-based taxation, since it lowers the real return to saving. Consumers would be expected to bring consumption forward to avoid the higher tax in the second period, so that net exports decrease in the first period and increase in the second. (Formally, the effect is equivalent to that of a increase in the rate of residence-based taxation, discussed below). Second, with only one consumption good in each period the model above cannot capture the important feature of reality that effective rates of commodity taxation commonly vary quite widely across commodities. In terms of the destination-based VAT commonly deployed, in particular, non-tradables are often subject to a relatively low tax rate—non-traded foodstuffs, in particular, are often exempted on equity grounds, and the coverage of services is commonly incomplete. In this case the VAT will tend to decrease the size of the tradable sector and hence export intensity, with production and consumption shifting to non-tradables (Feldstein and Krugman (1990)). Quite how this effect would manifest itself in the pattern on net exports over time, however, is not clear. Third, another important feature of VAT reality is imperfect refunding of VAT paid in inputs used by exporters: controlling such refunds is a key administrative challenge in many countries, especially in the developing world but also in the OECD countries in the empirical analysis below. If such refunds are not properly paid, the VAT acts

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<sup>6</sup> The equivalence result in the present context is the observation that if  $T_o = T_v / (1 + T_v)$  then the two taxes raise the same present value of tax revenue; so long as the government is freely able to borrow or lend, they thus lead to the same real allocation even if revenue is not returned to the consumer as a lump sum. For a general statement of equivalence results, see de Meza, Lockwood and Myles (1994) and, in an intertemporal context similar to that here, Genser, Haufler and Sørensen (1995).

in part as an export tax. As is noted by Desai and Hines (2005), this too would be expected to reduce the size of the tradables sector, and reduce export intensity.

One other point should be noted. This is that the effects of the origin-based tax are quite different from those of the source-based corporate tax,  $T_s$ . Thus one cannot argue for irrelevance of the corporate tax by asserting that it is analogous to an origin tax and then invoking irrelevance or equivalence results on the latter. The key point here is that the origin tax to which these results apply is a tax only on final consumption goods, whereas a source based tax applies to all output. The latter thus has distorting effects on production more akin to this of a production tax levied on all stages of production—and for which, given the distortion of production choices, the irrelevance and equivalence results do not apply.

### C. Trade and corporate taxation

Turning to the impact of corporate taxes, note first that (9) and (10) together imply that

$$F'(K) = \frac{r}{1-T_s} \quad (11)$$

For simplicity, we now also suppose  $U(C_1, C_2) = u(C_1) + \beta u(C_2)$ , with  $u(C)$  strictly concave,<sup>7</sup> so that (9) becomes:

$$\frac{u'(C_1)}{u'(C_2)} = \beta(1 + (1-T_R)r). \quad (12)$$

Consider first the effects of the source-based tax,  $T_s$  (with the residence-based tax  $T_R$  set to zero). Using (3), the right of (4) can be written as:

$$Y^*(T_s) \equiv Y + \frac{F[K(T_s)] - \left(\frac{r}{1-T_s}\right)K(T_s)}{1+r} \quad (13)$$

which, using (11), is readily shown to be decreasing in  $T_s$ . Thus the present value of consumption falls. To derive the impact on exports, note that since in this case the right of (12) is simply  $\beta(1+r)$ , which is unchanging, maintaining the equality requires that  $C_1$  and  $C_2$  both fall. This fall in  $C_1$  in turn means, from (5), that first period exports rise; and since the present value of exports is zero, this in turn means that exports in the second period must fall.

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<sup>7</sup> This is stronger than is needed for the results below.

The intuition is straightforward. A source-based tax on corporate income reduces investment at home, meaning greater capital exports (or less capital imports) in the first period, which is financed by running a greater trade surplus (or smaller deficit);<sup>8</sup> one can think of the increased capital exports leading to an exchange depreciation. In the second period income, net income from abroad is higher as a consequence of the increased capital exports in the first, enabling a smaller trade surplus.

For the residence-based tax, note first from (11) that domestic investment is unchanged and hence so too, using also (3) in (4)(with  $T_s$  set to zero), is the present value of lifetime consumption. But then from (12) it is readily verified that  $C_1$  increases.<sup>9</sup> Hence net exports fall in the first period and rise in the second—the opposite pattern to that of an increase in the source tax. The reason is again straightforward. A residence-based tax has no effect on the level of investment at home, since it does not affect the return required by non-resident investors. It does however lower the net return on savings faced by the home consumer, which—given our assumption on preferences—leads to lower savings. This means less investment abroad in period 1, which implies a lower trade surplus. This again reverses itself in period 2, when the reduction in income from abroad implies a higher trade surplus.

Source- and residence-based corporate taxes thus have very different effects on the pattern of net exports. There is some reason to suppose, however, that—point for point—the former are likely to be stronger in practice. This is because the impact of source-based taxation arises from the tax-sensitivity of the location of real investment, which is now thought to be quite marked,<sup>10</sup> while that of residence-based taxation arises from the interest-sensitivity of aggregate savings, the significance of which remains less clear.

Several issues arise in extracting empirical guidance from these results. A first—given that they lead to quite different conclusions—is whether corporate taxation is best seen as source- or residence-based. In practice, corporate tax systems often have a significant element of source taxation. This may be explicit, with outright exemption of corporation's earnings from abroad: this is the case, for example, in the Netherlands. Or it may be implicit.

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<sup>8</sup> Sinn (1985) argues that an effect of this kind explains the high level of capital imports into the U.S. following a cut in effective marginal corporate tax rates in 1981.

<sup>9</sup> Using (4) in (12) defines  $C_1(T_R)$  implicitly by

$$\frac{u'[C_1(T_R)]}{u'[(1-r)(Y^* - C_1(T_R))]} = \beta(1 + (1 - T_R)r)$$

where, by the argument in the text,  $Y^*$  is independent of  $T_R$ . Differentiating with respect to  $T_R$ , the result follows from concavity of  $u(C)$ .

<sup>10</sup> See for example the surveys in Hines (1999) and de Mooij and Ederveen (2003).

For while many countries—including the United States and United Kingdom—in principle apply the residence principle (allowing a non-refundable credit against their own taxes for those paid abroad), their taxes typically only apply when a multinational's subsidiary abroad pays dividends to the parent, so that those taxes can be deferred (and hence reduced in present value) by delaying that repatriation. While most OECD countries now have controlled foreign corporation rules, under which profits of subsidiaries earned abroad—typically in low-tax jurisdictions—may be brought into tax even if not repatriated to the parent, the scope of their application remains limited. All this brings many countries' corporate tax systems close to ones of de facto source taxation.

Second, the corporate taxes in the model above bear only on the marginal return to investment and savings, leaving the return to the fixed factor untaxed. The closest empirical analogue to  $T_s$ , for example, is the marginal effective tax rate, not the statutory or any measure of the average effective rate. In practice, however, corporate taxes are likely to bear also on intra-marginal returns, so the question arises to how the taxation of rents would affect the analysis above. So long as the fixed factors themselves are internationally immobile—so that the rents are location-specific—such taxation will have no effect on the level of real investment, so that the impact can only be in the form of income effects operating through the raising of tax revenue itself. And to the extent that the home country levies tax on rents that would otherwise accrue to its own residents, there will be no effect at all in the model above, given the assumption that revenue is returned to the consumer as a lump sum.

Thus it is only to the extent that the fixed factor is owned by non-residents that even income effects will arise. A home country tax on rents accruing to foreigners, for example, allows an increase in the present value of lifetime consumption. Given the assumption on preferences above, this will be taken entirely as an increase in  $C_1$ ; with production unchanged, period 1 exports will thus fall, with a reduced trade surplus reflecting increased borrowing from abroad in anticipation of the greater receipts in period 2. This effect will be weakened under alternative assumptions on preferences, but will not be reversed so long as any of the anticipated increase in revenue is reflected in present consumption.

Further effects will arise if the fixed factor is internationally mobile, as in the recent literature on the concept and impact of average effective tax rates (as in Devereux and Griffith (2003), for example). In this respect, an increase in the corporate tax will tend to drive real investment abroad, so that the effects will be closely akin to those of the source based tax analyzed above.

A third set of issues relate to the limits and interpretation of the model itself. In an overlapping generations or Blanchard-Yaari framework, for example, the condition that the present value of net exports be zero—of which heavy use was made above—does not apply. The essence of the intertemporal optimization would remain the same, however, so that the effects shown above are again likely to leave their mark. The question also arises as to how to interpret, for practical purposes, the two periods into which the model divides the future. To the extent that anticipatory adjustment to tax changes may take the form of stock

adjustment, the first period is naturally thought of as corresponding to fairly brief, short-run effects. Sluggish adjustment of real investment, on the other hand, is likely to slow the response to changes in source taxes. The safest empirical course, pursued below, is to recognize the potential complexity of dynamic effects and leave the rest to the data.

One last limitation—which applies also to the analysis of indirect taxation above—deserves emphasis. This is the assumption that all tax revenue is returned to the consumer as a lump sum. In the more plausible case in which it is not, the path of public expenditure may be affected by either a change in the present value of tax receipts or, if the government is constrained in its ability to borrow, by a change in its time path. And changes in public expenditure may themselves affect export performance. If government expenditure is concentrated on non-tradables, for example, a shift that enabled an increase in government expenditure may also lead to reduced exports by this route.

### III. THE DATA: A FIRST LOOK

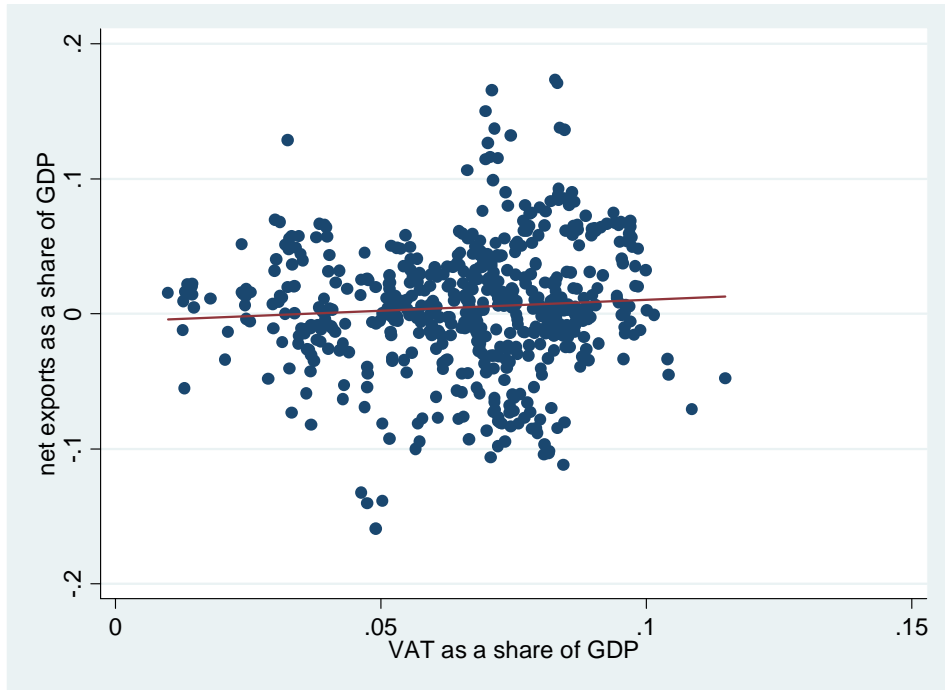
The sample—summary statistics for which are provided in the appendix—is an unbalanced panel of 27 OECD countries, covering the period after VAT introduction in each country. The estimation period is from 1967 to 2003, and the total number of observations is 573.

Figures 1 and 2 present scatter plots depicting the relationship between the trade balance (net exports relative to GDP) and reliance on corporate taxes and VAT, respectively. The correlation coefficient between the trade balance and VAT reliance is positive but only marginally significant at 0.07. That between trade balance and corporate tax reliance is also positive, but in this case it is highly significant, at 0.35. These simple plots thus suggest that net exports are positively associated with both VAT reliance and corporate tax reliance, albeit only weakly so in the case of the former.

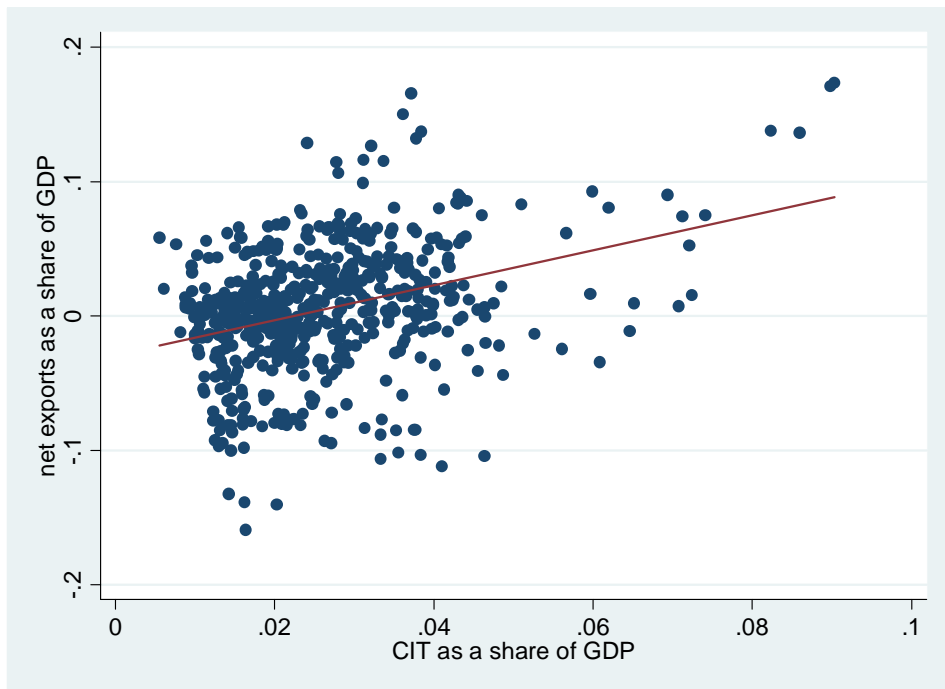
Figures 3 and 4 depict the time series behavior of these variables by plotting the unweighted annual averages of the trade balance, and the degree of revenue reliance on VAT and corporate taxes in our sample. There is again a suggestion of a positive association between net exports and both VAT and corporate tax reliance in our sample, though the correlations are not significant.

Little can be safely concluded from these simple correlations, however, since they abstract from the impact on net exports of other factors, may be contaminated by various biases, and do not address the dynamics of interest here. These considerations call for a closer econometric analysis, to which we now turn.

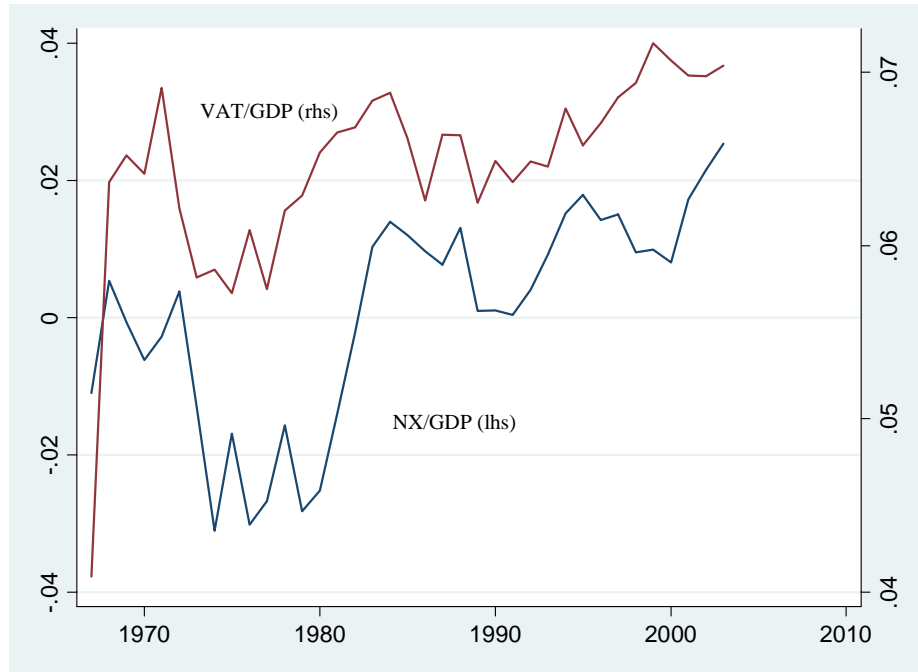
**Figure 1. Trade Balance Against VAT/GDP**



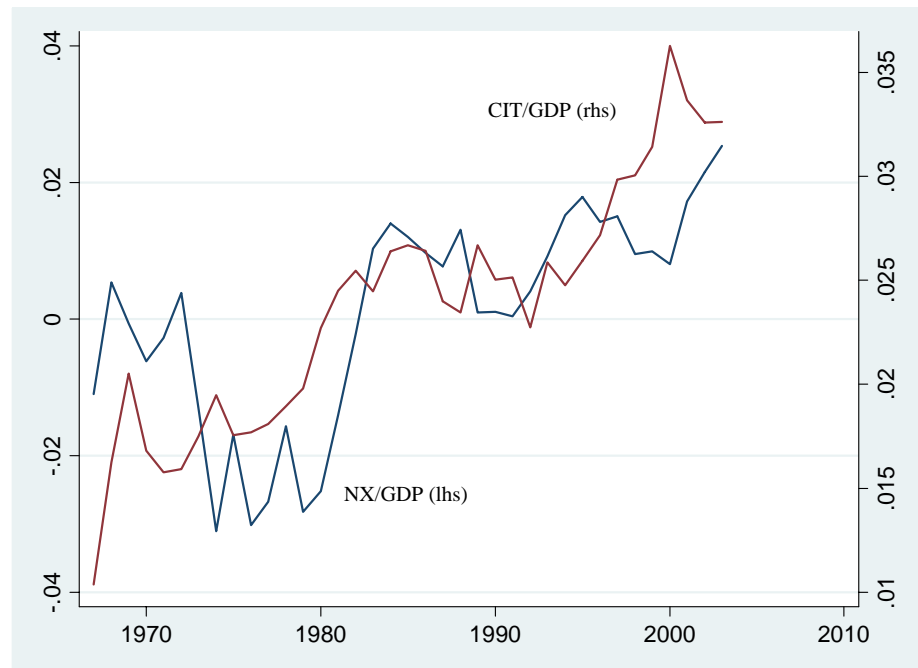
**Figure 2. Trade Balance Against CIT/GDP**



**Figure 3. Trade Balance and VAT Reliance, Unweighted Yearly Average**



**Figure 4. Trade Balance and Corporate Tax Reliance, Unweighted Yearly Average**





## IV. Empirical Analysis

After outlining the empirical strategy, this section reports results for both static and, our main focus, dynamic specifications.

### A. Econometric Specification and Issues

The basic form of the equation that we estimate is, for country  $i$  at time  $t$ :

$$\begin{aligned}
 NX_{it} = & \alpha_i + \mu_t + \phi NX_{i,t-1} + \sum_{k=0}^2 \beta_k (VAT_{i,t-k}) + \sum_{k=0}^2 \gamma_k (CIT_{i,t-k}) \\
 & + \sum \delta_k (TAX_{i,t-k}) + \theta X_{it} + \varepsilon_{it}
 \end{aligned} \tag{14}$$

where  $NX$  denotes net exports of goods and services (relative to GDP),  $CIT$  and  $VAT$  are variables relating to the corporate tax and VAT respectively—we use several variants— $TAX$  denotes the sum of all tax revenues (relative to GDP), the vector  $X$  denotes other conditioning variables (including GDP per capita and various geographic controls, described in the Data Appendix),  $\alpha_i$  and  $\mu_t$  are country- and time-specific effects respectively, and  $\varepsilon_{it}$  is an idiosyncratic error term. We allow for up to two lags in the variables of interest: at least one lag is required in order to pick up the potential sign reversals of the impact of tax changes suggested by the theory above. The inclusion of the overall tax ratio  $TAX/GDP$ , allows for the possibility that net exports are affected by taxes in general rather than by the VAT and corporate tax in particular.

The coefficients on the current values of the corporate tax and VAT reliance variables ( $\gamma_0$  and  $\beta_0$ , respectively) capture their short run impacts on the trade balance, while the long run effects are given by:<sup>11</sup>

$$\Delta_{CIT} = \frac{\gamma_0 + \gamma_1 + \gamma_2}{1 - \phi} \quad \Delta_{VAT} = \frac{\beta_0 + \beta_1 + \beta_2}{1 - \phi} \tag{15}$$

The theory predicts that, in so far as the corporate tax approximates to a source-based tax, its short run impact should be an increase in net exports,  $\gamma_0 > 0$ , with a subsequent reduction and consequent sign reversal of the effect, picked up in  $\gamma_1$  and/or  $\gamma_2$  (if it occurs within two years), and, ultimately, a permanent reduction in net exports. To the extent that these changes sum in present value to zero, one might expect the long run effect to be small: this leads one to focus on the hypothesis of no long run effect:  $\Delta_{CIT} = 0$ . In so far as the corporate tax approximates a residence-based tax, the expectation is of the opposite sign pattern of effects: a short run reduction in net exports followed by an increase. For an idealized single rate

<sup>11</sup> Note that when  $TAX/GDP$  is included in these regressions, these coefficients are to be interpreted as relating to changes in VAT or CIT whose revenue impact is offset by changes in other tax instruments.

VAT, the theory predicts no effect in either short or long runs ( $\beta_0 = \Delta_{VAT} = 0$ ), at least if changes in the tax rate are unanticipated. But VATs are rarely so perfect, and changes are sometimes preannounced, so the expected pattern of effects is less clear.

The corporate tax and VAT variables are likely to be endogenous, not least since they share a common denominator with the dependent variable. For this reason, we also report results using the basic rates of the two taxes, though these are conceptually imperfect and, in the case of the corporate tax, reduce the sample size. In addition, we will need to control for biases arising from the presence of the lagged dependent variable. Hence, our preferred empirical strategy is to rely on instrumental variables (IV) or generalized method of moments (GMM) procedures that control for biases due to unobserved firm-specific effects and lagged endogenous variables.<sup>12</sup> For this we will use suitably lagged values of our regressors as instruments. In the absence of higher order-serial correlation in the residuals, and provided the instruments are correlated with the endogenous variables but not with the error term, the GMM estimator consistently estimates the parameters of our model. This is so even when we include the lagged dependent variable and other endogenous variables as regressors in our model.

## B. Results

This section reports a range of empirical equations estimated along the lines described above. Though not reported, all specifications include year dummies to control for any unobserved common time-specific effects. All standard errors are heteroskedasticity-robust.

### Static results

To fix ideas, and relate our results to those in the previous contributions noted in the introduction, we begin by presenting results using a static specification, constraining the coefficients on all the lagged variables in (14) to be zero and so relating the trade balance to only the current values of the corporate tax and VAT reliance variables.

Table 1 investigates the effect of the VAT. Column 1 is a very simple specification, including only VAT reliance (that is, VAT revenue relative to GDP). Column 2 adds the log of GDP per capita, to control for income differences, and geographic controls (area of the country and dummy variables that equal 1 for landlocked and island economies). In both

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<sup>12</sup> See Arellano and Bond (1991) for the form of this one-step GMM estimator, which exploits overidentifying restrictions.

**Table 1. The VAT and Net Exports**

	1	2	3	4
(VAT/GDP) <sub>t</sub>	0.070 (0.078)	0.106 (0.092)	-0.575** (0.245)	-0.544** (0.245)
(TAX/GDP) <sub>t</sub>				-0.194*** (0.067)
Constant	0.001 (0.013)	-0.005 (0.017)		
Observations	573	573	573	573
R-squared	0.09	0.11	0.62	0.63
F-statistic	1.48	1.67	12.67	12.88

Notes:

1/ Robust standard errors in parentheses.

2/ \* means significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

3/ Col 1: Year Effects only; Col 2: Year Effects, GDP controls and Geographic controls;  
Cols 3 and 4: Year Effects, Country effects, GDP controls and Geographic controls.

cases, the coefficient on the VAT reliance variable is insignificant. In column 3, however, country-specific fixed effects are added capturing the effect on exports of time-invariant features of individual economies. In this case, the coefficient on the VAT reliance variable becomes significantly negative, suggesting that the previous results may have been biased by correlations between omitted country-specific variables and our VAT variable. Column 4 adds as an additional regressor the overall tax revenue as a share of GDP. This variable enters with a significantly negative coefficient, while that on the VAT variable remains significantly negative and of similar magnitude to that in column 3. These results are reminiscent of those of Desai and Hines (2005), though they focus on gross rather than net exports; and indeed we find a similar pattern of effects for the former.

Table 2 turns to the impact of the corporate tax. Columns 1 to 4 use the same specifications as in Table 1,<sup>13</sup> but replace the VAT variable with corporate tax revenue as a share of GDP. In all cases, there is a significant, robust, large and *positive* association between corporate taxes and export performance. Broadly speaking, a one percentage point increase in corporate tax revenue relative to GDP, compensated by increases in other taxes, increases net exports by rather more than one percentage point. Adding basic controls thus confirms the loose

<sup>13</sup> The sample comprises only observations for which a VAT is in place (so as to clearly identify the effects of moving to consider the two jointly); broadly similar results are obtained using all observations for which the corporate tax variable is available.

visual impression from Figure 2: contrary to what appears to be a widespread view, increased reliance on corporate tax revenues tends to be associated with a stronger net export position.

The final column of Table 2 investigates the combined effects of both the corporate tax and the VAT. The VAT reliance variable emerges in column 5 as insignificant in the presence of the corporate tax variable, suggesting that in Table 1 the VAT variable may have been proxying for the omitted corporate tax variable. Finally, column 6 of Table 2 controls for the

**Table 2. Corporate Taxes and Net Exports**

	1	2	3	4	5	6
(CIT/GDP) <sub>t</sub>	1.182*** (0.183)	1.219*** (0.180)	1.291*** (0.167)	1.479*** (0.169)	1.441*** (0.172)	1.270*** (0.244)
(TAX/GDP) <sub>t</sub>				-0.317*** (0.064)	-0.309*** (0.064)	-0.233*** (0.077)
(VAT/GDP) <sub>t</sub>					-0.300 (0.215)	-0.182 (0.327)
Constant	-0.014 (0.009)	-0.021 (0.012)				-0.072*** (0.020)
Observations	573	573	573	573	573	546
R-squared	0.17	0.20	0.66	0.68	0.68	0.68
F-statistic	3.05	3.17	15.00	16.15	16.01	14.67

Notes:

1/ Robust standard errors in parentheses.

2/ \* means significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

3/ Column 1: Year Effects only; Col 2: Year Effects, GDP controls and Geographic controls; Cols 3 to 6: Year Effects, Country effects, GDP controls and Geographic controls; Col 6 uses first lags of VAT, corporate tax and total tax variables to instrument their current values.

endogeneity of our tax variables by instrumenting their current values with their first lags. Thus does not change the conclusion from column 5: export performance is unrelated to reliance on VAT, but positively related to reliance on corporate taxes.

## Dynamic results

Our main interest, however, is in the dynamic specification (14), since it is this that allows for the more complex effects, especially in relation to the corporate tax, that are suggested by the theory. Estimation is by GMM, as discussed above, using as instruments suitably lagged values of net exports and our regressors. For this, we proceed, as is standard, by first-differencing (14) to eliminate the country-specific fixed effects, and capture the time-specific fixed components by including time dummies. Thus the model actually estimated relates the first-differenced trade balance in period  $t$  to its own lag, the first-differenced measures of  $VAT_i$  and  $CIT_i$  in periods  $t$ ,  $(t-1)$  and  $(t-2)$ , and differences in controls. Though not shown, all specifications include time dummies and log GDP per capita to control for income differences; time invariant characteristics (such as the geographic controls) drop out in the differencing. Instrument validity is evaluated reporting the p-value of the Sargan Statistic (also known as Hansen's J statistic), which is a test of overidentifying restrictions under the joint null that the model is correctly specified and the instruments are valid. The properties of the residuals are described by the p-values of the m1 test to detect first-order serial correlation (which we expect to find if the presumed specification is correct) and of the m2 test proposed by Arellano and Bond (1991) to detect second-order serial correlation in the first-differenced residuals (which we wish to reject).

Results are reported in Table 3. Column 1 reports the basic specification given in (14), using VAT and corporate tax reliance as the tax variables of interest. The coefficient on the lagged dependent variable is significantly positive, as one would expect, and all the diagnostics are satisfactory—the same is true of all reported results, and so this is not commented on further. Our main interest attaches, of course, to the tax variables. And here the results are both striking and in some respects surprising.

Beginning with the corporate tax, the coefficient on the current value reliance is significantly positive, while those on the first lag and second lags are negative (albeit individually insignificant in the latter case). This pattern of sign reversal is exactly as the theory above predicts for a source-based corporate tax. The point estimates imply that a one point increase in reliance on the corporate tax is associated with an increase in net exports of 0.83 percent of GDP, reflecting—in terms of the theory above—the movement of capital away from the reduced net returns at home. In the following year, net exports recover by 0.84 percent of GDP, leaving them<sup>14</sup> 0.23 points lower than prior to the tax change. The overall impact on net exports remains negative thereafter—consistent with increased income from abroad as a consequence of the initial reallocation of capital abroad—and converges to zero. After 10 years, net exports are a little under 0.02 percentage points lower than prior to the tax

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<sup>14</sup> Taking account of the effect through the lagged dependent variable.

Table 3. Dynamic Specifications

	1	2	3	4	5	6
$NX_{t-1}$	0.732*** (0.090)	0.404*** (0.066)	0.715*** (0.077)	0.661*** (0.103)	0.781*** (0.045)	0.772*** (0.047)
(CIT variable) <sub>t</sub>	0.831** (0.397)	1.307** (0.526)	1.000** (0.507)	1.006* (0.538)	0.057** (0.029)	0.059** (0.029)
(CIT variable) <sub>t-1</sub>	-0.838** (0.410)	-0.757* (0.457)	-0.935* (0.489)	-0.955** (0.453)	-0.066** (0.032)	-0.061* (0.033)
(CIT variable) <sub>t-2</sub>	-0.013 (0.168)	-0.230 (0.202)	-0.122 (0.210)	-0.170 (0.189)		
(VAT variable) <sub>t</sub>	-1.371*** (0.521)	0.001 (0.001)	0.008 (0.335)		-0.049 (0.325)	
(VAT variable) <sub>t-1</sub>	0.974** (0.427)	-0.003** (0.001)	0.105 (0.290)		0.029 (0.254)	
(VAT variable) <sub>t-2</sub>	0.273 (0.308)	0.000 (0.002)	0.162 (0.234)			
(TAX/GDP) <sub>t</sub>	-0.197** (0.100)	-0.499*** (0.188)	-0.335*** (0.147)	-0.376** (0.163)	-0.261*** (0.086)	-0.282*** (0.108)
(TAX/GDP) <sub>t-1</sub>	0.256** (0.110)	0.173 (0.126)	0.352** (0.124)	0.347*** (0.116)	0.204*** (0.061)	0.209*** (0.074)
(TAX/GDP) <sub>t-2</sub>	-0.141* (0.081)	0.072 (0.112)	-0.078 (0.074)	-0.048 (0.077)		
Constant	0.001 (0.001)	0.001*** (0.001)	0.001*** (0.001)	0.001*** (0.001)	0.010 (0.010)	0.010 (0.007)
Observations	492	344	492	492	298	298
Diagnostic tests (p-values)						
First-order s.c.	0.006	0.022	0.007	0.011	0.004	0.003
Second-order s.c.	0.490	0.167	0.402	0.425	0.201	0.196
Sargan	1.000	1.000	1.000	1.000	1.000	1.000
<b>CIT variable</b>	CIT/GDP	CIT/GDP	CIT/GDP		Statutory Corporate Tax Rate	
<b>VAT variable</b>	VAT/GDP	Standard VAT rate	VAT/consumption		VAT Revenue/Consumption	

Notes:

1/ Robust standard errors in parentheses.

2/ \* means significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

3/ Instruments consist of : (i) (t – 3) to (t – 5) values of net exports and the tax variables and (t – 1) to (t – 3) values of log GDP per capita in columns 1 to 4; and (ii) (t – 2) to (t – 4) values of net exports and the tax variables and (t – 1) to (t – 3) values of log GDP per capita in columns 5 and 6.

increase.<sup>15</sup> In the long run, the effect converges to zero: formally, the null that  $\Delta_{crr} = 0$  cannot be rejected.<sup>16</sup>

Strong dynamic effects also emerge for the VAT. An increase in VAT reliance reduces net exports sharply in the short run. The effect is largely reversed, but not eliminated, after one year, leaving an overall reduction in net exports that persists indefinitely but converges to zero: again, the<sup>17</sup> null hypothesis of no long run effect cannot be rejected. The absence of a long run effect is consistent with theory. The dynamics, and their strength, are harder to rationalize. Anticipatory behavior does not seem to provide an explanation. Suppose, for example, that all increases in VAT rates are pre-announced, that consumers bring consumption forward in response but not by so much that revenue actually falls once the increase in the VAT rate applies. Then periods of high VAT reliance would be ones of low consumption, and hence of strong net exports—not weak, as found here. Alternatively, the negative impact on net exports might reflect the working out of the Feldstein-Krugman effect, or (perhaps less plausibly for these OECD countries) less than full refunding of input VAT to exporters. Or the result might simply be an artifact of movements in consumption due to other causes: if some other shock causes consumption to be high in some period, so, all else equal, VAT revenue will be high and net exports low.

To investigate this latter possibility, columns 2 and 3 of Table 3 repeat the exercise using VAT variables intended to capture more closely the parametric features of the tax. Column 2 uses the standard rate of the VAT.<sup>18</sup> This though will not capture the impact of the additional rates applied in many countries, and of exemptions. To provide a handle on these, column 3 uses the ratio of VAT revenue to total consumption. With both variables, the short run effects found for VAT reliance vanish (except for the second lag using the standard VAT rate, the coefficient on which is in any event small). Using these alternative proxies, there is thus no convincing evidence that reliance on VAT has any significant explanatory power for the trade balance in either the short or the long run, suggesting that the results found for VAT reliance were indeed arising from the confounding effects of exogenous shocks to consumption.

Changing the VAT variable—or omitting it altogether, as in Column 4—has no impact, however, on the dynamics found for the corporate tax: there is still a short run increase in net exports, turning into a vanishing, negative effect. And indeed the coefficients themselves are quite robust across these various specifications.

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<sup>15</sup> This calculation ignores the insignificant coefficient on the second lag of the corporate tax variable.

<sup>16</sup> The p-value on this hypothesis test is 0.91.

<sup>17</sup> The p-value is in this case 0.74.

<sup>18</sup> Available data on the standard rate of VAT cover only the period 1984-2003, restricting the sample.

It could be, however, that the corporate tax reliance variable is subject to the same difficulties as just examined for the VAT: it might be, for example, that high net exports are associated with high export earnings that are then picked up in strong corporate tax revenues. Or it could be that high profits, associated with high corporate tax payments, lead to higher investment abroad. To address such possibilities, in columns 5 and 6 of Table 2—with and without the effective rate of VAT—we replace reliance on the corporate tax with the statutory corporate tax rate.<sup>19</sup> The coefficients naturally change, but the qualitative results do not: the VAT-related variable continues to have no shorter or long run effect, while the corporate tax is positively related to net exports in the short run, but with the effect reversed after one period and converging to zero in the long run. The finding of powerful short run dynamics but no long-run effect from the corporate tax thus emerges as quite robust.

We also experimented with using the marginal effective rate of corporate tax (METR) as the CIT variable.<sup>20</sup> This proved to be insignificant (not shown, for brevity). That may simply reflect the difficulties of constructing such a summary measure of incentives to invest, especially over a period during much of which the dispersion of METRs across assets and activities was itself a significant policy concern. Another interpretation, combined with the results in the text, is that the effects at work arise largely from the average effective rate of corporate tax (AETR) rather than the METR (the former being a weighted average of the statutory and marginal effective rates,<sup>21</sup> and tending, it seems, to be closely tracked by the statutory rate), and so reflect the impact of the corporate tax on the location of mobile projects yielding pure profits.<sup>22</sup>

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<sup>19</sup> This restricts the sample to 16 countries between 1983 and 2001. Note that there do not exist good panel data on corporate profits that would enable calculation of an ‘effective’ rate of corporation tax analogous to the VAT variable used above.

<sup>20</sup> As calculated by Devereux, Griffith and Klemm (2002), and again restricting the sample as in the previous footnote.

<sup>21</sup> Devereux and Griffith (2003).

<sup>22</sup> Three further points should be noted. First, broadly similar results are obtained using gross rather than net exports as the left hand variable: see columns 1 and 2 of Table A4 in the Appendix. Second, broadly similar results are also obtained if reliance on VAT and the corporate tax is instead measured by their revenues relative to all tax revenue, rather than GDP: this is shown in Column 3 of Table A4. Third, although not the focus of our interest here, total tax revenue as a proportion of GDP also enters typically enters the estimated equations with a strong effect, with an initial increase in the tax ratio leading to a reduction in net exports followed by a reversal and, ultimately, no long run effect. Whether this reflects a temporary impact from the size of government—and similar results are obtained replacing the tax ratio by general government expenditure relative to GDP (not shown)—or effects from other domestic taxes, such as the personal income tax, is left to future work.



## V. SUMMARY AND CONCLUSIONS

The experience of OECD countries over the last thirty five years or so emerges from the analysis here as consistent with two sets of predictions as to the impact on the trade balance of the domestic tax system.

First, the VAT itself appears to have no impact, in either short or long-runs, tending to confirm the view that it is inherently trade neutral. While an increase in reliance on the VAT is associated with strong dynamic effects—a sharp deterioration in net exports that quickly declines—this can be explained as an artifact of unrelated shocks to consumption.

Second, and more striking, changes in the corporate tax have powerful dynamic effects, of a kind consistent with its being an essentially source-based tax. In the short run, increased corporate taxation is associated with increased net exports, consistent with the notion that such an increase leads capital to flow abroad. This increase turns into a persistent reduction in net exports, however, consistent with an increased inflow of income from abroad associated with the initial outflow. Over the long run, however, this effect declines to zero, leaving net exports unaffected.

Some aspects of domestic tax policy, it seems, do have strong effects on trade performance. And they can be quite complex.

## Appendix

### Data

The sample is an unbalanced panel of 27 current OECD countries with a VAT, covering the period 1967-2003, in each case covering the period after VAT introduction in each country. Luxembourg and Mexico are excluded from the sample due to lack of tax revenue data and the US because it does not have a VAT. Data on GDP and exports are from the *World Economic Outlook* database, and on tax revenue from the *OECD Revenue Statistics* Database, which reports data from 1965 onwards. Data on final consumption expenditure are drawn from the World Development Indicators database. Statutory corporate tax rates are taken from Devereux, Griffith and Klemm (2002), for 16 OECD countries from 1983-2001. Statutory rates of VAT are from the Tax Policy Division at the International Monetary Fund. The geographic controls—country size, and dummies indicating whether the country is an island or landlocked—are from Rose (2002).

Descriptive statistics of the main variables in the sample are reported in Table A1.

**Table A1. Descriptive statistics**

Variable	Number of observations	Mean	Median	Standard deviation
Net Exports as a fraction of GDP	573	0.005	0.005	0.047
Exports as a fraction of GDP	573	0.355	0.318	0.158
Log GDP per Capita	573	10.767	10.001	2.436
Total Tax Revenue, as a fraction of GDP	573	0.372	0.372	0.077
VAT Revenue, as a fraction of GDP	573	0.066	0.070	0.020
VAT Revenue, as a fraction of total consumption	573	0.082	0.088	0.036
Standard VAT Rate	461	17.5	18.6	5.373
Corporate Tax Revenue, as a fraction of GDP	573	0.026	0.024	0.013
Statutory Corporate Tax Rate	334	0.389	0.386	0.120

Table A2 reports the number of countries by year and Table A3 the balance of the panel.

**Table A2. Distribution of countries over years**

Year	Observations
1967	1
1968	3
1969	4
1970	6
1971	6
1972	7
1973	10
1974	10
1975	10
1976	10
1977	11
1978	11
1979	11
1980	12
1981	12
1982	12
1983	12
1984	12
1985	13
1986	15
1987	16
1988	16
1989	18
1990	19
1991	21
1992	21
1993	23
1994	24
1995	25
1996	25
1997	25
1998	26
1999	26
2000	27
2001	27
2002	26
2003	20

**Table A3. Balance of Panel**

No. of years	No. of countries
3	1
5	1
9	1
10	2
11	1
12	1
13	2
14	1
15	1
16	1
18	2
19	1
24	1
27	1
31	4
34	2
35	1
36	2
37	1

Table A4. Robustness

	1	2	3
LDV <sub>t-1</sub>	0.862*** (0.064)	0.915*** (0.036)	0.729*** (0.092)
(CIT variable) <sub>t</sub>	0.510** (0.223)	0.067** (0.028)	0.278* (0.159)
(CIT variable) <sub>t-1</sub>	-0.602** (0.299)	-0.075*** (0.016)	-0.268* (0.150)
(CIT variable) <sub>t-2</sub>	-0.038 (0.208)		-0.018 (0.058)
(VAT variable) <sub>t</sub>	-0.656 (0.505)	0.307 (0.247)	-0.514*** (0.194)
(VAT variable) <sub>t-1</sub>	0.808** (0.371)	-0.193 (0.189)	0.365*** (0.141)
(VAT variable) <sub>t-2</sub>	0.128 (0.272)		0.105 (0.097)
(TAX/GDP) <sub>t</sub>	-0.276*** (0.078)	-0.248** (0.090)	-0.397** (0.156)
(TAX/GDP) <sub>t-1</sub>	0.230** (0.113)	0.202* (0.103)	0.394*** (0.104)
(TAX/GDP) <sub>t-2</sub>	-0.050 (0.076)		-0.088 (0.063)
Constant	0.000 (0.000)	-0.001 (0.001)	0.001 (0.001)
Observations	492	298	492
Diagnostic tests (p-values)			
First-order s.c.	0.003	0.004	0.007
Second-order s.c.	0.203	0.207	0.225
Sargan	1.000	1.000	1.000
<b>Dependent variable</b>	X/GDP	X/GDP	NX/GDP
<b>CIT variable</b>	CIT/GDP	Statutory Tax Rate	CIT/TAX
<b>VAT variable</b>	VAT/GDP	VAT/consumption	VAT/TAX

Notes:

1. Robust standard errors in parentheses.

2/ \* means significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

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Rosanne Altshuler served as Senior Economist to the President's Advisory Panel of Federal Tax Reform. Before joining the Tax Reform Panel, she was acting as a special advisor to the Joint Committee on Taxation. Rosanne will return to Rutgers University where she is an associate professor of economics in January of 2006. Rosanne received her B.A. from Tufts University and her Ph.D. in Economics from the University of Pennsylvania. She has published numerous articles on the economics of taxation in scholarly journals and books. Her work has also appeared in *Tax Notes* and *Tax Notes International*. She has served on the Board of Directors of the National Tax Association and has edited the National Tax Journal since 2001.



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Alan J. Auerbach is the Robert D. Burch Professor of Economics and Law, Director of the Burch Center for Tax Policy and Public Finance, and former Chair of the Economics Department at the University of California, Berkeley. He is also a Research Associate of the National Bureau of Economic Research and previously taught at Harvard and the University of Pennsylvania, where he also served as Economics Department Chair. Professor Auerbach was Deputy Chief of Staff of the U.S. Joint Committee on Taxation in 1992 and has been a consultant to several government agencies and institutions in the United States and abroad. A former Editor of the *Journal of Economic Perspectives*, he has been a member of the Executive Committee and Vice President of the American Economic Association, and is a Fellow of the Econometric Society and of the American Academy of Arts and Sciences.

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Currently, Professor Desai teaches First-Year Finance and has participated in several executive education programs at HBS. Additionally, he co-teaches Public Economics (EC 1410) at [Harvard College](#). He received the Student Association Award for teaching excellence from the HBS Class of 2001. He received his Ph.D. in political economy with a concentration in corporate finance and public finance from [Harvard University](#); his MBA as a Baker Scholar from Harvard Business School; and a bachelors degree in history and economics with honors and distinction from [Brown University](#). In 1994, he was a Fulbright Scholar to India. His professional experiences include working at CS First Boston, McKinsey & Co., and advising a number of startup firms.

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His research interests are primarily concerned with the impact of different forms of taxation on the behaviour of economic agents, in particular companies. This has involved both theoretical and empirical research on, for example, the impact of taxation on corporate investment and dividend policy, and the location decisions of multinationals. He has published widely in academic journals.

He has been closely involved in international tax policy issues in Europe and elsewhere. He has worked with the OECD's Committee of Fiscal Affairs and the European Commission, in particular with the Ruding Committee and as part of the panel of experts used by the Commission in developing its 2001 proposals for reform of European corporation taxes. He has been actively involved in tax policy in a number of countries. He is Policy Watch editor of *International Tax and Public Finance*.

Recent publications include:

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“Debating Proposed Reforms of the Taxation of Corporate Income in the European Union”, *International Tax and Public Finance*, 2004, 11, 71-89.

“Taxing multinationals”, *International Tax and Public Finance*, 2003, 10, 469-487 (with R. Glenn Hubbard).

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Bill Gale is a Senior Fellow and holds the Arjay and Frances Miller Chair in Federal Economic Policy in the Economic Studies Program at the Brookings Institution. He is deputy director of the Economic Studies Program and co-director of the Tax Policy Center, a joint venture of the Brookings Institution and the Urban Institute. His areas of expertise include tax policy, budget and fiscal policy, and public and private saving behavior and pensions, and intergenerational transfers of wealth.

Before joining Brookings, Gale was an assistant professor in the Department of Economics at the University of California at Los Angeles, and a senior staff economist for the Council of Economic Advisers. He has also served as a consultant to the General Accounting Office and the World Bank.

Gale is co-editor of Rethinking Estate and Gift Taxation (2001), Economic Effects of Fundamental Tax Reform (1996), the Brookings-Wharton Papers on Urban Affairs, (1999-present) and two forthcoming volumes: The Evolving Pension System: Trends, Effects, and Proposals for Reform (2003) and Private Pensions and Public Policies (2003), all published by Brookings.

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He has also published in a wide variety of popular media outlets, including the Los Angeles Times, the New York Times, the Wall Street Journal, and the Washington Post.

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Gale received his B.A. in economics from Duke University and his Ph.D. in economics from Stanford University. He also studied for a year as an undergraduate at the London School of Economics. He lives in Fairfax, VA, with his wife, two children, and golden retriever.

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Michael J. Graetz is the Justus S. Hotchkiss Professor of Law at Yale University. Before becoming a professor at Yale in 1983, he was a professor of law at the University of Virginia and the University of Southern California law schools and Professor of Law and Social Sciences at the California Institute of Technology. His publications on the subject of Federal taxation include a leading law school text and more than 50 articles on a wide range of tax, health policy, social insurance, and tax compliance issues in books and scholarly journals. His most recent books, *True Security: Rethinking Social Insurance* and *The U.S. Income Tax: What It Is, How It Got That Way and Where We Go From Here*, were published in 1999 by Yale University Press and W. W. Norton & Co, respectively. He is the author of *The "Original Intent" of U.S. International Taxation*, 46 Duke L.J. 1021 (1997) and *Taxing International Income: Inadequate Principles, Outdated Concepts and Unsatisfactory Policies* (forthcoming Tax L.Rev. 2001).

During January-June 1992, Michael Graetz served as Assistant to the Secretary and Special Counsel at the Treasury Department. In 1990 and 1991, he served as Treasury Deputy Assistant Secretary for Tax Policy. Professor Graetz has been a John Simon Guggenheim Memorial Fellow and he received an award from Esquire Magazine for courses and work in connection with provision of shelter for the homeless. He served on the Commissioner's Advisory Group of the Internal Revenue Service. He served previously in the Treasury Department in the Office of Tax Legislative Counsel during 1969-1972.

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Hines studies tax policy, particularly the taxation of multinational corporations. His work concerns the determinants of foreign direct investment, the influence of tax regimes on the location and magnitude of R&D investment, export incentives, transfer pricing, financing of multinational corporations, the design of tax treaty policy, and the effects of tax policies on other activities of multinational firms. His research also examines the impact of domestic tax incentives on investment in the United States, issues related to tax compliance, the efficiency consequences of taxation, and the impact of tax exemptions for nonprofit organizations in the United States.

## Glenn Hubbard

Glenn Hubbard was named dean of Columbia Business School on July 1, 2004. A Columbia faculty member since 1988, he is also the Russell L. Carson Professor of Finance and Economics. Professor Hubbard received his BA and BS degrees *summa cum laude* from the University of Central Florida, where he received the National Society of Professional Engineers Award. He also holds AM and PhD degrees in economics from Harvard University. After graduating from Harvard, Professor Hubbard began his teaching career at Northwestern University, moving to Columbia in 1988. He has been a visiting professor at Harvard's Kennedy School of Government and Harvard Business School as well as the University of Chicago. Professor Hubbard also held the John M. Olin Fellowship at the National Bureau of Economic Research.

In addition to writing more than 90 scholarly articles in economics and finance, Professor Hubbard is the author of a leading textbook on money and financial markets. His commentaries have appeared in *Business Week*, the *Wall Street Journal*, the *New York Times*, the *Financial Times*, the *Washington Post*, *Nikkei* and the *Daily Yomiuri*, as well as on television (on PBS's *Nightly Business Report*) and radio (on NPR's *Marketplace*).

In government, Professor Hubbard served as deputy assistant secretary of the U.S. Treasury Department for Tax Policy from 1991 to 1993. From February 2001 until March 2003, he was chairman of the U.S. Council of Economic Advisers under President George W. Bush. While serving as CEA chairman, he also chaired the Economic Policy Committee of the OECD. In the corporate sector, he is currently a director of ADP, Dex Media, KKR Financial Corporation, and Ripplewood Holdings.

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Professor Lazear has written extensively on labor markets and personnel issues; microeconomic theory; issues involving worker compensation and effects on productivity; governmental policies on discrimination, affirmative action and comparable worth; educational policy; unemployment; culture, language and diversity issues; the doctrine of employment at will; distribution of income within the household; and pricing and marketing policies. He has over 100 published articles and eight books.

Professor Lazear's book *Personnel Economics* (MIT Press, 1995) expands on his 1993 Wicksell Lectures. In 1998, he received the Melamed Prize, which cited this book as the best research by a business school professor anywhere in the world during the previous two years. He also received the 1994 Distinguished Teaching Award from Stanford University's Graduate School of Business and the 2000 Ph.D. Faculty Distinguished Service Award. In 2004, he was awarded the IZA Prize for Outstanding Achievement in Labor Economics.

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Prior to joining GE in 1988, he was a partner in the law firm of Dewey, Ballantine in Washington, D.C. and New York City. From 1976 to 1981 Mr. Samuels served as the Deputy Tax Legislative Counsel and Tax Legislative Counsel of the U.S. Department of Treasury in Washington, D.C.

Mr. Samuels is the Chairman of the International Tax Policy Forum, a Fellow of the American College of Tax Counsel, a Trustee of the American Tax Policy Institute and a member of The Business Roundtable Tax Coordinating Committee. He is a member of the University of Chicago Law School Visiting Committee, was an adjunct professor of taxation of NYU Law School (1975 to 1986), and a Visiting Lecturer at Yale Law School (1997-2006).

Mr. Samuels is a graduate of Vanderbilt University (1966) and the University of Chicago Law School (1969), and received an LLM in taxation (1976) from NYU Law School.

EXECUTIVE OFFICE OF THE PRESIDENT  
COUNCIL OF ECONOMIC ADVISERS  
WASHINGTON, D.C. 20502

**Matthew J. Slaughter**

Matthew J. Slaughter was nominated by President Bush on September 22, 2005, and confirmed by the U.S. Senate on November 4, 2005, to serve as a Member of the Council of Economic Advisers. Dr. Slaughter is currently on leave from Tuck School of Business at Dartmouth College, where he is an Associate Professor of Business Administration. He is also currently a Research Associate at the National Bureau of Economic Research, a Visiting Fellow at the Institute for International Economics, and a Term Member at the Council on Foreign Relations. In recent years he has also been a Visiting Scholar at the Federal Reserve Board and the International Monetary Fund, and a Consultant at the World Bank and the U.S. Department of Labor.

Dr. Slaughter's area of expertise is the economics and politics of globalization, work that has been supported by several grants from organizations including the National Science Foundation and the Russell Sage Foundation. More than three dozen articles by Dr. Slaughter have been published as book chapters and in academic journals, and he also recently coauthored the book *Globalization and the Perceptions of American Workers*. He currently serves in various editorial positions for several academic journals dealing with globalization.

In addition to numerous presentations at academic conferences and seminars, in recent years Dr. Slaughter has spoken to many non-specialist audiences and his work has been widely featured in the business media. He has also been involved with individual companies and industry associations interested in fostering dialogue on issues of international trade, investment, and taxation.

Dr. Slaughter joined the Tuck faculty in 2002. Prior to coming to Tuck, since 1994 he had been an Assistant and Associate Professor of Economics at Dartmouth, where in 2001 he received the school-wide John M. Manley Huntington Teaching Award. Dr. Slaughter received his bachelor's degree summa cum laude and Phi Beta Kappa from the University of Notre Dame in 1990, and his doctorate from the Massachusetts Institute of Technology in 1994.

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