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Corporation tax revenue growth in the UK: A microsimulation analysis ☆

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ABSTRACT

This paper examines the built-in flexibility properties — as measured by the elasticity of revenue with respect to profits — of the UK corporation tax system. Emphasis is placed on determining some of the major influences on the extent to which total corporation tax revenue changes when profits change over the economic cycle. A microsimulation model, CorpSim, is constructed and used to obtain numerical results. In the model, corporations use group relief, capital allowances and losses in a tax-minimising manner. The growth of aggregate corporation tax revenue in practice in the UK appears to be highly volatile in relation to the growth of profits. High volatility in revenue elasticities is found to be especially associated with economic downturns. In mild economic downturns, corporation tax revenue elasticities may rise (because tax growth falls less than profit growth), but in more severe downturns, large but temporary decreases in revenue elasticities (and even negative elasticities) can be expected.

1. Introduction

The purpose of this paper is to examine the built-in flexibility properties — as measured by the elasticity of revenue with respect to profits — of the UK corporation tax system. Emphasis is placed on determining some of the major influences on the extent to which total corporation tax revenue changes when profits change over the economic cycle. This exercise is motivated by the fact that volatility of corporate tax revenues in recent years has proved hard to predict, in part because the underlying revenue properties of the tax are not well understood. It is important to analyse the elasticity or built-in flexibility properties of the corporation tax system, in order to be able to distinguish their effects from those of discretionary changes in tax rates and thresholds, or other factors such as changes in avoidance and evasion.[1] Hence, in the simulations reported here, the various tax thresholds are held constant and the revenue elasticity measures the extent of fiscal drag.

Section 2 briefly discusses the concepts of tax buoyancy and elasticity. It may be thought that, because the UK corporate tax schedule displays very little rate progression, its built-in flexibility properties are negligible. However, a crucial role is played by tax deductions, particularly regarding losses and capital allowances. The asymmetric treatment of gains and losses, arising from the fact that losses can only be deducted against positive profits, suggests that there may be significant cyclical effects.[2] In a theoretical analysis of the tax structure, Creedy and Gemmell (2008) showed that, in principle, the revenue elasticity may vary considerably over the economic cycle. The present paper extends that work by obtaining numerical orders of magnitude.

Given the complexity of corporation tax regulations and the structure of companies, combined with the paucity of data relating to the distribution of profits in the UK, the approach taken is to construct a simplified microsimulation model. Although the model necessarily abstracts from a number of complexities, it nevertheless captures the essential characteristics of the system for present purposes. This model is referred to as CorpSim. The approach contrasts with aggregate corporate tax revenue forecasting models based on time-series regression analyses which generally cannot separate the built-in effects on revenues from those due to other factors such as discretionary actions.

The approach may be contrasted with standard tax microsimulation models of households, used to examine revenue and distributional implications of income taxes and a range of transfer payments. These models are typically based on a large cross-sectional survey, providing sufficient information about each individual and household so that tax liabilities and eligibility for transfer payments can be determined reasonably accurately given gross incomes.[3] In the present

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[1] For example, Devereux et al. (2004) considered the fact that corporate tax revenues have remained high despite periodic decreases in the statutory tax rate. They attribute this largely to growth in financial companies' profits.

[2] The potential implications for tax revenue of this asymmetry in the US were highlighted by Auerbach (2007, p. 8). Earlier, Auerbach (1986) and Altshuler and Auerbach (1990) examined the dynamic effects on investment behaviour of tax law asymmetries.

[3] However, variations in benefit take-up rates can introduce a difference between actual net incomes and those arising in principle.

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context, a considerable challenge arises from the need to model the transformation, for each corporation, between gross profits and taxable profits.

Microsimulation models of corporation tax must be able to capture the complex interplay between the liability conditions contained within the tax code, and company choices allowable under that code. An important dynamic element is involved. For example, it is necessary to model company choices of precisely when to claim various allowances against tax and how to share these allowances across companies within the same group. Of necessity, a model of corporate taxes must therefore contain a dynamic component relating to changes in profits over time, in view of the crucial role played by the ability to carry unclaimed losses and capital allowances into the future.

Any model which seeks to explain how tax revenue changes over time requires, at a minimum, three main components. These are an initial distribution of profits for a population of corporations, a method of generating each corporation's profits over time and a method for computing the deductions against profits for each corporation in each year. The way in which profits are modelled within CorpSim is described briefly in Section 3, with further details in Appendix B. This component generates the changing distribution of profits over time for a sample of corporations. The model is restricted to two domestic sources of profit for each corporation, and complications arising from international transactions are ignored.[4]

Section 4 describes how deductions, in the form of losses and capital allowances arising from investment, are used in the model to offset corporation tax. These generate total taxable or net profits, given gross profits from the two sources. In this section, attention is restricted to the case of a single corporation in isolation. Section 5 turns to the consideration of corporations within groups, involving the introduction of group relief. Modelling the use of deductions is considerably more complex in this context compared with that of a single corporation, in view of the much larger number of possibilities. The microsimulation model developed here uses a search algorithm designed to produce, for each corporation, the minimum taxable profit in each period. No attempt is made to model the endogenous formation of groups. However, the results demonstrate that it is the ability to form groups that has a major impact on the tax revenue elasticity over the business cycle.

Having described the structure of CorpSim, some results from applying the simulation model to a variety of scenarios are discussed in Section 6. These provide useful insights into the revenue elasticity properties of corporation tax over the economic cycle and reveal strong similarities to the observed buoyancy of tax liabilities in recent years. Section 7 discusses revenue elasticities over the long run. Results are summarised and conclusions drawn in Section 8.

The simulation model, as presently constructed, does not incorporate behavioural responses in the sense that the time profile of corporations' gross profits, and hence losses, are exogenously determined. Capital allowances in turn depend on the time profile of profits from the two sources, given the assumed form of investment function used in the model. Groups of corporations minimise their tax liabilities given the exogenous values of those variables. This is reasonable where the primary focus of the simulations is to examine corporation tax revenues for given tax rates and allowances. Nevertheless, the present model is capable of investigating the revenue consequences of changes in these tax parameters, and provides a 'no response' benchmark against which behavioural simulations could be compared. The incentives for tax evasion, by misreporting information, are not examined here so the results can be regarded as applying to full compliance.[5]

[4] This is not meant to imply that international aspects are unimportant, simply that they cannot easily be incorporated into the present simulation model. A useful extension would allow for the effect of tax on firms' behaviour in an international context. In addition, since almost all declared foreign income in the UK is tax-relieved via foreign income tax credits, there is currently very little net tax liability from this source.

[5] This assumption may affect the results if there is a systematic variation in non-compliance over the business cycle.

2. Tax buoyancy and elasticity

Tax buoyancy measures the observed percentage change in tax revenues divided by the percentage change in the tax base. Buoyancy is affected both by the built-in properties of the tax structure and by changes in any other factors, such as changes in tax parameters or compliance, which alter the relationship between the tax base and revenues raised from that base. The automatic revenue growth, associated with these built-in properties — fiscal drag — is a familiar feature of progressive income taxes where rising marginal tax rates generate an increasing share of total income paid in income tax as average incomes rise. It can be measured in unit-free terms by the revenue elasticity of a tax — the automatic percentage change in tax revenues divided by the percentage change in the tax base.[6] The difference between buoyancy and elasticity therefore provides a measure of the impact of changes in discretionary and other exogenous factors (such as compliance) on tax revenues. In the present context, as shown by Creedy and Gemmell (2008) it is not the existence of a progressive rate schedule that produces significant revenue elasticities but the fact that deductions and allowances are endogenous, are subject to asymmetries and can vary substantially over the business cycle.

Table 1 shows annual gross profit and corporation tax growth rates, and the resulting revenue buoyancy, in the UK since 1992.[7] This shows that annual tax and profit growth rates are highly volatile. Buoyancy is also highly volatile, because tax and profit growth rates follow quite different patterns over time. A key objective of the simulation analysis in later sections is, therefore, to identify how far this observed volatility in corporation tax buoyancy is also generated by simulations of automatic responses as captured by the revenue elasticity.

3. A model of profits

This section provides a brief outline of the gross profit component of CorpSim; further details are in Appendix B. The dynamic component contains both systematic and stochastic elements, and is designed to generate changes in the distribution of profits over time by tracing the profits of each of a large number of corporations over a required time period. Standard stochastic models of income distribution cannot be used because, unlike income, profits are negative for many corporations. The approach used here involves an assumption that there is some minimum profit (maximum negative profit) below which corporations cannot go in any year.[8]

In practice, corporations can earn profits from several sources which are taxed under different schedules. The corporation tax rules generally limit the extent to which losses or other deductions available under one schedule can be offset against others. However, aggregate data suggest that total UK-source profit is dominated by two income sources: trading profits and profits arising from loan-relationships (interest income).[9] This section therefore models two profit sources and subsequently models deductions against those profits based on

[6] For progressive taxes this elasticity exceeds one, because revenues rise proportionately faster than the tax base. See Creedy and Gemmell (2004, 2006) for further discussion in the context of income and consumption taxes.

[7] These data, from HMRC National Statistics, Table 11.2, are for corporation tax accruals in each fiscal year (beginning on 05 April), for on-shore companies, excluding life assurance companies. see http://www.hmrc.gov.uk/stats/corporate_tax/table11_2.pdf.

[8] CorpSim does not allow for 'births' and 'deaths' (or shifts into or out of the tax jurisdiction), but considers a fixed population over a given time period. It therefore also ignores taxes on liquidation.

[9] Data for 2003–04 show that in aggregate across financial and non-financial sectors (excluding North Sea oil, and life assurance) gross trading profits accounted for around 77% of total UK-source gross profits with loan relationship income accounting for a further 16%. When foreign-source income is included the former two profit sources account for around 75% of total gross profit.