Non-linear Effects of Fiscal Deficits on Growth in Developing Countries

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Abstract

This paper examines the relation between fiscal deficits and growth for a panel of 45 developing countries. It finds evidence of a threshold effect at a level of the deficit around 1.5% of GDP. While there appears to be a growth payoff to reducing deficits to this level, this effect disappears or reverses itself for further fiscal contraction. There is also evidence of interaction effects between deficits and debt stocks, with high debt stocks exacerbating the adverse consequences of high deficits.

Keywords: Fiscal deficits, growth, threshold effects, developing countries.

JEL Codes: H3 , H6 , O4

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1. Introduction

A great deal of attention has been devoted in both theoretical and empirical literatures to the possible impact of various fiscal magnitudes on growth. In general, the theoretical literature has been careful to respect the government budget constraint, which imposes the requirement that a change in one magnitude has to be matched by offsetting changes elsewhere. This has not usually been true of the empirical literature, which has frequently examined the consequence of variations in a subset of budget items, implicitly assuming that the (hidden) offsets elsewhere are neutral[1]. Since the offsetting changes are unspecified, and could take a variety of different forms, this assumption is strong – all possible offsetting combinations are being treated as neutral. For example, consider the common case where a study includes the share of government consumption expenditure in GDP as one of the regressors, and interprets the coefficient on this variable as a measure of the impact on the growth rate of a small increase in this share. This interpretation assumes that the coefficient would be invariant to whether the increase was financed by a one-for-one reduction in capital spending, or one-for-one increases in grant aid, tax revenue, or deficit financing. Furthermore, it assumes that this neutrality would hold within each of these categories, for example between monetizing the deficit and increased domestic borrowing.

Even in the theoretical literature, much of the effort has been devoted to consideration of revenue neutral shifts in (more or less) distortionary taxes, and compositional shifts in (more or less) productive expenditures in isolation, or to combinations of the two in a balanced budget configuration. While there is also an extensive literature devoted to the consequences of budget deficits, much of this has been in a context of lump sum taxation and expenditure which is unproductive (as modelled, for example, by lump sum transfers)[2]. Very little attention has been accorded to the fiscal issue of most practical interest, where variations in distortionary taxes and/or productive expenditures may be partly offset by changes in deficit financing[3].

This paper sets out to consider this question in the context of developing countries, in a way that respects the government budget constraint. Before doing so, however, it is instructive to consider a simple scatter plot of the relation between the fiscal deficit and growth. Most empirical analyses in this area assume that this relation is linear (see for example Easterly *et al*, 1994).[4] It is true that a linear representation tends to fit the

[1] For an extensive survey of the literature from this perspective, see Gemmell (2000).
[2] We here follow the common terminology for distinguishing between expenditure which enhances output - is 'productive' - and that which does not. 'Unproductive' expenditure may however be of high social value, for example by entering utility directly; hence it should not be confused with waste, though it might include that.
[3] For example, in one of the leading textbooks on growth, Barro and Sala-I-Martin (1995), the only discussion of government and growth (pages 152-161) presupposes a continuously balanced budget, so consideration of public debt is excluded. In another, Aghion and Howitt (1998), government as a fiscal institution barely makes an appearance; the only consideration of public debt is relegated to one of the problem sets. (Problem 7 of Chapter 1).
[4] One notable exception is Giavazzi *et al* (2000).

data reasonably but nonetheless may mask important and policy-relevant non-linearities especially at low levels of the fiscal deficit. This is certainly suggested by the data in Figure 1, which plots average annual per capita income growth against the fiscal deficit for 45 non-OECD countries[5] overlaid with a semi-parametric estimate of the sample relationship between the two (see Robinson, 1988).

Figure 1: Fiscal Deficit and Growth in Non-OECD Countries 1970-1999

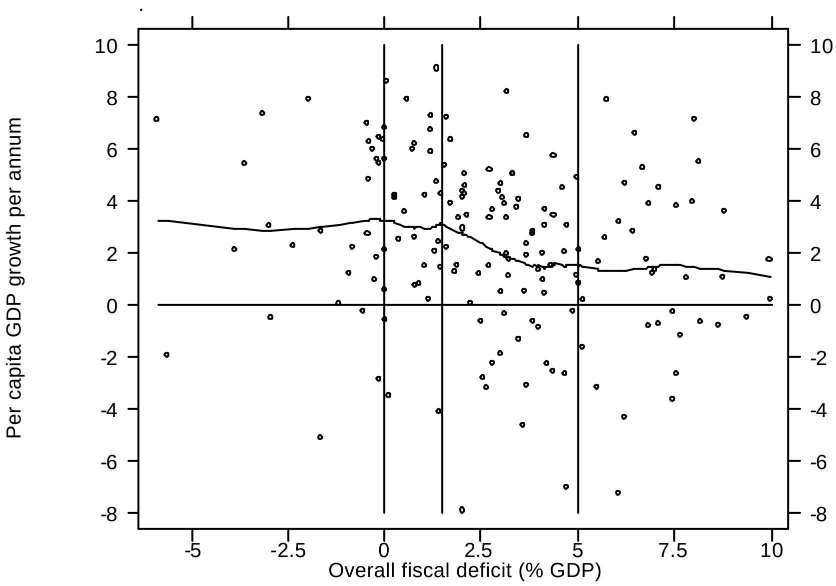

Figure 1 is generated from a semi-parametric model of the form $y = Zb + f(x) + e$ where Z denotes a vector of control variables, x is the fiscal deficit after grants and interest on debt, and *f(x)* is a potentially non-linear function to be estimated non-parametrically on the pooled sample of countries. The control variables are defined and described in Section 4 below. By sorting the data on x and differencing the sorted data, asymptotically efficient estimates of $\hat{b}$ can be generated, allowing *f(x)* to be derived residually as $f(x) = y - Z\hat{b}$ (see Yatchew, 1998). The non-parametric function *f(x)* is then plotted against average annual per capita GDP growth as a locally weighted smoothing (lowess) kernel estimator using the `ksm` routine in STATA with a bandwidth setting of 0.5.

Given the high degree of dispersion in the data this evidence is only tentative – we subject the result to a more rigorous analysis below -- but nonetheless two features are worth noting. First, as others have remarked, high deficits are associated with low average real per capita GDP growth.[6] However, secondly, the relationship is not linear: the gains to growth of fiscal contraction are most marked as the deficit falls from around 5% of GDP and these taper out well before the economy reaches a balanced budget position.

This type of relationship is quite plausible *a priori*. The distortionary impact of taxation is increasing in the tax rate, while that of a very small deficit may be low. Hence, for a given level of government spending, a shift from a balanced budget to a

[5] Details of country coverage and data definitions are provided in Table 1 and Appendix 1.

[6] There is, however, an important qualification to this result – based on the consistent treatment of the government budget constraints in models of this type – which we discuss below.

(small) deficit may temporarily reduce distortion[7]. If these distortions impact on growth rather than simply on output levels, it is feasible that growth will be maximized when there is some recourse to deficit financing.

The rest of the paper is organized as follows. Section 2 considers how deficit financing might be considered in the context of distortionary taxes and productive expenditure[8]. The approach is to set up a simple fixed coefficient model of savings behaviour, which has the merit of permitting the discussion to move beyond steady state properties. Section 3 describes the empirical model and the estimation strategy, which allows both for threshold effects in the deficit and for interactions between the deficit and debt stocks. Section 4 turns to the empirical application, and utilizes data from the IMF's Government Finance Statistics for 45 developing countries over the period 1970-99. A robust threshold effect is found at a deficit equal to 1.5% of GDP, but interaction effects are also important. Section 5 concludes.

2. Deficit financing when government operations are not neutral

The model

In the empirical application, we will be concerned to investigate the impact on growth of both deficit flows and debt stocks, both independently and interactively. Most of the data are drawn from economies which are far from balanced growth or "steady state" configurations. The approach here is to set up a simple fixed coefficient model of savings behaviour which may be regarded as a linear approximation to the OLG. This savings model is then embedded in a simple endogenous growth model along the lines of the model of government and growth due to Barro (1990) and Barro and Sala-i-Martin (1992). Specifically, attention is restricted to a general flat-rate tax on output, so that the possibility of shifts in the composition of taxes is ignored. The government spending activity simply involves purchases of current output and no separate production process. It may create a congestible productive public good; alternatively, it may enter consumers' utility directly, but have no consequences for output. Government debt carries an interest rate equal to the net private rate of return.

Government

All government activities are scaled relative to GDP (Y). The government makes two kinds of expenditures, a productive type in relative amount $G_p / Y = g_p$ and an unproductive type in amount g_u. It receives an aid income ratio of a, and sets a flat-rate output tax at rate t. The debt income ratio is $D/Y = \Delta$. The government budget constraint, relative to GDP is therefore:

$$t = g_p + g_u - a + r\Delta - d \qquad (1)$$

where d is the (conventional) deficit after grants and interest payments.

The wage and interest rates faced by the consumer are net of the output tax. The unproductive type of expenditure could be of either of two types. One is expenditure

[7] The longer run effects may be quite different, since the deficit will also raise the debt stock over time, and that will in general also impact on growth.

[8] It would be appealing to utilize some variant of the overlapping generation model to provide a basis for this investigation. However, while it is possible to derive relatively transparent analytic results for the steady state relation between deficits and growth in intertemporal optimising models of this kind, this is no longer the case for out of steady state behaviour.

by those controlling the government in their own interests, with no benefit to the general population. The other is where it enters consumers' utility functions directly, but in a way which is neutral to their intertemporal decisions. In both cases, the only impact it has on growth is via the financing requirements it imposes.

Production

Since the empirical application is to countries with very different rates of population growth, it is unappealing to model growth effects subject to a stationary population. However, many endogenous growth models suffer from scale effects, where average and marginal products of capital are proportional to the size of the workforce. The model utilized here avoids that shortcoming, but this complicates the growth relations somewhat. The productive public expenditure is here supposed to have benefits in proportion to the aggregate labour force; i.e. it is congestible in the number of workers over whom it is spread. There is also a positive externality associated with the overall capital intensity of production in the economy. The representative firm's production function takes the Cobb Douglas form:

$$y_i = A^{a+b} l_i^{1-a} k_i^{a} (K/L)^{b} (G_p/L)^{1-a}$$

where the firm is indexed by *i*, and has constant returns in the factors it hires. We abstract from depreciation. Competitive markets then ensure that:

$$r = (1-t)\partial y_i/\partial k_i = (1-t)a\,A^{a+b}(k_i/l_i)^{a-1}(K/L)^{b}(G_p/L)^{1-a-b}$$

Hence for the economy in aggregate

$$Y = A^{a+b} K^{a+b} G_p^{1-a-b} = AKg_p^{(1-a-b)/(a+b)} \tag{2}$$

$$r = (1-t)\,aAg_p^{(1-a+b)/(a+b)} \tag{3}$$

and the net-of-tax wage bill is:

$$W = (1-t)(1-a)Y \tag{4}$$

The optimal choice of productive public expenditure is to set $g_p = 1 - a - b$ [9].

Saving and the determination of the growth rate

We assume a very simple fixed propensity model, with three parameters. s is the propensity to save out of net income, with no distinction made between wage and interest income; d determines the size of the wealth effect in reducing savings, again with no distinction by the composition of wealth; and q measures the relation between private saving and the government deficit. If $q = 1$, private saving rises one-for-one with the deficit, a sort of Ricardian effect. If $q = 0$, private savings are invariant to the deficit, so the deficit crowds out private capital formation one-for-one,

[9] The presence of the congestible aggregate capital externality ($b > 0$) permits the share in output of optimal productive public expenditure to differ from the pre-tax share of labour. Forcing these to coincide is an unappealing feature of some models.

in a sort of unreconstructed Keynesian effect. Intermediate values represent partial crowding out. Hence aggregate private saving is:

$$S = s[W + r(K + D)] - d(1-t)(K+D) + q\dot{D} \tag{5}$$

Writing $Y = BK$ where $B = Ag_p^{(1-a-b)/(a+b)}$, we have $r = (1-t)aB$. Also, $S = \dot{K} + \dot{D}$, and $g = \dot{K}/K$. Hence we can write (5) as:

$$g = (1-t)[(sB-d) - (d - saB)B\Delta] - (1-q)Bd \tag{6}$$

For positive growth in the absence of debt or deficit, we require (i) $sB > d$. It also seems plausible to assume (ii) that $d > saB$, so that the reduction in savings due to the wealth effect of additional government debt outweighs the additional savings out of the associated interest income, and (iii) that $1 > q > 0$, so that there is a partial savings offset to the deficit. (6) imposes no restriction on the relation between the debt stock and the flow deficit; it is a dynamic equation. This does not carry through to the steady state, which requires that $\dot{\Delta} = 0$, so that $d = \Delta g$. Substituting into (6), we obtain the steady state growth equation:

$$g_{ss} = \frac{(1 - g_p - g_u + a)[(sB-d) - (d - saB)B\Delta]}{(1 + aB\Delta)(1 + (1-q)B\Delta) - [(sB-d) - (d-saB)B\Delta]\Delta} \tag{7}$$

where the tax rate t has been substituted out, i.e. equation (7) describes the impact on steady state growth of alternative debt and expenditure levels with the tax rate adjusting as necessary.

For the three conditions listed, and for plausible values of the parameters, maximum steady state growth typically involves a positive net worth for government, i.e. $\Delta < 0$. This is consistent with the type of steady state result obtained from a more fully articulated OLG model.

Growth effects of changes in the budget deficit and the level of debt
Equations (1) and (6) (together with (2) and (3)) enable us to examine the impact of changes in the deficit and debt stocks on growth. As stressed earlier, any change in the deficit must be accompanied by an offsetting change elsewhere in the budget. The same is true for the changes in interest payments associated with different debt stocks. In the present model, there are three candidates for this role, g_u, g_p and t. As might be anticipated, these different combinations have very different implications. We illustrate each in turn.

(i) unproductive expenditure
With unproductive expenditure as the accommodating component, B and t are both invariant, so we can differentiate (6) to obtain:

$$\frac{dg}{dd} = -(1-q)B$$

$$\frac{dg}{d\Delta} = -(1-t)(d - saB)B$$

$$\frac{\partial^2 g}{\partial d \partial \Delta} = 0$$

These show, within the confines of the present model, that the impact on growth of an increased deficit and of an increased debt stock are both unambiguously negative[10], and that the interaction term between deficit and debt is zero.

(ii) productive expenditure
With productive expenditure as the accommodating component, t is still invariant, but not *B*. Hence:

$$\frac{dg}{dd} = (1-t)\left[(s - d\Delta) + 2saB\Delta\right]\left(\frac{1-a-b}{a+b}\right)\frac{B}{g_p} - (1-q)\left[B + d\left(\frac{1-a-b}{a+b}\right)\frac{B}{g_p}\right]$$

$$\frac{dg}{d\Delta} = -(1-t)(d - saB)B$$

$$\frac{\partial^2 g}{\partial d \partial \Delta} = -(1-t)(d - 2saB)\left(\frac{1-a-b}{a+b}\right)\frac{B}{g_p}$$

The effect of increased debt remains negative, while the sign on the deficit become ambiguous. This sign is also likely to be function of the deficit. In any case, the growth effects of the deficit are non linear. The interaction term ceases to be automatically zero, but again has an ambiguous sign.

(iii) the tax rate
With taxation as the accommodating component, B is invariant, but the term $(1-t)$ in (6) has to be substituted with:

$(1-t) = \frac{1-g_p-g_u+a+d}{1+aB\Delta}$. Hence:

$$\frac{dg}{dd} = \frac{(sB-d)-(d-saB)B\Delta}{1+aB\Delta} - (1-q)B$$

$$\frac{dg}{d\Delta} = -\frac{(1-g_p-g_u+a+d)[(1+aB\Delta)(d-saB)B+[(sB-d)-(d-saB)B\Delta]aB}{(1+aB\Delta)^2}$$

$$\frac{\partial^2 g}{\partial d \partial \Delta} = -\frac{[(1+aB\Delta)(d-saB)B+[(sB-d)-(d-saB)B\Delta]aB}{(1+aB\Delta)^2}$$

[10] The latter result derives directly from assumption (ii).

The sign on debt remains negative, that on the deficit is ambiguous, while that on the interaction term becomes unambiguously negative.

Summary

It is interesting that such a simple model, with all the direct relations specified in a fairly parsimonious linear way, can generate such a wide variety of results. The model suggests that even in the potentially benign case (for deficit financing) where $r < g$, debt is usually unhelpful for growth performance. For given debt, the impact of the deficit is more ambiguous, and may be non-linear. Finally, there may also be interaction effects on growth between the flow deficit and the debt stock. However, the existence, and where it exists, the sign of this interaction may vary according to the uses to which the deficit is put.

3. Empirical model and estimation strategy

Following the discussion in Section 2 we estimate the empirical growth model

$$gy_{it} = \beta'\mathbf{X_{it}} + \gamma'\mathbf{W_{it}} + \theta d_{it}[W_1 - \tilde{W}_1]_{it} + \delta'\mathbf{K_{it-1}} + \kappa'(W_1\mathbf{K})_{\mathbf{it-1}} + u_{it}$$

$$d_{it} = \begin{cases} 1 \text{ if } W_1 > \tilde{W}_1 \\ 0 \text{ if } W_1 \le \tilde{W}_1 \end{cases} \qquad (8)$$

and $u_{it} = \mu_i + \lambda_t + \varepsilon_{it}$.

Countries are indexed by i, time, defined in terms of five-year periods, by t, and u_{it} is a standard two-way error term with μ_i denoting time-invariant country-specific effects, λ_t common time-varying effects, and ε_{it} the idiosyncratic error component. The dependent variable *gy* denotes average *per capita* income growth, **X** is a vector of control variables (consisting of the rate of growth of population to proxy for the growth of the labour supply, the level of investment, and the start of period income), and **K** is a measure of the government's start-of-period net indebtedness, defined as the sum of domestic and external official debt plus base money. The vector **W** consists of the elements of the government budget (tax revenue, non-tax revenue, grants, expenditure, net lending, interest on debt and the deficit), and W_1 is the fiscal deficit after grants and interest on debt.

The model provides for two mechanisms through which the marginal effect of the fiscal deficit on growth may be non-constant across the sample. The first is a (single) threshold effect which allows the marginal effect of the fiscal deficit on growth to vary around a threshold value of the deficit, determined by the data and denoted $\tilde{W}_1$. The second, captured by the interaction terms (W_1 **K**) allows the relationship between a country's current fiscal stance and its (current or future) growth to depend in part on its fiscal and monetary history.

Since the fiscal variables are bound together by the government budget constraint, estimation of the parameters of equation (8) requires that we eliminate one of the fiscal variables to avoid perfect co-linearity amongst the regressors. Doing so necessarily alters the interpretation of the coefficients on the included fiscal factors, including the deficit. Defining the budget identity as $\sum_{j=0}^{l} W_j = 0$ then substituting out one of the fiscal factors, denoted W_0, equation (8) can be written as

$$gy_{it} = b\,'\mathbf{X_{it}} + \sum_{j=1}^{m} p_j W_{jit} + q\,d_{it}[W_1 - \tilde{W}_1]_{it} + d\,'\mathbf{K_{it-1}} + k\,'(W_1\mathbf{K})_{\mathbf{it-1}} + u_{it} \qquad (9)$$

where the coefficient $p_j = (g_j - g_0)$ measures the marginal impact of fiscal factor W_j on growth net of the marginal impact of the excluded factor W_0. As noted by Kneller *et al* (1999), much of the empirical literature in this area falls into the trap of implicitly assuming that the eliminated category is growth-neutral. This interpretation, though widely prevalent in the literature, is sustained only by assumption: the government budget identity means that it is never possible either to identify directly from the data the gross effect of any fiscal factor on growth – i.e. the g_j parameters. -- or to subject the assumption of neutrality to empirical testing. Nor is it meaningful to do so, since no fiscal change can be sensibly considered independently of its financing and *vice versa*.

Practice in this area (for example Kneller *et al,* 1998 and Miller and Russek, 1997) has attempted to choose a disaggregation of the fiscal balance so as to select a category of revenue or expenditure (or the deficit) which may plausibly be assumed to be non-distortionary. [11] Though desirable, the neutrality assumption is neither necessary nor is it likely to hold in general in a large cross-country data panel. Given the limitations on the coverage, and quality, of fiscal data in developing countries as well as the heterogeneity across countries, it is difficult to identify revenue or expenditure categories that are plausibly growth-neutral across all countries without disaggregating the data to a point where sample coverage is severely compromised. For the data sample considered in this paper, there is no obvious 'growth-neutral' category. We therefore choose to define our excluded fiscal category as a residual component of total expenditure consisting of total non-interest expenditure less expenditure on health, education, infrastructure, public order and safety (including defence) and public administration, all of which are assumed to be broadly growth enhancing, *ceteris paribus*.[12] Although we have no strong priors in either direction on the impact of this residual category of expenditure on growth, since we cannot assume the effect is zero the coefficient estimates reported below must be read as measuring the effect of a particular fiscal factor on growth net of the effect of this residual expenditure category. In other words, for example, the coefficient on tax revenue should be interpreted as the net effect on growth of an increase in tax revenue used to finance additional 'residual' expenditure.

[11] Kneller *et al* (1999) find two fiscal variables (one expenditure and one revenue aggregate) which have equal net (and hence equal gross) impacts on growth. Despite their claim to the contrary (p 178), this equality does not constitute a test for neutrality. Rather it is a test of whether they are equally distortionary.

[12] Based on the GFS economic classification, this residual category therefore consists of economic services, recreation and culture, plus other miscellaneous expenditure.

Threshold Effects and Public Debt
Estimation and inference on the threshold effect is carried out using the methods developed by Hansen (1999).[13] We start by restricting attention to a restricted version of (9) in which $d' = k' = 0$. This restricted model is then estimated by OLS using a within groups transformation of the data to remove country-specific fixed effects. Defining $S(W) = \hat{u}(W)'\hat{u}(W)$ as the residual sum of squares of the model estimated for a threshold level W, then the optimal threshold value is given as

$$\hat{\tilde{W}}_1 = \underset{\tilde{W}_1}{\operatorname{argmin}}\, S(\tilde{W}_1)$$

where we restrict the threshold deficit level to lie in the range from -2% of GDP to 6% of GDP. Inference on whether $\hat{\tilde{W}}_1$ is significantly different from zero is hampered by the fact that the threshold is not identified under the null that $q = 0$ since the null is consistent with any arbitrary value of $\tilde{W}_1$ .A bootstrap method proposed by Hansen (1999) is therefore employed to simulate the asymptotic distribution of the following statistic

$$LR_0 = (S(\tilde{W}_1 = 0) - S(\hat{\tilde{W}}_1)) \big/ \hat{s}^{\,2}.$$

where $\hat{s}^{\,2}$ is the estimated variance from (9).[14] If the null of no significant threshold at $\hat{\tilde{W}}_1$ is rejected, its asymptotic confidence interval is constructed from the LR_1 statistic

$$LR_1 = (S(\tilde{W}_1) - S(\hat{\tilde{W}}_1)) \big/ \hat{s}^{\,2}.$$

LR_1 necessarily takes the value of zero at $\tilde{W}_1 = \hat{\tilde{W}}_1$ and tends in distribution to the random variable Q with limiting distribution $\Pr(Q \le x) = (1 - e^{-x/2})^2$. This distribution can be inverted to define the a% critical value for the LR_1 statistic as $c(a) = -2\log(1 - \sqrt{1-a})$. Plotting LR_1 for the range of $W_1 = [\tilde{W}_{1\min} ... \tilde{W}_{1\max}]$ against this critical value traces out the confidence interval around $\hat{\tilde{W}}_1$.

Once we have identified the optimal threshold this is imposed on (9) and the model is re-estimated. At this stage we relax the restriction on the debt stock effects to investigate whether the observed threshold effect in the deficit is robust to the inclusion in the model of the degree of public indebtedness.

Data, Estimation and Econometric Issues
Our data consist of a panel of 45 non-OECD countries covering the period from 1970-99.[15] We follow standard practice and compute 5-year averages so as to smooth over some of the cyclical features of the data. This gives us a potential sample size of 270 but because of missing data this is reduced to a usable sample (before taking lags) of 184 observations.[16]

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[13] This procedure has recently also been applied to examine threshold effects in the relationship between inflation and growth. See Khan and Senhadji (2001).
[14] See Hansen (1999) for details of the bootstrap routine.
[15] See Appendix I. Our sample is broadly comparable to that used by Devarajan *et al* (1996).
[16] The limiting constraint on the sample is the fiscal data which have been compiled from the IMF's Government Finance Statistics. Accurate fiscal and deficit financing data are notoriously difficult to

*** Table 1 here ***

Table 1 provides a summary of the characteristics of the data and defines the variable mnemonics used later in the paper. The dominant feature of the data is the growth slowdown from the mid-1970s. This affected all countries worldwide but the recovery amongst the developing countries in our sample has been weak with average per capita growth in the late 1990s still lower than that enjoyed 20 years earlier. The growth slowdown was accompanied initially by a steady rise in external government indebtedness and only in the 1990s by a fiscal adjustment. Against this background both investment and the level and composition of revenue and expenditure remained comparatively stable. It follows that these two factors will not in themselves explain the slowdown and recovery in growth, although they may well explain variations around this trend movement. As a consequence, all the models presented below include a set of time dummy variables to capture common time-varying factors not otherwise included in our model. We do not report the coefficients on these time-dummy variables but they are generally strongly significant and appear to do most of the work in picking up the common growth slowdown.[17]

Finally in this section we note two econometric issues which are central to our empirical strategy. The first concerns the characteristics of the fiscal data. For our sample as a whole, the principal components of the budget have a much lower variation over time and across countries than per capita income growth. While the cross-country coefficient of variation for per capita growth is around 2.5 for the pooled data sample, it is only 0.8 for tax revenue and 0.7 for total non-interest expenditure. The principal exception is the budget deficit itself which has a sample coefficient of variation of approximately 1.3. Thus the low degree of variability in fiscal aggregates relative to growth (both across countries and over time) stacks the deck against finding statistically strong effects from regression analysis of the kind carried out here, especially for conventional taxation and expenditure aggregates.[18]

The second problem is that fiscal performance and investment are highly likely to be endogenous to economic growth, at least in the short-run. Working with five-year aggregates means that we smooth out short-run cyclical simultaneity between growth, investment and fiscal performance. However we choose to tackle the problem of the endogeneity of fiscal factors rather differently by allowing them to influence growth

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collect in all countries and this is especially true for lower income countries. Using period averages helps a bit but we were nonetheless obliged to eliminate a large number of countries for want of data. Unfortunately exclusion from the data sample is a far from random process: in many countries an early victim of fiscal distress is the timely and accurate reporting of statistics to the GFS. As with all other work in this area, our results are therefore likely to embody potential biases arising from this endogenous self-selection process.

[17] The median value for the coefficients on the time dummies in the models reported in Tables 2 and 3, measured relative to 1975-79 average growth are as follows (where the t-values are in parenthesis): 1980-84, -1.9% (2.29); 1985-89, -1.1% (1.26); 1990-94, -1.7% (1.99); and 1995-99, -0.9% (1.06).

[18] Easterly (1995) suggests two reasons why fiscal aggregates, especially revenue shares, have such low variance. The first is that 'natural experiments', in which countries have moved to very high or very low (average) tax rates, which would help identify the impact of revenue and expenditure on growth are hard to find. This contrasts to the evidence on inflation and growth where there are numerous 'extreme' inflation episodes that allow the relationship between inflation and growth to be identified with some precision. The second is that cross-country data consist only of revenue shares and not marginal rates so that variations in tax rates (which might be substantial) may not be manifest in tax revenue shares, especially if the informal economy is large and scope for tax evasion exists.

only with a lag. This approach is similar to that adopted by Devarajan *et al* (1996) who define the dependent variable as a forward moving average of the growth rate and use a Hansen-Hodrick correction for the error serial correlation entailed by this transformation. Given the limitations on fiscal data it is not feasible in this case to use annual data. An alternative approach would be to adopt an instrumental variable or GMM estimation technique to instrument the contemporaneous effect of fiscal factors on growth. Though note reported here, we find that that estimating the models by IV methods (using lagged values as instruments) leaves the coefficient point estimates more or less unchanged although, as expected, it significantly reduces the precision of the estimates.[19]

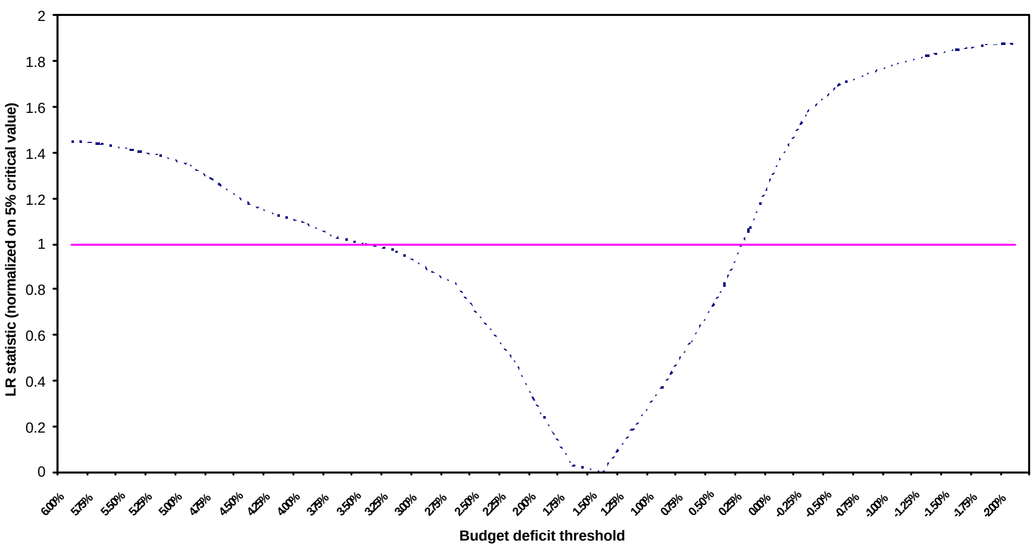
4. Results and Discussion

We start by testing for the presence of a threshold. Table 2 presents the estimates of the location and significance of the threshold, and Figure 2 plots the simulated 95% asymptotic confidence interval around the estimated optimal threshold value based on the LR_1 statistic.

Table 2: Tests for threshold effects

Optimal deficit threshold (Estimated from (9) subject to $d' = k' = 0$)	1.5% of GDP
LR_0 statistic:	7.917
P-value (Based on Hansen (1999) with 1000 bootstrap repetitions)	0.043

Figure 2
95% confidence interval for threshold estimate



[19] These results are available on request from the authors.

The point-estimate locates a growth threshold at a conventional deficit level of 1.5 percent of GDP, which, on the basis of the bootstrapped critical value for LR_0, is significant at a 5 percent, but not 1 percent critical value. On the basis of the LR_1 statistic the 95% confidence interval around the point estimate extends from 3.5 percent to 0.25 percent of GDP. These results confirm the evidence from Figure 1 and support the inclusion of a threshold effect in the model. Table 3 presents the coefficient estimates from the restricted version of equation (9) where $d' = k' = 0$. Column [1] reports a baseline model in which no allowance is made for the threshold effect in the fiscal deficit. Column [2] repeats then introduces the threshold factor.

*** Table 3 here ***

In both cases the omitted fiscal category is what we referred to above as 'residual expenditure' so that each fiscal coefficient is net of the (unknown) impact of an increase in this category of expenditure. Hence the coefficients on taxes should be interpreted as the impact of raising revenue to finance an equivalent value of residual expenditure, holding all other fiscal factors constant. Similarly the coefficients on *texp_y* measures the growth impact of shifting expenditure at the margin away from the residual to the non-residual expenditure, holding revenue and the deficit constant. A similar interpretation follows for the deficit. Clearly the choice of the excluded category is arbitrary, in the sense both that the model's statistical properties are invariant to the choice of excluded categories, and that all of the net coefficients can be recovered by substitution between the different versions of the model. This can be seen from Appendix Table 1 where the model in column [1] is re-estimated over the same data sample but dropping each fiscal variable in turn. To avoid tedium we do not repeat this exercise for each regression.

Bearing this interpretation in mind, the results reported in column [1] appear to be consistent with theory and of broadly plausible magnitudes. The size and sign of the control variables are consistent with the literature with average investment being positively and consistently significant. Initial income though positive is insignificant which reflects in part the bias from using a fixed-effects estimator in the presence of a lagged dependent variable. It is, however, the fiscal factors that are of greater interest in this paper. Net of the excluded category higher taxation and higher non-tax revenue effort reduces average growth (in the next period), while a switch of expenditure from the residual to the 'included' expenditure category (where the latter consists of supposedly productive forms of expenditure) is strongly growth-enhancing. Finally, a deficit-financed increase in 'residual' expenditure is growth-reducing. In all cases the semi-elasticities are large and correspond to sizeable growth effects: the coefficient on *txrev_y* of -0.10, for example, implies that a tax-financed increase in residual expenditure equivalent to 1% of GDP would reduce average annual *per capita* growth by 0.1 percentage points.[20]

In column [2] we allow for a threshold in the effect of the fiscal deficit on growth. Including the threshold marginally improves the overall fit of the model but does not substantially alter the other coefficients. The effect on the impact of the deficit on growth is consistent with the results from Table 2 but appears to be more marked than was suggested in Figure 1. For values of the deficit less than or equal to the threshold

[20] Notice that if all countries had fully optimized their fiscal policy all the coefficients on the fiscal factors would be (locally) zero, although in this case the coefficients could not be identified.

value of 1.5 percent of GDP a marginal increase in the deficit is locally growth-enhancing: an increase in the deficit of one percentage point (for example from a balanced budget to 1% of GDP) would increase the average annual *per capita* growth rate by around one quarter of one percent. By contrast, at levels of the deficit above the threshold the effect is reversed, although the semi-elasticity is of a similar order of magnitude (0.26-0.47 = -0.21). Thus not only does the threshold indicate a change in the marginal effect but that this change is sufficiently large as to suggest a turning point. The final two columns re-estimate the same models but aggregate over the individual revenue and expenditure categories to give a more parsimonious representation of the model in which the parameters of interest are estimated with marginally more precision. The interpretation of the effect of the deficit is essentially unaltered.

The results in Table 3 are striking and at first glance would appear to point to the existence of a growth-maximzing budget deficit. It is important, however, not to rush to this conclusion for at least two reasons. The first is the possibility that the threshold effect simply reflects the effect of omitted variables, the most obvious of which are the levels of public indebtedness. We investigate this possibility in Table 5 where we re-estimate (9) but relax the restriction that $d' = k' = 0$ so that growth is a function of (start of period) debt stocks and the interaction of these stocks with the level of the deficit. As shall be seen the threshold effect is robust to the inclusion of stock effects.

The second point to note is that although the threshold itself is well defined, the interpretation of the coefficient on the fiscal deficit either side of the threshold is strictly net of the effect of the excluded fiscal category. The extent (and sign) of the change in the marginal effect of the fiscal deficit around the threshold will necessarily depend on the expenditure or revenue-reduction an increase in the deficit is financing for the reasons discussed above. This can be seen in Table 4 which reports the semi-elasticity of the fiscal deficit from the model in column [4] of Table 3 for alternative excluded fiscal categories.

Table 4: The (net) effect of the fiscal deficit

Excluded Fiscal Category	[1] 'Residual' Expenditure	[2] Productive Expenditure	[3] Total Revenue
Fiscal deficit ≤ 1.5% of GDP	0.301	0.444	0.413
[t-statistic]	[1.98]	[2.14]	[1.96]
Fiscal deficit > 1.5% of GDP	-0.203	-0.060	-0.091
[t-statistic]	[2.17]	[2.01]	[2.19]

Notes: [a] The figures reported in this table are the deficit semi-elasticity of growth. A value of 0.10 implies that a one percentage-point (of GDP) increase in the deficit would increase average annual per capita growth by 0.1 percentage points (i.e. 10 basis point). **[b]** The semi-elasticities reported in column [1] are derived from Table 3, column [4]. The coefficients in columns [2] and [3] derive from the same model estimated with an alternative fiscal category excluded. **[c]** The statistical characteristics of all three models are necessarily identical and are reported in Table 3.

In all three cases there is evidence of a sign-switch around the threshold point. Compared to the model reported in Table 3, column [4], if the excluded fiscal category is revenue – so that the coefficients on *dc_y* measure the effect of a deficit-financed revenue reduction – the marginal benefit of an increase in the deficit rises from 0.301 to 0.413 for a country starting from an initial deficit of less than 1.5% of GDP while the marginal cost of an increase in the deficit falls from -0.203 to -0.091 for a country starting from a deficit in excess of 1.5% of GDP. This pattern is slightly strengthened if the excluded category financed by a deficit increase is 'productive' expenditure. Given the data and aggregation over fiscal categories we have adopted the threshold does indeed always define a turning point but this need not be so. It is entirely plausible that if the excluded category was extremely growth-enhancing, an increased deficit used to finance higher expenditure (or lower taxation) in the excluded category could increase growth for all countries, regardless of their initial deficit (although the differential effect between the groups would remain constant and the same as in Table 4). by choice of excluded category the threshold may not represent a turning point at all.

Finally in this section we introduce the level of public indebtedness. Table 5 reports the results of estimating (9) where we disaggregate total government indebtedness into its interest-bearing components namely domestic and external debt interest bearing debt and base money, each expressed as a share of GDP. [21]

*** Table 5 here ****

A number of interesting features emerge from these results. The first is that because of limited data on indebtedness including these stock effects in the model reduces the usable sample to around 120 observations which means that the equations in Tables 3 and 5 are not directly comparable. Nonetheless, either on its own or interacted with the flow deficit, the degree of public indebtedness does not greatly alter the overall characteristics or the coefficients on the control variables, total revenue and total expenditure. The coefficients on initial income are now consistently negative and slightly more significant than before. At the same time, the inclusion of public indebtedness, principally external indebtedness, appears to knock out the country-specific effects. Conditional on the other variables in the model (and the time-varying effects), external indebtedness thus provides a summary statistic for otherwise unobservable country heterogeneity in growth patterns. Countries growing more slowly than average, other things equal, are characterized by systematically higher external indebtedness and *vice versa*.

The second feature of these results is that the level public indebtedness clearly matters for growth, both in its own right and indirectly through its effect on the fiscal deficit. Higher levels of interest-bearing debt (columns [1] to [3]) are associated with lower future growth, while higher real money demand is associated with higher future growth (column[4]). Although these effects are not statistically significant they are relatively strong. A doubling of total indebtedness (which is somewhat less than the increase from the mid-1970s to the early 1990s for our sample countries) is associated with a reduction in the average annual *per capita* growth by around 0.3 percentage

[21] The measure of external indebtedness, taken from Loayza *et al* (1998), does not adjust for the degree of concessionality of external debt.

points of GDP. By contrast, an increase in base money (i.e. rising real money demand) has a beneficial but again statistically insignificant effect on growth. In this case an increase in base money of one percent of GDP (equivalent to just under 10 percent increase in real money demand) is associated with an increase in average growth of almost 0.2 percent per annum.

It would appear, however, that it is through its interaction with the flow deficit that these stock effects have their main effect. This can be seen in the final four columns of Table 5 and are summarised in Table 6 below which summarises the consequences for the distortionary effect of deficit financing of changes in the level of government (external) indebtedness and changes in the demand for money.

Table 6. Semi-elasticity of fiscal deficits on growth: stock-flow interactions

	[1]	[2]	[3]
(i) External Debt (% GDP)	Sample Mean 25%	High External Debt 60%	Low External Debt 10%
Fiscal deficit ≤ 1.5% of GDP	0.305	0.281	0.313
Fiscal deficit > 1.5% of GDP	-0.253	-0.277	-0.247
(ii) Money Demand (% GDP)	Sample 12.7%	High 20%	Low 5%
Fiscal deficit ≤ 1.5% of GDP	0.293	0.356	0.235
Fiscal deficit > 1.5% of GDP	-0.188	-0.124	-0.091

Notes: [i] See note **[a]** to Table 4.

As noted in Section 2, holding other factors constant we would expect the growth cost of a given fiscal deficit to be an increasing function of the level of domestic and external debt. On the other hand the higher seigniorage extracted as a result of a higher private sector demand for money may be expected to lower the distortion associated with any given deficit. The evidence from the models with external debt and real money demand support this conjecture, although the same cannot be said for the model with domestic debt, which possibly reflects problems with the accurate measurement of domestic indebtedness in developing countries.

The inclusion of the stock-flow interaction effect lowers the direct effect (and significance) of indebtedness on growth but as the summary statistics provided in Table show changes in the levels of debt have a significant impact on the distortionary effect of the deficit on growth. Clearly, when measured at their sample mean values, the implied semi-elasticities will be roughly equal to the corresponding values of

0.301 and -0.203 reported in Tables 3 and 4.[22] What is more interesting is how these semi-elasticities change as the level of debt increases or decreases, *ceteris paribus*. As Table 6 indicates, an increase in the external debt ratio to 60 percent of GDP, the level prevailing in the 1990s, reduces the semi-elasticity of an increase in the deficit by around 0.026 *per annum* for a country with a low initial deficit and increases the marginal cost of deficit financing for a high-deficit country by the same amount. The effect coming through the demand for money is no less powerful. Here, for example, a drop in domestic money demand to, say, 5 percent of GDP, similar to the level experienced in many low income countries facing stabilization problems in recent years, would reduce the semi-elasticity for low-deficit countries by 0.057 *per annum* and strengthen the marginal distortion in high-deficit countries by the same amount. At first glance these effects appear relatively mild, but since they are cumulative even relatively small changes in the level of net indebtedness and real money demand will have a substantial impact on per capita income over the long-run.

5. Summary and Conclusion

Inspection of the scatterplot in Figure 1 suggests a non-linearity in the relation between growth and the fiscal deficit for a sample of developing countries. We present a simple growth model in which two types of non-linearity may emerge, one involving the size of the deficit and the other interactions between the deficit and the public debt stock. Our empirical analysis, which respects the government budget constraint, confirms the existence of these interactions and identifies a threshold effect in the deficit which is robust to their inclusion. The threshold involves not only a change of slope but also a change of sign in the relation regardless of the budget category excluded from the model, indicating that for an economy not on its steady state growth path, there is a range over which deficit financing may be growth-enhancing.

Appendix I. Sample Countries

Argentina, Bahrain, Barbados, Bhutan, Brazil, Bulgaria, Cameroon, Chile, Colombia, Costa Rica, Dominican Republic, Egypt, El Salvador, Ghana, Honduras, Hungary, India, Indonesia, Israel, Kenya, Korea, Lebanon, Lesotho, Malaysia, Mali, Mauritius, Mexico, Morocco, Nicaragua, Peru, Panama, Paraguay, Poland, Romania, Senegal, Singapore, South Africa, Sri Lanka, Suriname, Thailand, Togo, Tunisia, Uruguay, Zambia, Zimbabwe.

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[22] The actual values in the case of external indebtedness are 0.305 = 0.322-0.068*0.25 for the low-deficit case and –0.253 = 0.322-0.556-0.068*0.25 for the high-deficit case. If the sample data were exactly comparable between the models reported in Tables 3 and 5, this approximation would be exact.

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TABLE 1. SUMMARY DATA STATISTICS

		1970-99	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99
Country Characteristics	**Mnemonic**							
Annual average growth in per capital income	*gypc*	1.2%	3.6%	2.6%	0.6%	1.2%	0.1%	2.0%
Annual average population growth	*gpop*	2.2%	2.3%	2.4%	2.3%	2.1%	2.0%	1.8%
GNP per capita (constant 1995 US$)	*lgnppc*	875	852	1031	1172	1146	1202	1186
Investment as % GDP	*i_y*	23.7%	21.0%	25.1%	24.5%	22.6%	23.7%	24.3%
Central government domestic debt as % GDP	*ddy*	12.7%	12.0%	12.5%	11.1%	13.1%	15.6%	11.0%
Central government external debt as % GDP	*xdy*	25.7%	5.1%	8.8%	24.9%	52.6%	45.2%	49.2%
Total central government debt as % GDP	*debt*	38.4%	17.1%	21.3%	36.0%	65.7%	60.8%	60.2%
Reserve Money as % GDP	*mb*	12.7%	9.6%	10.1%	11.9%	14.0%	15.7%	14.2%
Fiscal Variables [% of GDP]								
Total tax revenue	*txrev_y*	17.8%	13.9%	16.7%	18.4%	18.6%	18.7%	18.8%
Non-tax revenue	*ntax_y*	5.0%	2.7%	4.2%	5.3%	5.9%	5.4%	5.0%
Total Revenue		22.8%	16.6%	20.9%	23.8%	24.6%	24.1%	23.8%
Grants	*grants*	1.8%	0.8%	1.1%	2.0%	2.1%	1.9%	1.2%
Total Revenue and Grants	*trev_y*	24.6%	17.4%	22.0%	25.8%	26.6%	26.0%	25.0%
'Productive' Expenditure	*texp_y*	16.1%	8.9%	11.4%	12.5%	12.7%	13.1%	12.9%
'Residual' Expenditure		9.6%	11.0%	12.9%	14.2%	13.9%	11.9%	11.0%
Interest on debt	*int_y*	2.9%	1.1%	1.6%	2.8%	3.6%	3.6%	3.7%
Total Expenditure		28.5%	21.1%	25.9%	29.6%	30.2%	28.7%	27.6%
Net Lending	*nl_y*	1.3%	1.3%	1.9%	1.8%	1.5%	0.8%	0.7%
Total Expenditure and Net Lending		29.8%	22.4%	27.8%	31.3%	31.7%	29.5%	28.4%
Overall Budget Deficit	*dc_y*	5.3%	5.1%	5.7%	5.6%	5.1%	3.5%	3.4%
Primary Budget Deficit	*dp_y*	4.2%	4.8%	5.3%	4.8%	3.6%	1.7%	0.9%

Sources:
Data on per capita growth, GNP per capita, population growth, investment, and reserve money are taken from World Development Indicators (World Bank 2000)
Data on govement debt are from Loayza *et al* The World Saving Data Base (World Bank 1998) and fiscal data are from Government Finance Statistics (IMF CD-ROM, May 2001)
Definitions: (GFS codes reported in parentheses)
Total tax revenue = direct taxes (81ah + 81bh + 81ch + 81dh) + indirect taxes on domestic goods and services (81eh) + taxes on international trade (81fh).
Non-tax revenue = non-tax revenue plus other revenue including capital taxes (81ybh + 81gh + 81ych)
Expenditure is grouped as follows:
'Productive' = education, health, housing, transport and communication, public order and safety, non-interest administration (82ch+82dh+82eh+82fh+82hih+82pah+82ach+82kh)
'Residual' = economic services plus recreation and cultural (82gh+82h-82hih)
The overall budget deficit is defined as total expenditure and net-lending less total revenue and grants;
the primary budget deficit is defined as total expenditure and net lending less interest payments less total revenue.
All fiscal aggregates refer to central government fiscal accounts only.

TABLE 3. FISCAL FACTORS AND GROWTH

Fixed effects estimation with all fiscal effects lagged [a] [b]
(Excluded category: 'residual' expenditure) [c]

Sample: 5 year period averages (1970-74 to 1995-99)

Dependent Variable: average annual growth in per capita income (gypc)

		[1]	[2]	[3]	[4]
Control variables					
constant		**0.025**	**0.012**	**0.032**	**0.017**
		[0.96]	[0.77]	[1.21]	[0.67]
lgnppc_1 (x100)	**[d]**	**0.123**	**0.072**	**-0.052**	**0.050**
		[0.41]	[0.25]	[0.02]	[0.22]
i_y		**0.097**	**0.117**	**0.101**	**0.117**
		[2.75]	[3.22]	[3.19]	[3.80]
gpop		**-0.721**	**-0.678**	**-0.706**	**-0.632**
		[2.14]	[2.04]	[2.17]	[2.05]
Fiscal factors					
txrev_y		**-0.113**	**-0.106**		
		[2.38]	[2.26]		
ntax_y		**-0.187**	**-0.134**		
		[2.95]	[1.95]		
grants_y		**-0.019**	**-0.028**		
		[0.23]	[0.34]		
trev_y				**-0.122**	**-0.112**
				[3.42]	[3.27]
texp_y	**[c]**	**0.121**	**0.085**		
		[1.21]	[1.64]		
nl_y		**0.203**	**0.200**		
		[1.31]	[1.31]		
dp_y					
int_y		**0.185**	**0.221**		
		[1.31]	[1.57]		
totexp_y				**0.147**	**0.143**
				[2.85]	[2.86]
dc_y		**-0.162**	**0.264**	**-0.147**	**0.301**
		[2.43]	[1.92]	[2.24]	[1.98]
[dc_y-0.015]			**-0.473**		**-0.504**
			[1.85]		[2.17]
N		155	155	155	155
Countries		40	40	40	40
R-sq:		0.2638	0.2840	0.2454	0.2727
Adjusted R-sq		0.2181	0.2343	0.2201	0.2432
F-Pooling		1.81	1.85	1.83	1.84
Pr		0.0094	0.0078	0.0081	0.0076

Notes:
[a] Heteroscedastic consistent t-statistics in parentheses
[b] Estimation includes time-dummy variables (not reported).
[c] texp_y excludes 'residual' expenditure (see text for description)
[d] _1 denotes start of period value.

TABLE 5. FISCAL FACTORS, PUBLIC INDEBTEDNESS AND GROWTH

Fixed effects estimation with all fiscal effects lagged [a] [b]
(Excluded category: 'residual' expenditure) [c]

Sample: 5 year period averages (1970-74 to 1995-99)

Dependent Variable: average annual growth in per capita income (gypc)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Stock Effect	*Total Debt*	*Domestic Debt*	*External Debt*	*Base Money*	*Total Debt*	*Domestic Debt*	*External Debt*	*Base Money*
Control variables								
constant	**0.041**	**0.050**	**0.038**	**-0.002**	**0.042**	**0.051**	**0.039**	**0.058**
	[1.55]	[1.87]	[1.46]	[0.07]	[1.58]	[1.91]	[1.49]	[0.19]
lgnppc_1 (x100) **[d]**	**-0.096**	**-0.203**	**-0.099**	**0.239**	**-0.104**	**-0.231**	**-0.124**	**0.202**
	[0.35]	[0.71]	[0.37]	[0.72]	[0.39]	[0.81]	[0.46]	[0.62]
i_y	**0.085**	**0.074**	**0.087**	**0.101**	**0.084**	**0.077**	**0.087**	**0.105**
	[2.63]	[2.16]	[2.73]	[2.71]	[2.60]	[2.25]	[2.74]	[2.85]
gpop	**-1.159**	**-0.914**	**-0.993**	**-0.637**	**-1.160**	**-0.919**	**-0.975**	**-0.638**
	[2.94]	[2.38]	[2.69]	[1.62]	[2.97]	[2.37]	[2.65]	[1.65]
Fiscal factors								
trev_y	**-0.054**	**-0.065**	**-0.064**	**-0.094**	**-0.057**	**-0.071**	**-0.066**	**-0.106**
	[1.30]	[1.53]	[1.57]	[1.88]	[1.40]	[1.67]	[1.63]	[2.21]
totexp_y **[c]**	**0.138**	**0.141**	**0.143**	**0.124**	**0.145**	**0.142**	**0.149**	**0.123**
	[2.57]	[2.57]	[2.67]	[2.06]	[2.70]	[2.57]	[2.75]	[2.07]
dc_y	**0.329**	**0.100**	**0.313**	**0.333**	**0.340**	**0.087**	**0.322**	**0.195**
	[1.97]	[0.39]	[1.95]	[1.23]	[2.11]	[0.34]	[1.92]	[0.70]
[dc_y-0.015]	**-0.584**	**-0.316**	**-0.558**	**-0.506**	**-0.581**	**-0.311**	**-0.558**	**-0.481**
	[2.02]	[1.15]	[1.94]	[1.77]	[2.02]	[1.13]	[1.95]	[1.70]
Asset Stocks **[d]**								
debt_1	**-0.003**				**-0.002**			
	[0.69]				[0.32]			
ddy_1		**-0.014**				**-0.003**		
		[0.52]				[0.26]		
xdy_1			**-0.004**				**-0.002**	
			[1.17]				[0.29]	
mb_1				**0.019**				**0.004**
				[0.37]				[0.83]
Stock Interactions **[e]**								
D*debt_1					**-0.055**			
					[1.84]			
D*ddy_1						**0.030**		
						[0.10]		
D*xdy_1							**-0.068**	
							[1.96]	
D*mb_1								**0.777**
								[1.56]
N	119	122	123	121	119	122	123	123
Countries	31	31	31	30	31	31	31	31
R-sq:	0.2694	0.2572	0.259	0.271	0.2744	0.2566	0.2621	0.2889
Adjusted R-sq	0.2233	0.2116	0.2139	0.2258	0.2286	0.2110	0.2172	0.2456
F-Pooling	1.65	1.83	1.64	2.04	1.40	1.8	1.43	2.04
Pr	0.0104	0.0025	0.0113	0.0015	0.1203	0.0202	0.1058	0.0067

Notes:
[a] Heteroscedastic consistent t-statistics in parentheses
[b] Estimation includes time-dummy variables (not reported).
[c] totexp_y excludes 'residual' expenditure (see text for description)
[d] _1 denotes start of period value.
[e] Interactions variables D*X denote the interaction of dc_y with variable X.

Appendix Table 1
Panel Data Estimates: Fixed Effects (incl time dummy variables)
Dependent Variable (gypc)
Fiscal Effects (Lagged)
Data: 5-year period averages (1970-74 to 1995-99)

Excluded Fiscal Category	*dtax_y*		*itax_y*		*ttax_y*		*ntax_y*		*grants_y*		*exp1_y*		*exp2_y*		*exp3_y*		*int_y*		*nl_y*		*dc_y*	
	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value	coeff.	t-value
_cons	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53	**0.01**	0.53
lgnppc_1	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67	**0.00**	0.67
i_y	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00	**0.11**	3.00
gpop	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83	**-0.60**	-1.83
Ldtax			**-0.09**	-0.69	**0.05**	0.48	**0.07**	0.75	**-0.12**	-1.15	**-0.03**	-0.28	**-0.13**	-1.85	**0.28**	1.82	**-0.26**	-1.27	**0.02**	0.12	**0.03**	0.38
Litax	**0.09**	0.69			**0.15**	1.07	**0.17**	1.77	**-0.03**	-0.20	**0.07**	0.49	**-0.04**	-0.41	**0.38**	2.20	**-0.16**	-0.76	**0.11**	0.57	**0.13**	1.09
Lttax	**-0.05**	-0.48	**-0.15**	-1.07			**0.02**	0.18	**-0.18**	-1.50	**-0.08**	-0.88	**-0.19**	-1.74	**0.23**	1.51	**-0.31**	-1.31	**-0.04**	-0.19	**-0.02**	-0.16
Lntax	**-0.07**	-0.75	**-0.17**	-1.77	**-0.02**	-0.18			**-0.19**	-1.75	**-0.10**	-1.01	**-0.21**	-3.18	**0.21**	1.52	**-0.33**	-1.50	**-0.06**	-0.34	**-0.04**	-0.47
Lgrants	**0.12**	1.15	**0.03**	0.20	**0.18**	1.50	**0.19**	1.75			**0.09**	0.79	**-0.01**	-0.13	**0.41**	2.31	**-0.13**	-0.67	**0.14**	0.80	**0.16**	1.44
Lexp1	**-0.03**	-0.28	**0.07**	0.49	**-0.08**	-0.88	**-0.10**	-1.01	**0.09**	0.79			**0.10**	0.95	**-0.31**	-2.21	**0.23**	0.94	**-0.05**	-0.27	**-0.06**	-0.57
Lexp2	**-0.13**	-1.85	**-0.04**	-0.41	**-0.19**	-1.74	**-0.21**	-3.18	**-0.01**	-0.13	**-0.10**	-0.95			**-0.42**	-2.73	**0.12**	0.65	**-0.15**	-0.94	**-0.17**	-2.51
Lexp3	**0.28**	1.82	**0.38**	2.20	**0.23**	1.51	**0.21**	1.52	**0.41**	2.31	**0.31**	2.21	**0.42**	2.73			**0.54**	1.67	**0.27**	1.12	**0.25**	1.60
Lint	**-0.26**	-1.27	**-0.16**	-0.76	**-0.31**	-1.31	**-0.33**	-1.50	**-0.13**	-0.67	**-0.23**	-0.94	**-0.12**	-0.65	**-0.54**	-1.67			**-0.27**	-1.15	**-0.29**	-1.49
Lnl	**0.02**	0.12	**0.11**	0.57	**-0.04**	-0.19	**-0.06**	-0.34	**0.14**	0.80	**0.05**	0.27	**0.15**	0.94	**-0.27**	-1.12	**0.27**	1.15			**-0.02**	-0.11
Ldc	**-0.03**	-0.38	**-0.13**	-1.09	**0.02**	0.16	**0.04**	0.47	**-0.16**	-1.44	**-0.06**	-0.57	**-0.17**	-2.51	**0.25**	1.60	**-0.29**	-1.49	**-0.02**	-0.11		
n	155		155		155		155		155		155		155		155		155		155		155	
R-square	0.301		0.301		0.301		0.301		0.301		0.301		0.301		0.301		0.301		0.301		0.301	