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## Tax Smoothing and Expenditure Creep

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# TREASURY WORKING PAPER

98/9

## Tax Smoothing and Expenditure Creep

Chris Pinfield

### ABSTRACT

Tax smoothing minimises the economic costs of raising taxes to finance a varying profile of expenditure. This standard result assumes that expenditure pressures do not vary with the short term fiscal position. In the presence of expenditure creep, however, tax smoothing is no longer optimal tax policy.

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## Introduction

A basic result in fiscal theory is that the economic costs of raising taxes, to finance a varying profile of expenditure, are minimised by striking an average tax rate over the period. This is the “tax smoothing” result.

In New Zealand and many other countries, demographic changes are set to push up Government expenditure (in particular on superannuation) over time. Both inter-generational and tax smoothing arguments can be advanced in favour of setting taxes so as to achieve an initial (and lengthy) period of budget surpluses, followed by a period of deficits as expenditure rises.

The tax smoothing argument would be undermined, however, if the period of surpluses were to trigger higher expenditure than would otherwise be the case – “expenditure creep” in other words. This short paper addresses the issue at a theoretical level. Does the basic tax-smoothing result hold when expenditure is not exogenous?

For purposes of comparison, I also look at the effect on the results of expenditure control, in the shape of an exogenous reduction in expenditure from its originally-projected level.

## The basic model

We set up a simple two-period fiscal model for this purpose. The two periods can be viewed as the short term and the longer term. GDP is fixed at  $Y$  in each period. The interest/discount rate from period 1 to period 2 is  $r$ . There is no initial debt. Expenditure is fixed at  $\bar{G}_1$  in period 1.

Expenditure in period 2 is  $G_2$  which can vary in response to the fiscal situation in period 1, or in response to active expenditure control (more on these later). If the period 1 budget is balanced, and without additional expenditure control, then period 2 expenditure is  $\bar{G}_2$ . We are interested in the situation where  $\bar{G}_2 > \bar{G}_1$ .

Tax rates are  $t_1$  and  $t_2$ . We also define “balanced budget” tax rates by  $\bar{t}_1 = \bar{G}_1/Y$  and  $\bar{t}_2 = \bar{G}_2/Y$ . At these tax rates the budget would be balanced in each period.

The inter-temporal budget constraint is:

$$t_1 Y + \frac{t_2 Y}{1+r} = \bar{G}_1 + \frac{G_2}{1+r}$$

In what follows it will be convenient to isolate the effect on the budget constraint of the difference, if any, between  $G_2$  and  $\bar{G}_2$ , or equivalently between  $G_2/Y$  and  $\bar{t}_2$ .

The budget constraint now becomes:

$$(A) \quad (t_1 - \bar{t}_1) + \frac{t_2 - \bar{t}_2}{1+r} = \frac{G_2/Y - \bar{t}_2}{1+r}$$

Subject to this constraint we seek to minimise a measure of the dead-weight costs of taxation:

$$(B) \quad t_1^2 + \frac{t_2^2}{1+r}$$

(B) is a standard quadratic loss function. Any other concave function will generate the same results in qualitative terms.

Note that this formulation does not take account of any marginal costs or benefits from variations in period 2 expenditure away from  $\bar{G}_2$ .

### Exogenous expenditure

We begin by fixing  $G_2$  at  $\bar{G}_2$ . Then the budget constraint (A) simplifies to:

$$(C) \quad (t_1 - \bar{t}_1) + \frac{t_2 - \bar{t}_2}{1+r} = 0$$

To minimise the costs of taxation, we form a Lagrangian from (B) and (C) and differentiate with respect to  $t_1$  and  $t_2$  to obtain:

$$2t_1 + \lambda = 0 \quad \text{and}$$

$$\frac{2t_2}{1+r} + \frac{\lambda}{1+r} = 0$$

Hence  $t_1 = t_2$  - the basic tax-smoothing result.

### Endogenous expenditure

We now let second-period expenditure vary with the size of the first-period surplus, or, equivalently, with the difference between the first-period tax rate and its balanced-budget value. We can represent this by:

$$\frac{G_2 - \bar{G}_2}{\bar{G}_2} = \varepsilon \frac{t_1 - \bar{t}_1}{\bar{t}_1} \quad \text{or}$$

$$G_2/Y - \bar{t}_2 = \varepsilon \frac{t_1 - \bar{t}_1}{\bar{t}_1} \bar{t}_2 \quad \text{for some positive elasticity } \varepsilon$$

The inter-temporal budget constraint (A) is now:

$$(t_1 - \bar{t}_1) + \frac{t_2 - \bar{t}_2}{1+r} = \frac{\varepsilon}{1+r} \frac{\bar{t}_2}{\bar{t}_1} (t_1 - \bar{t}_1) \quad \text{or}$$

$$(D) \quad (1 - \varepsilon')(t_1 - \bar{t}_1) + \frac{t_2 - \bar{t}_2}{1+r} = 0 \quad - \text{ where } \varepsilon' = \frac{\bar{t}_2}{\bar{t}_1} \frac{\varepsilon}{1+r} .$$

Minimising the deadweight costs of taxation now involves solving:

$$2t_1 + \lambda(1 - \varepsilon') = 0 \quad \text{and}$$

$$\frac{2t_2}{1+r} + \frac{\lambda}{1+r} = 0$$

This implies that the optimal tax setting is no longer  $t_1 = t_2$ , but:

$$t_1 = (1 - \varepsilon')t_2$$

- ie lower taxes in the first period than the second.

### Expenditure control

In this model we can represent the effects of expenditure control by an exogenous reduction in the level of second period expenditure. This will affect the required tax rates but not the qualitative results derived above.

### A numerical simulation

We can illustrate what is going on by three scenarios. In all of them,  $r = 0.5$  (equivalent to 8% compounded for 5 years) and  $\bar{t}_1 = 0.3$  (ie first-year spending of 30% of GDP).

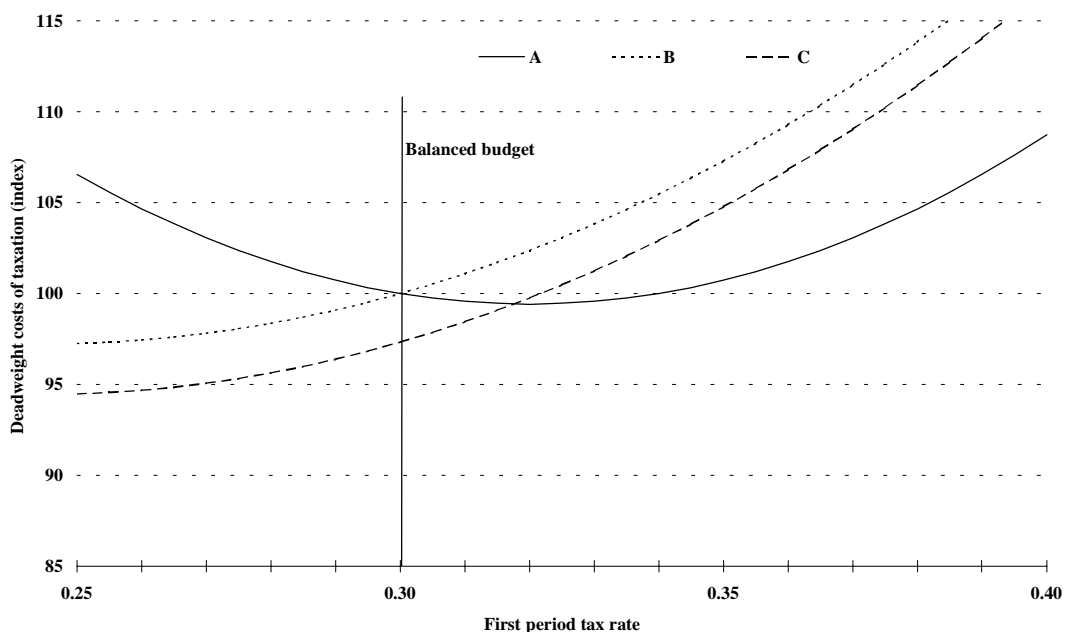
	$\bar{t}_2$	$\varepsilon$
(A) exogenous expenditure	0.35	0.0
(B) 2 <sup>nd</sup> period expenditure endogenous	0.35	0.5
(C) 2 <sup>nd</sup> period expenditure reduced by 1% of GDP, but still sensitive to the fiscal situation	0.34	0.5

The elasticity of 0.5 chosen for scenarios (B) and (C) is equivalent to assuming that half of any period 1 surplus is diverted into additional period 2 expenditure. The expenditure control option chosen for scenario (C) is equivalent to a spending reduction, in period 2, of 3%.

The numerical results are as follows:

	$t_1$	$t_2$	Deadweight loss (index)
(A) with balanced budget	0.30	0.35	100.0
(A) with taxes smoothed	0.32	0.32	99.4
(B) with balanced budget	0.30	0.35	100.0
(B) with taxes smoothed	0.326	0.326	103.2
(C) with balanced budget	0.30	0.34	97.3

The following chart sets out the results. The horizontal axis sets out the first-period tax rate. The second-period tax rate is not shown but is calculated from the budget constraint. In all scenarios a first-period tax rate of 0.30 implies that the budget is balanced in each period. The vertical axis sets out the resulting deadweight costs, indexed by setting the costs of scenario (A), under a balanced budget, at 100.



Four comments can be made:

- \* in the “exogenous expenditure” scenario (A) there are lower costs from tax smoothing, as compared to balancing the budget, but these are relatively small, less than 1%;
- \* in the “endogenous expenditure” scenario (B) tax smoothing would involve over 3% higher costs than balancing the budget;

- \* the “endogenous expenditure plus expenditure control” scenario (C) involves lower costs, compared to (B) of nearly 3%;
- \* in both scenarios (B) and (C) deadweight costs would be reduced still further by lowering the first period tax rate below 30% - ie by going into deficit in the first period and thereby dragging down second-period expenditure - but that leads into other issues that are not addressed in this particular model.

## **Conclusion**

This simple model serves to demonstrate that tax smoothing is not optimal tax policy under all circumstances. For plausible parameter values, the economic gains from tax smoothing are quite modest even if expenditure is not influenced by the short-term fiscal position. Rather larger are the implications for the costs of taxation of feedback effects from the budget surplus to expenditure; or of successful expenditure control. Put another way, while there are modest economic gains to be had from tax smoothing, these will only be achieved if the resulting surpluses, in the initial period, are successfully preserved.