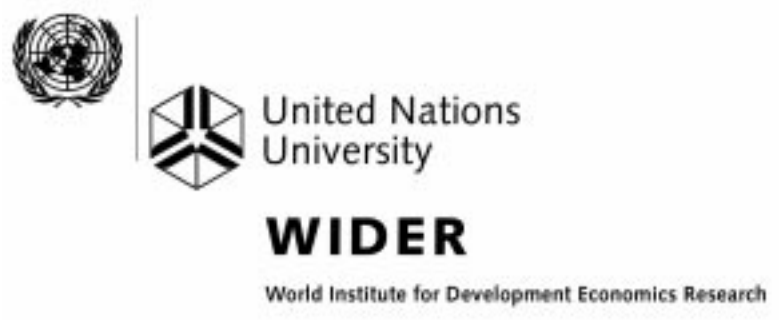

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Fiscal Policy and Private Investment in Less Developed Countries

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Abstract

This paper analyses the impact of fiscal policy on private investment for a sample of thirty-three LDCs. The paper makes a number of important contributions to the existing empirical literature. Its main contribution is that it is the first attempt to analyse the existence of a non-linear relationship between fiscal policy variables and investment. Moreover, we explicitly focus on different aspects of fiscal policy and their influence on investment, instead of only looking at aggregate fiscal policy variables.

Keywords: private investment, public investment, fiscal policy, LDCs

JEL classification: O23, H30

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Introduction

During the 1980s and 1990s many less developed countries (LDCs) have obtained structural adjustment loans financed by the World Bank or the IMF. These loans aim at helping these countries to reduce structural imbalances, which led to the stagnation of their economic growth performance in both decades.[1] An important element of these loans is that their disbursement is conditional on changes of economic policy, specified in a so-called structural adjustment programme. An important part of the proposed policy changes in the programmes focuses on fiscal adjustment and the restructuring of the public sector. According to the World Bank and IMF, the structural imbalances have been caused to a large extent by high fiscal deficits and a large and inefficiently functioning public sector. Therefore, many programmes aim to reduce government spending and to raise revenues, through measures such as reducing the civil service wage bill, tax reform, and the reduction of subsidies.[2] The IMF- and World Bank-sponsored programmes seem to assume that reducing fiscal deficits is beneficial for the long-run growth process, no matter how such a reduction is achieved. But is this really true?

While these policy prescriptions are a dominant element in the programmes, in the empirical literature there is no consensus regarding the impact of fiscal policy on macroeconomic performance in LDCs. The differences in outcomes may at least partly be explained by methodological weaknesses of these studies. First, a large number of studies only focus on aggregate variables of fiscal policy, such as, *e.g.*, government consumption, overall taxes, or budget deficits. Thus, they disregard the importance of the composition of fiscal policies and thereby overlook the possibility that different policies may have different effects on macroeconomic variables (Gemmell 2000). Second, the empirical literature does not deal with the question whether the relationship between different fiscal variables and macroeconomic performance can be non-linear.[3] There may, however, be good reasons to believe that such a non-linear relationship exists, at least for specific fiscal variables.

The lack of convincing empirical evidence may lead to the wrong policy advice to LDC countries that are currently struggling with structural imbalances. These countries may need to reduce large fiscal deficits, but they do not have a clear guide of how to achieve this without hurting their long-term economic prospects. Which components of spending should be reduced and which taxes can be raised without disturbing private initiatives? Moreover, the lack of clear empirical evidence may hamper the design of so-called *second-generation* economic reforms for countries (Adam and Bevan 2000). These countries may have managed to bring their fiscal deficits under control, but do not know what combination of public spending and revenues will be most helpful to

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1 See Addison (2000) for a discussion of the causes and consequences of fiscal imbalances in LDCs.

2 See Lienert and Modi (1997) for a general overview of civil service reforms in the 1980s and early 1990s for a sample of 32 Sub-Saharan African countries.

3 An exception is Devarajan *et al.* (1996). They focus on fiscal policy and growth. Moreover, they only focus on two fiscal policy variables (current expenditures and capital expenditures) when evaluating the existence of non-linear relationships between fiscal policy and growth.

achieve higher growth and poverty reduction. Thus, there is clearly a need for an in-depth analysis into the effects of fiscal policy variables on macroeconomic performance.

This paper aims to contribute to the empirical literature on the relationship between fiscal variables and macroeconomic performance. In particular, we make the following four important contributions:

i) We empirically analyse the impact of fiscal policy on macroeconomic performance for a sample of 33 LDCs. Empirical evidence on this issue is scarce for these countries.

ii) We specifically look at the impact of fiscal policy on private investment. Most studies focus on the relationship between fiscal policy and growth.

iii) We explicitly focus on different aspects of fiscal policy and their influence on private investment, instead of only looking at aggregate fiscal policy variables. We claim that this is the first paper providing a comprehensive study of the relationship between a large number of government expenditure and revenue categories, and private investment.

iv) However, the main contribution of this paper to the empirical literature is that it is the first serious attempt to analyse the existence of a non-linear relationship between fiscal policy variables and private investment.

The paper is organised as follows. Section 1 presents a survey of the theoretical and empirical literature on the relationship between fiscal policy and private investment. Section 2 discusses the data and the econometric methodology used in this paper, while section 3 discusses the results of the empirical analysis. Section 4 presents concluding remarks and suggestions for further research.

1 Fiscal policy and private investment: a survey of the theoretical and empirical literature

What does theory tell us about the relationship between fiscal policy and private investment? What is the empirical evidence on this relationship? And what can we learn from the theoretical and empirical literature for the design of fiscal policy adjustment programmes aiming at increasing private investment, and achieving higher growth and more poverty reduction? Before discussing the theoretical and empirical literature on these issues, we shortly explain why we focus on private investment, instead of on economic growth, as has been done in most of the existing literature.[4]

1.1 Why focus on private investment?

Structural adjustment programmes of the World Bank and IMF emphasise the need to reduce government budget deficits in order to stimulate private initiative. The fiscal policy adjustments described in the programmes signify a reduced role of government in the economy. The reduction of the role of government in the economy of LDCs is a key

[4] Gemmell (2000) and Odedokun (2000) deal with the relationship between fiscal policy and growth.

element of the Washington consensus, which aims at increasing the role of the market mechanism.[5] According to the World Bank and IMF reducing the role of the government will reduce barriers to private initiative and will stimulate investment activities, both qualitatively and quantitatively. Increased investment ultimately leads to higher economic growth. In our analysis we focus on the impact of fiscal policy on the quantity of investment and therefore implicitly investigate to what extent and under what conditions IMF and World Bank are right to emphasise the positive effects of their fiscal policy recommendations.

Another reason to focus on private investment is that other studies have shown that a disproportionate share of the change of economic growth of countries is explained by a change of private investment as a result from changes in fiscal policy.[6] This result stresses the importance of effects of fiscal policy on the quantity of investment. Our discussion of the theoretical literature may help to explain why quantity effects appear to be so important.

1.2 Theory of the relationship between fiscal policy and private investment[7]

As was already noted, most of the theoretical (and empirical) literature looks at the relationship between fiscal policy and economic growth. Yet, this literature is also important for evaluating the relationship between fiscal policy and private investment. As the discussion below will show, one of the main channels through which fiscal policy has an influence on growth is via its impact on private investment.

The theoretical literature on the relationship between fiscal policy and growth has grown substantially since the mid-1980s, when the endogenous growth models emerged. According to these models, the process of economic growth is endogenously determined. A crucial difference with neo-classical growth models is that these new growth models do not assume diminishing marginal productivity of capital. Consequently, (changes in) the capital stock can affect the long-run per capita growth rate, either via a quantity (*i.e.* more investment) or a quality (*i.e.* more efficient investment) effect. These new growth models, therefore, conclude that economic policy —among which is also fiscal policy—can increase the steady-state economic growth rate, if policies aim at influencing the quantity and/or quality of the capital stock. Examples of endogenous growth models incorporating the role of fiscal policy are Barro (1990), Barro and Sala-i-Martin (1992), King and Rebelo (1990) and Rebelo (1991).

The exact nature of the impact of fiscal policy on economic growth according to these models depends on the type of fiscal policy instruments used. In particular, the growth effects of fiscal policy can be divided into productive and non-productive expenditures, and distortionary and non-distortionary taxes (Kneller, *et al.* 1999; Gemmell 2000).

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5 See Stiglitz (1998) for a critique of the Washington consensus.

6 See, for example, Chhibber and Dailami (1993). See also Alesina *et al.* (1998). This study looks at fiscal policy effects on private investment for OECD countries, however.

7 For an extensive overview of the literature on the relationship between fiscal policy and growth we refer to Gemmell (2000). Parts of this section draw from this paper.

Productive expenditures and non-distortionary taxes stimulate growth, whereas non-productive expenditures and distortionary taxes reduce growth.

When government expenditures create positive production externalities, focus on enhancing innovation and research and development and/or stimulate the accumulation of private capital, these expenditures are seen as productive. It is generally assumed that public investment in infrastructure, education and health belong to this category (Aschauer 1989; Kneller *et al.* 1999). In these cases, public investment is said to crowd-in private investment.

However, if financial resources are scarce, public investment may also reduce the possibilities of the private sector to obtain credit to finance investment. Moreover, if public investment is financed through monetary financing, private investment may be seriously discouraged (Ramirez 1996). In these cases public investment is said to crowd-out private investment opportunities (Buiter 1977).

Examples of non-productive government expenditures are subsidisation of inefficient state-owned enterprises or enterprises that produce market goods. Moreover, spending on salaries of public servants is often regarded as non-productive. The main channel through which this latter spending category influences private investment negatively is through the pressure it puts on raising wages in the private sector. This reduces costs and thus increases profitability of investment, which in turn may increase investment activity (Alesina *et al.* 1999).

Government tax policy is non-distortive when this policy does not influence investment decisions (either in physical or human capital). An example of a non-distortive tax is the value-added tax (VAT). Distortive taxes, on the other hand, do influence the investment decisions of the private sector. In general, many tax policies (with VAT being one of the few exceptions) are seen as distortionary in this respect. Raising labour taxes, for example, may lead to higher wage. Such a rise of wages will depress profitability of private investment. Moreover, increases in social security contributions may lead to higher real wage demands. Again, a rise of real wages will reduce the real rate of return on investment, thus adversely affecting investment activity (Alesina *et al.* 1999). High corporate income taxes depress the rate of return on investment, thereby distorting investment decisions.

Categorising government expenditures and revenues as being productive/non-productive and distortive/non-distortive, respectively, may not be easy in practice, however. Expenditures on infrastructure, for example, may be productive in one case, but may equally well be unproductive in other cases. Several LDCs have made infrastructure investments that later on became to be known as so-called “white elephants”. At the same time, spending on salaries may have positive demand-side effects that compensate for the negative effects mentioned above.

Next to focussing on different fiscal policy instruments, we may also look at the impact of budget deficits on economic growth. In general, budget deficits are assumed to have a negative impact on growth. First, high deficits may signal a high tax burden in the future. This may discourage current aggregate expenditures, and thus also private investment. Several models investigate this issue. In all these models expectations of the public with respect to the future effects of current (adjustments of) budget deficits are

crucial. Examples of models on this issue are Bertola and Drazen (1993), Giavazzi and Pagano (1990 and 1996) and Sutherland (1997).[8]

In some these models, emphasis is put on the role of specific deficit adjustments on growth. These models show that reducing expenditure on particular components of the government budget may provide a positive signal with respect to the seriousness of the government to implement a fiscal adjustment programme. Cutting the wage bill and reducing subsidies on primary goods are difficult to implement from a political economy point of view. Thus, cuts in these kinds of government expenditures may lend credibility to the adjustment efforts of the government, which may stimulate private investment.

Second, high budget deficits may lead to higher real interest rates in financial markets, which may reduce investment and growth. Moreover, high budget deficits may increase risk premiums on interest rates, in particular raising the inflation risk and the default risk premium. High interest rate risk premiums may discourage private investment (Alesina and Perotti 1997). Finally, when high deficits are financed with financial market loans, this may decrease the opportunities of the private sector to borrowing.[9]

To conclude, the brief summary of the theoretical literature presented above has made clear that fiscal policy can influence economic growth in a number of ways. Moreover, it has also been shown that one of the main channels through which fiscal policy has an influence on growth is via its impact on private investment. Another conclusion that can be drawn from the above discussion is that the relationship between fiscal policy and growth is not always clear-cut and in some cases theories differ in their view on the direction of the relationship between the two variables. This means that the relationship between fiscal policy variables and growth (and private investment) becomes an empirical question.

1.3 Empirical evidence of the relationship between fiscal policy and private investment

1.3.1 Fiscal policy and growth

There is quite a large literature focussing on the effects of fiscal policy on economic growth.[10] The main part of these studies concentrates on analysing these effects for OECD countries. The major part of empirical analyses of the relationship between fiscal policy and growth may be divided into two different categories. First, a large number of studies focus on aggregate variables of fiscal policy, such as taxation, investment spending or consumption spending. They disregard the importance of the composition

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8 The argument central to all these models is sometimes referred to as the "wealth effect cum expectations" argument (see, *e.g.*, Perotti 1996).

9 See also Adam and Bevan (2000) on this point. They analyse the impact of fiscal adjustment on the supply of bank credit to the private sector.

10 Gemmell (2000) provides an excellent survey of the empirical literature on the relationship between fiscal policy and economic growth.

of fiscal policies, thereby overlooking the possibility that different policies may have different effects on growth. The findings of these studies show mixed results.

Second, few studies investigate the impact of specific components of fiscal policy on growth. One of the most comprehensive studies in this category is the one by Devarajan *et al.* (1996) who look at different components of government expenditures. It is also one of the few studies including LDCs in the sample of countries. Also the findings of this category of studies show mixed results. An interesting finding of the study by Devarajan *et al.* (1996) is that the outcomes for OECD countries and LDCs are different. Whereas capital expenditure has a positive and government consumption a negative effect on growth for OECD countries, the reverse is true for LDCs.

1.3.2 Fiscal policy and investment

When we turn to the empirical analysis of the relationship between fiscal policy and private investment, it appears that the relationship between public and private investment has received quite a lot of attention, both for developed countries as well as for LDCs. As was discussed above, in the literature it is pointed out that public investment may either crowd-in or crowd-out private investment. In a seminal contribution, Aschauer (1989) shows that for the United States—using data for the 1949-1985 period—there is a strong positive relationship between productivity and the ratio of the public investment to the private capital stock. Thus, he finds evidence for a crowding-in effect of public investment. Several authors have elaborated on the work of Aschauer and have looked at the issue for other developed countries.[11] A number of studies have investigated the relationship between public and private investment for LDCs. The evidence on these countries is less clear-cut. Although most studies find a positive relationship, in some cases a negative relationship has been reported.[12]

Apart from these studies on the relationship between public and private investment, very little empirical research is available on the impact of other fiscal variables on investment. One of the very few studies we were able to trace in this respect is the paper by Alesina *et al.* (1999). This paper analyses the influence of public wages on private investment. The authors use data for 18 OECD countries during the 1960-1996 period. According to their outcomes a reduction of the government wage bill has a substantial positive influence on private investment. Moreover, they investigate the impact of labour taxes on profits and investment. Although a rise of these taxes reduces profits and thus investment, the impact is less strong. No evidence is able for these effects in LDCs.

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11 See, *e.g.*, Argimon *et al.* (1997) for 14 OECD countries; Erenburg (1993) for the United States; Monadjemi (1993) for the United States and Australia; Pereira and Sagales (1999) for Spain; Sturm (1998) and Sturm *et al.* (1999) for the Netherlands. See also Gramlich (1994) for a comprehensive overview of the literature on the impact of infrastructure investment.

12 See, *e.g.*, Blejer and Kahn (1984) for a sample of 24 LDCs; Odedokun (1997) for a sample of 48 countries; Ramirez (2000) for eight Latin American countries; Nazmi and Ramirez (1997) for Mexico; De Oliveira-Cruz and Teixeira (1999) for Brazil; Ekpo (1999) for Nigeria; Sobhee (1999) for Mauritius; and Ghali (1998) for Tunisia.

1.4 Is the relationship between fiscal policy and private investment non-linear?

The empirical literature discussed in the previous sub-section only considers linear relations between fiscal policy on the one hand and investment and growth on the other hand.[13] It generally does not address the possibility that the magnitude of government expenditures and revenues matters for the impact of fiscal policies on investment and growth, i.e. the relationship may be non-linear.[14] Yet, there are strong reasons to believe that the relationship between different fiscal policy variables and private investment and growth can be non-linear.

The existence of such non-linear relationships may be described as follows:

- Investment in infrastructure may become effective only after some point, since infrastructure investment usually is associated with large (positive) externalities.
- Expenditures on defence may be associated with positive spill-overs, since the defence industry involves a lot of research and development activity.
- Education and health services may stimulate investment and growth through stimulating factor accumulation; yet, after some point, raising expenditures on these categories may retard investment and growth, since their operation starts to become inefficient. Thus there is an optimum level of operation with respect to education and health services.
- The distortionary effect of taxes on private investment decisions may become only effective after taxes have reached a minimum level. This refers to the famous tax Laffer curve.
- The central government needs a sufficient number of civil servants in order to offer public services efficiently. After a certain number of civil servants, however, the efficiency of services may reduce. This suggests that there is an optimal number of civil servants, and thus of government spending on their wages, associated with efficient public services. This optimum level may depend on the type (and number) of services provided.

These examples clearly show the importance of analysing whether or not the relationship between different fiscal policy variables and private investment is non-linear. As far as we know, no study has yet analysed the non-linear relationship between different categories of fiscal policy and investment in LDCs. Devarajan *et al.* (1996) is the only study investigating non-linear relationships, in their case between current and capital expenditure and growth.

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13 In the theoretical literature the papers by Barro (1990) and Devarajan *et al.* (1996) explicitly take into account the possibility of a non-linear relationship between fiscal policy and growth.

14 The existence of non-linear relationships has been investigated in other areas of the empirical growth literature. In particular, this phenomenon has been analysed in studies investigating the effects of inflation on economic growth. See, e.g., Ghosh and Wolf (1998) and Ghosh and Phillips (1998).

1.5 Theory and evidence on fiscal policy and private investment: An evaluation

Based on this short review of the empirical literature on the relationship between fiscal policy and investment and growth we conclude the following:

- Most studies focus on OECD countries; empirical research for LDCs is scarce.
- The main part of the literature focuses on aggregate fiscal variables, rather than on different fiscal policy variables.
- Generally, the findings of the empirical literature on the relationship between fiscal policy and growth show mixed results. Moreover, the scarcely available evidence seems to suggest that the relationship between fiscal policy and growth is different for LDCs as compared to OECD countries.
- Only a few studies investigate the relationship between fiscal policy variables and private investment, with the exception of the relationship between public and private investment. Studies on this latter issue show mixed results.
- No studies are available that investigate whether fiscal policy and investment may be described by a non-linear relationship.

Thus, overlooking the available empirical literature, our analysis in this paper can make a valuable contribution, since we focus on the impact of the different fiscal policy variables on private investment for a set of LDCs. Most importantly, however, this paper makes a valuable contribution because it is the first study ever investigating the non-linearity of the relationship between a large number of fiscal policy variables and private investment.

2 Data and methodology of the empirical research

Before analysing the effects of fiscal policy on private investment, we start by discussing the data set and explaining the estimation method we use. We perform panel estimates for a set of LDCs, using observations of variables that have been averaged over three periods: 1970-1979, 1980-1989 and 1990-1998. Most other studies in the field make use of cross-country regression analysis.[15] Our choice to employ panel estimation is based on the fact that cross-country regression analysis does not take into account time series properties.

Our panel of countries is determined by the availability of the data. Information on private investment as well as on specific components of fiscal policy for LDCs appears to be limited, which considerably reduces the number of countries in our analysis.[16] The amount of countries varies between 33 and 35, depending on the variables used in the

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15 See, *e.g.*, Barro (1991) and Easterly and Rebelo (1993).

16 The lack of data, especially for Sub-Saharan African countries, in general and with respect to fiscal policy variables in particular, should be a major concern of donor organisations. Improving data availability may improve the accountability of recipient governments with respect to the use of donor money. Therefore, donor organisations may be advised to consider increasing their support to data collection in these countries.

regressions. In particular, information on most countries in Sub-Saharan Africa is not available.[17]

All equations are estimated by using generalised least squares (GLS) to avoid heteroscedasticity problems.[18] Moreover, all equations are estimated with fixed effects to allow for country-specific intercepts, and with time dummies for the 1970s and 1980s.

The regression analysis is carried out as follows. We first select a restricted set of variables, the so-called conditioning variables, which have been found to be important in numerous other cross-country regression analyses. We are not interested in these variables as such, but we include them in the regressions to account for possible omitted variable bias. They are included in all regressions presented in this study.

The following conditioning variables have been found most frequently in other studies: the logarithm of real GDP per capita, the logarithm of one plus the black market premium, the primary and second enrolment rates, private sector credit as a percentage of GDP, external debt as a percentage of GDP, the import plus export share of GDP, the index for changes in the terms of trade, and the lagged value of per capita growth. We only include the logarithm of real GDP per capita (*log(gdp)*) and the logarithm of one plus the black market premium (*log(1+bmp)*) in all regressions. The other variables have been excluded since they appear to be insignificant or suffer from multicollinearity problems with respect to the GDP variable and/or the black market premium. We expect a positive sign for GDP per capita and a negative sign for the black market premium in all regressions.

Next, we add different fiscal policy variables in different combinations to the set of conditioning variables. In particular, we perform the following sets of regressions. The first set focuses on analysing linear relationships between fiscal policy variables and private investment (Section 3.1). The regressions in this set are divided into three categories: those focussing on total government expenditures and revenues, those focussing on disaggregated expenditures, and those focussing on disaggregated revenues. The second set focuses on non-linear relationships between fiscal policy variables and private investment (Section 3.2). Again, regressions are divided into the three categories already mentioned. All fiscal policy variables are expressed in percentages of GDP.

Before we present and discuss our results, we briefly explain how we analyse the non-linear relationships between fiscal policy variables and private investment. As discussed in the previous section, we consider possible non-linear effects of different fiscal policy variables on private investment since we hypothesise that specific government expenditures and/or revenues start to have positive (or negative) effects on private investment after a certain threshold value is reached. We examine the existence of a non-linear relationship by adding a quadratic term for the different fiscal policy variables to the regression model. A positive and significant linear term in combination

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17 See Appendix B for a complete list of the countries included in our data set.

18 In alternative regressions we also use the ordinary least squares (OLS) estimator. Although there are some differences in outcome, in most cases the OLS regressions were qualitatively in line with the GLS regressions. For reasons of space, the OLS regressions are not presented.

with a negative and significant quadratic term suggests that the effect of a specific fiscal policy variable on private investment can be described as an inverted-U curve. On the other hand, a significant negative linear term in combination with a significant positive quadratic term suggests a U-curved relationship between a fiscal policy variable and private investment.

3 Empirical results

3.1 Linear relationships

We start the empirical analysis by considering linear relationships between the government budget surplus (*Surplus*), as well as total government expenditures (*Govexp*) and government revenues (*Govrev*), and investment.[19] Table 1 shows that an increase in the government budget surplus has a positive effect on private investment (equation [1.1]). This result suggests that the effects of a change in the surplus, whether caused by an increase in government revenues or a decrease in government expenditures, are identical. However, there is no a priori reason why this should always be the case. Therefore, we disaggregate *Surplus* into *Govexp* and *Govrev*. As can be seen from Table 1, if both variables are included simultaneously, only government expenditures are significant with a negative sign (equation [1.2]). If *Govexp* or *Govrev* are included separately, then both seem to have a significant negative effect (equations. [1.3] and [1.4]).

As we discussed in section 1, looking at aggregate variables of fiscal policy disregards the importance of the composition of fiscal policies, thereby overlooking the possibility that different fiscal policy variables may have different effects on investment. Therefore, the next step is to disaggregate government expenditures and revenues. Government expenditures are sub-divided into the following categories: wages and salaries (W*ages*), other purchases of goods and services (*Othgood*), interest payments of the government (*Intp*), subsidies plus other current transfers (*Subs*) and capital expenditures (*Capexp*).

Table 2 shows that if all components are included simultaneously, *Wages* and *Intp* have a negative effect, *Capexp* has a positive effects, and *Subs* and *Othgood* are insignificant (equation [2.1]). *Subs* becomes significant with a negative sign when it is included separately (equation [2.5]). The most important result from this set of regressions is that different categories of government expenditures have different effects on private investment. This confirms our hypothesis that it is important to distinguish different components of government expenditures.

The regressions suggest that an increase in capital expenditures lead to an increase in private investment. If we assume that capital expenditure mainly consists of public investments, then this result supports the view that an increase in public investment crowds in private investment. To further assess this result, we use a more direct measure

[19] See Appendix A for a complete list of the variables used in the empirical analysis.

of public investment (*Pubinv*).[20] The outcome of the regression analysis including *Pubinv* gives qualitatively the same result, *i.e.* more public investment crowds-in private investment (equation [2.7]).

The results in equation [2.1] also indicate that increasing wage expenditures reduces private investment. An alternative measure of such expenditures is total government consumption (*Govcon*). Wage expenditures are the most important component of government consumption. The regression including *Govcon* confirms the result found for *wages* (equation [2.8]).

Government expenditures may also be functionally disaggregated into defence expenditures (*Defence*), education expenditures (*Education*), health expenditures (*Health*), expenditures on economic affairs and services (*Econaf*) and expenditures on social security and welfare (*Socsec*). Table 3 shows the regression results when we use these categories of government expenditures. The general conclusion from this table is that again different spending categories have different effects on investment. *Education* has no (or a negative) effect on investment (equations [3.1] and [3.3]). Also for *Defence* no (or a negative) effect on investment is found (equations [3.1] and [3.2]). *Health* and *Socsec* have a significant negative effect on private investment, whereas *Econaf* has a significant positive effect (equations [3.3]-[3.5]).

Finally, we disaggregate government revenues into the following categories: taxes on income and profits (*Taxprof*), domestic taxes on goods and services (*Domtax*), taxes on international trade and transactions (*Taxinttr*) and non-tax revenues (*Nontax*). The results of the regressions are presented in Table 4. The regression results suggest that an increase in *Taxprof* and *Nontax* have favourable effects on private investment, whereas an increase in *Domtax* and *Taxinttr* lead to a decrease in private investment (equation [4.1]).

3.2 Non-linear relationships

The results discussed in the previous sub-section do not take into account the possibility that the relationship between fiscal policy variables and investment may be non-linear. Yet, in section 1 we explained why such relationships might exist, at least for several government expenditure and/or revenue categories. The results found for the linear relations between fiscal policy variables and investment may change when we consider the possibility of non-linear relationships. Whether such non-linear relationships actually exist is an empirical question to which we turn in this sub-section.

We first consider non-linear relationships between the government budget surplus (*Surplus*), as well as total government expenditures (*Govexp*) and government revenues (*Govrev*), and investment. The results of the regression analysis are shown in Table 5. With respect to the budget surplus the results suggest that there are increasing returns with respect to this variable: both the linear term and the quadratic term of *Surplus* are significant and have a positive sign (equation [5.1]). Next, if both linear and quadratic

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[20] Note that the set of countries for this regression differs slightly from the regression results in equation [2.1].

terms of *Govexp* and *Govrev* are included simultaneously, all coefficients become insignificant (equation [5.2]). This may be due to multicollinearity and/ or aggregation problems. If only linear and quadratic terms for *Govexp* or *Govrev* are included in the regression, then the results suggest that low levels of government revenues do not hurt private investment, whereas government revenues reduce private investment at high levels (equation [5.4]). Thus, we find evidence for an inverted-U curve with respect to the relationship between government revenues and investment. We conclude that the results of the analysis of non-linear relationships provide a different picture when compared to the results of the analysis of linear relationships between fiscal policy and investment.

Next, we discuss non-linear effects of different categories of government expenditures on investment. Table 6 shows that if different categories of government expenditure are included, linear as well as quadratic terms are significant in all regressions. These results confirm that the non-linear effects are important for different categories of government expenditures. Moreover, the nature of the relationship differs for different expenditure categories. For *Wages* and *Subs* we find an inverted-U curve: increasing the levels of expenditures on these categories reduces private investment only after a certain threshold value is surpassed (equations [6.2] and [6.5]).[21] Alternatively, for *Capexp*, *Othgood* and *Intp* we find a U curve. Thus, these spending categories only positively affect private investment after a certain value is surpassed; for low values of expenditure, these categories have a negative effect on private investment (equations [6.3], [6.4] and [6.6]).[22] Equation [6.1] shows that if all categories of government expenditure are included simultaneously, *Capexp*, *Othgood* and *Intp* become insignificant, whereas the results for *Wages* and *Subs* do not change qualitatively change (although there are considerable changes in the coefficients). This may suggest problems of multicollinearity.

To test for the extent to which these problems may influence the results presented in Table 6, we show the results of an alternative regression analysis, in which we only include those categories of expenditures in one equation that have simple correlation coefficients of below 15 per cent. Correlation coefficients are shown in Tables 12 and 13. Table 7 shows the results of these alternative regressions. The analysis confirms the results found earlier for *Wages*, and *Capexp* and *Othgood*: wage expenditures have a positive effect on investment at low levels and a negative effect at high levels; for capital expenditures and expenditures on other goods and services the relationship is the opposite (equations [7.1]-[7.3]). *Subs* and *Intp* have a negative linear effect on private investment; the non-linear relationship for these variables is no longer statistically significant (equations [7.2]-[7.5]).

The results for the functional disaggregation of government expenditures are presented in Table 8. The regression results show that *Health* and *Socsec* have a positive effect on private investment at low levels of expenditure, but negative effects on private investment for high levels, indicating the existence of an inverted-U curve (equations [8.4] and [8.6]). In contrast, the relationship between expenditures on defence and

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21 This result is also found when we investigate the non-linear relationship between *Govcon* and investment (equation [6.8]).

22 The results for *Pubinv* are similar to those for *Capexp*.

investment is characterised by a U-curve (equation [8.2]). *Econaf* has a positive, and even increasing, effect on private investment: both the linear and the non-linear term are significant and positive (equation [8.5]). Finally, expenditure on education has no effect on investment (equation [8.3]), confirming the results found for this category in sub-section 4.1.

Also with respect to the functional classification of government expenditures we find that if all categories of government expenditure are included simultaneously the results change, although not as dramatically as was the case in Table 6. Nevertheless, we test for the influence of possible problems of multicollinearity on the results in Table 8. Table 9 presents the results of an alternative regression analysis, in which we only include those categories of expenditures in one equation that have simple correlation coefficients of below 15 per cent. The results in Table 9 do not qualitatively differ from those presented in Table 8.

Finally, we turn to the discussion of the non-linear relationship between different categories of government revenues and investment. Table 10 presents the results of the analysis. If government revenue variables are included separately in the regressions, the results show that for *Taxprof* and *Taxinttr* the relationship with private investment is characterised by an inverted-U curve: these tax categories start to have a negative impact on private investment after a certain threshold level of tax revenues (equations [10.4] and [10.6]). The reverse relationship is found for *Domtax* and *Nontax* (equations [10.5] and [10.7]).

If all categories of government revenues are included simultaneously the results change slightly. In particular, the linear and non-linear terms of *Domtax* are no longer statistically significant (equation [10.1]). Including only combinations of categories of government revenues with simple correlation coefficients below 15 per cent in the regression does not change the results qualitatively (equations [10.2] and [10.3]). However, in this regression the linear term of *Domtax* is significant and negative; the non-linear term remains insignificant.

Overlooking the results of the regression analysis with respect to the existence of non-linear relationships between different fiscal policy variables and private investment, we may conclude that they are markedly different from the results found for the linear relations. Our analysis has convincingly shown that for several categories of government expenditures and revenues the relationship with private investment may be better characterised by either an inverted-U curve or a U-curve, instead of a simple linear relationship.

3.3 Financing government expenditures: a robustness check

Recently, a number of studies have shown that it matters how government expenditures have been financed when analysing the relationship between fiscal policy and growth (Kneller *et al.*, 1999; Miller and Russek, 1997). In other words, the financing mode of an increase in a specific government expenditure influences the impact of the expenditure on investment and growth. If this is the case, it becomes important to know, for example, whether an increase in infrastructure public investment is financed with taxes, and if so, which taxes, or whether it is financed with a decrease of other

expenditures, and if so, which expenditures. This also means that only including government expenditures or government revenues in the regressions can be problematic, since regression results may be misleading due to misspecification (Gemmell, 2000). If a particular fiscal expenditure category is financed by one or more revenue categories, then the coefficient for the expenditure category may include the impact of the revenue categories on investment.

Our empirical analysis in the previous sub-sections may also suffer from this misspecification problem. To circumvent the problem of misspecification, we carry out a regression analysis, in which both government expenditure revenue categories are included in the regression model. With respect to the government expenditures we focus the analysis on two categories in particular: capital expenditures and wage expenditures. Our aim is to investigate whether the results found in section 3.3 for these two categories, *i.e.* an inverted-U relationship between *Wages* and private investment and a U-curved relationship between *Capexp* and investment, still hold after taking into account the financing mode of these expenditures. We acknowledge that our approach does not provide an exhaustive analysis of the misspecification problem as described by Kneller *et al.* and Miller and Russek. Our aim here is to take into account the influence of the financing mode of an increase in specific government expenditure categories on investment as a robustness check of our most important results in sub-section 3.1 and 3.2.

Table 11 presents the results of our analysis. First, we add linear terms of the different revenue categories to the regression model including linear and non-linear terms of capital and wage expenditures. The results for both expenditure categories found earlier still hold after taking into account the financing mode of expenditures (equation [11.1]). Note, however, that *Domtax* and *Nontax* are now insignificant (compare Table 4). If we ignore these two revenue categories, the results for *Wages* and *Capexp* do not change (equation [11.2]). Next, we include the quadratic terms for the revenue categories found significant in equation [11.1]. Again, this does not affect the results for *Capexp* and *Wages* (equation [11.3] and [11.4])). The non-linear component for *Taxprof* is insignificant in this specification (compare Table 10).

We have included the threshold values of both *Wages* and *Capexp* in rows 13 and 14 of Table 11. The results show the following. If expenditures on wages (as a percentage of GDP) rise above 4 to 4.25 per cent, then such expenditures start to have a negative effect on private investment. Moreover, capital expenditures start to have a positive impact on private investment only after they have reached a level of 3.25 to 3.36 per cent (of GDP).

The conclusion from the above described exercise seems to be justified that the inverted-U relationship between *Wages* and private investment and the U-curved relationship between *Capexp* and investment, still hold after taking into account the financing mode of these expenditures.

3.4 Interpreting the empirical results

The empirical results presented in the previous sub-sections can be summarised as follows.

- The analysis has shown that it is important to take into account different categories of government expenditures and revenues, instead of using aggregate fiscal policy variables, as is done by most other studies. The results clearly show that different categories have different effects on private investment.
- The results also emphasise the importance of taking into account non-linearity of relationships. In a number of cases, the results of the analysis of non-linear relationships provide a different picture when compared to the results of the analysis of linear relationships between fiscal policy and investment.
- The results for capital and wage expenditures do stand out in this respect. The relationship between *Wages* and private investment is best described by an inverted-U curve, whereas for *Capexp* there appears to be a U-curved relationship with investment. These results can be interpreted as follows.
    i) With respect to wage expenditures the results are in line with the view that the central government needs a sufficient number of civil servants in order to offer public services efficiently. After a certain number of civil servants, however, the efficiency of services may reduce. Thus, the empirical results support the view that there is an optimal number of civil servants, and thus of government spending on their wages, associated with efficient public services.
    ii) With respect to capital expenditures the results support the view that such expenditures (including, *e.g.*, investment in infrastructure) become effective only after some point, due to the fact that they usually are associated with large (positive) externalities.
- We also find interesting results when using a functional disaggregation of expenditures. In particular, we discover that there is an inverted-U curved relationship between *Health* and private investment and a U-curved relationship between *Defence* and private investment. These results can be interpreted as follows:
    i) Expenditure on health stimulates investment until the optimum level of operation is reached; further expenditure on this category may then retard growth.
    ii) Expenditure on defence is comparable to expenditure on capital in the sense that it is associated with positive externalities. These externalities are related to research and development activities in the defence industry that spill-over to the private sector. However, such spill-over effects become effective only after defence expenditures have reached a minimum level. This explains the U-curved relationship between defence expenditure and investment
- We do not find any relationship between expenditure on education and private investment. Similar results have been found elsewhere in the literature,

although these studies focus on the relationship between fiscal policy and growth (see, *e.g.*, Devarajan *et al.* 1996; Miller and Russek 1997).

— In general, we do not find that the relationship between fiscal policy variables and investment is different for LDCs as compared to OECD countries. Devarajan *et al.*, (1996) and Miller and Russek (1997) suggest that this is the case when looking at growth effects of fiscal policy. Thus, for example they find a negative effect of capital expenditure on growth. Their explanation is that "…expenditures which are normally considered productive could become unproductive if there is an excessive amount of them." (Devarajan *et al.* 1996, pp.338-339) Our contribution of taking into account the possibility of non-linear relationships may, however, explain the seemingly puzzling findings of these studies: capital expenditure becomes effective only after it has reached a minimum level. In other words, the countries in the sample of the study by Devarajan *et al.* and Miller and Russek generally did not invest enough in public capital.

— The results with respect to the different categories of government revenues are less clear-cut. They appear to be sensitive to the exact specification of the model.

4 Concluding remarks

Our study is related to the empirical research on the macroeconomic impact of fiscal policy. We have made a number of important contributions to the existing empirical literature on this issue. First, we empirically analyse the impact of fiscal policy on macroeconomic performance of LDCs. Empirical evidence on this issue is scarce for these countries. Second, we specifically look at the impact of fiscal policy on private investment. Third, we provide a comprehensive study of the relationship between a large number of government expenditure and revenue categories, and private investment. Yet, our main contribution to existing literature is that it is the first serious attempt to analyse the existence of a non-linear relationship between fiscal policy variables and private investment.

The empirical results show that taking into account different government expenditure and revenue categories is important: different categories have different effects on investment. This outcome is not picked up when aggregate fiscal variables are used, which is the approach of the main part of the empirical literature. Moreover, relationships between specific fiscal categories and investment appear to be non-linear. In particular, we show that capital expenditure and expenditure on defence start to have a positive impact on private investment only after a minimum level of expenditure on these categories has been reached. Moreover, with respect to expenditures on wages and health, we find that they stimulate investment up to a certain level. If expenditures on both categories are increased beyond this level, investment is reduced.

The results of this study may have important policy implications. Most importantly, it shows that LDC governments need to be aware of the fact that their expenditure and revenue policies need to be carried out carefully. Simply raising or reducing expenditures on education, health or infrastructure may not bring the expected positive effects on private investment or may even hurt private investment. In some cases levels of expenditure on health may already be too high and further spending on this category

will reduce, rather than stimulate investment. In other cases, expenditure on capital may be too low and further spending is needed in order to obtain positive effects of public capital on investment. Therefore, policy makers in LDCs should consider the threshold values for the different policy instruments they want to use to stimulate private investment before deciding to reduce or increase expenditures and revenues.

The analysis also has important implications with respect to the contents of fiscal policy reform programmes of the IMF and World Bank. Several LDC countries are currently struggling with (large) fiscal imbalances. These countries need to reduce large fiscal deficits, but do not have a clear guide of how to achieve this without hurting their long-term economic prospects. Moreover, a number of countries, after having managed to reduce their fiscal deficits, are now considering *second-generation* economic reforms for countries. For these countries it is important to know what combination of public spending and revenues will be most helpful to achieve higher growth and poverty reduction.

In the past, fiscal policy reform programmes have been too standard. Policy recommendations were focused too much on aggregate fiscal variables. They did not take into account that reducing expenditures of some categories may actually hurt investment and growth. In many LDCs this resulted in the practice of cutting on capital expenditures in order to reduce budget deficits (Ramirez 1996; Toye 2000). We have shown that this practice may be particularly harmful for investment and growth prospects in cases where the threshold value for capital expenditures has not yet been reached.

To conclude, the analysis in this paper has shown that a reduction of budget deficits as such is not a panacea and can be even harmful. The combination of specific expenditure and revenue reforms may be of crucial importance. Perhaps, the IMF and World Bank could take the lead in designing programmes that contain the optimum mix of government expenditure and revenue changes so that budget deficits can be reduced without harming, and possibly even stimulating investment and growth.

Finally, there are several useful directions for further research. It may be important to further assess the impact of government expenditures on private investment by disaggregating government expenditures in expenditures to different sectors, such as infrastructure, education, housing or health. A fruitful extension may also be to try to examine the sensitivity of the results for the set of countries used by, for instance, distinguishing between different groups of countries. Finally, further research may elaborate on the impact of the financing mode of government expenditures on the relationship between different fiscal policy variables and investment and growth.

Table 1

Total government expenditures and revenues:

linear effects

	1	2	3	4
log(1+bmp)	-0.396*	-0.413*	-0.415*	-0.592*
log(gdp)	5.819*	4.867*	4.813*	5.333*
Surplus	0.184*			
Govexp		-0.179*	-0.185*	
Govrev		-0.007		-0.230*
N	74	74	74	83
adj. R^2	0.80	0.80	0.81	0.83

Note: The estimation technique is GLS (generalised least squares, with cross section weights). In all estimates fixed effects are taken into account, as well as time dummies for the 1970s and 1980s. R^2 is the adjusted R^2 for the unweighted model. *) denotes significant at the 1 per cent level; **) denotes significant at the 5 per cent level; ***) denotes significant at the 10 per cent level. The dependent variable in all equations is private investment as a percentage of GDP.

Table 2

Private investment and government expenditures: linear effects

	1	2	3	4	5	6	7	8
Log(1+bmp)	-0.209	-0.293*	-0.302*	-0.674*	-0.546*	-0.446*	-0.425*	-0.749*
Log(gdp)	5.417*	5.340*	6.046*	5.997*	5.458*	5.607*	3.873*	5.489*
Wages	-0.335*	-0.476*						
Othgood	0.247		-0.030					
Intp	-0.343*			-0.409*				
Subs	-0.030				-0.156*			
Capexp	0.296*					0.220*		
Pubinv							0.231*	
Govcon								-0.192*
N	74	75	75	81	81	79	110	109
adj. R^2	0.82	0.82	0.81	0.84	0.82	0.82	0.83	0.84

Note: see note to table 1.

Table 3

Private investment and functional classification of government expenditures: linear effects

	1	2	3	4	5	6
Log(1+bmp)	-0.405*	-0.495*	-0.318*	-0.414*	-0.314*	-0.598*
Log(gdp)	3.130*	3.978*	4.322*	4.822*	4.278*	3.499*
Defence	-0.812	-1.034*				
Education	-0.548		-0.633**			
Health	-0.620*			-0.428**		
Econaf	0.553*				0.484*	
Socsec	-0.280*					-0.189*
N	66	72	73	73	73	68
adj. R^2	0.80	0.81	0.82	0.81	0.82	0.80

Note: see note to table 1.

Table 4

Private investment and government revenues:

linear effects

	1	2	3	4	5
log(1+bmp)	-0.588*	-0.638*	-0.495*	-0.619*	-0.568*
log(gdp)	4.485*	5.124*	5.494*	5.791*	5.825*
Taxprof	0.425***	0.388***			
Domtax	-0.272*		-0.289*		
Taxinttr	-0.530*			-0.454*	
Nontax	0.250**				0.089**
N	81	81	81	81	81
R^2	0.82	0.83	0.82	0.83	0.82

Note: see note to table 1.

Table 5

Total government expenditures and revenues:

non-linear effects

	1	2	3	4
Log(1+bmp)	-0.734*	-0.397*	-0.371*	-0.584*
Log(gdp)	4.647*	5.038*	4.980*	5.651*
Surplus	0.873*			
Govexp		0.090	0.006	
Govrev		-0.123		0.288*
Surplus^2	0.099*			
Govexp^2		-0.005	-0.003**	
Govrev^2		0.002		-0.012*
N	74	74	74	83
Adj. R^2	0.83	0.78	0.80	0.83

Note: see note to table 1.

Table 6

Private investment and government expenditures: non-linear effects

	1	2	3	4	5	6	7	8
log(1+bmp)	-0.062	-0.403*	-0.365*	-0.807*	-0.425*	-0.476*	-0.480*	-0.800*
log(gdp)	5.767*	5.43*	5.694*	6.532*	5.518*	5.172*	4.615*	5.052*
Wages	0.521*	1.130*						
Wages^2	-0.059***	-0.105*						
Othgood	-0.106		-1.697*					
Othgood^2	0.067		0.166*					
Intp	-0.229			-0.682*				
Intp^2	-0.0002			0.014**				
Subs	0.821**				0.178*			
Subs^2	-0.036**				-0.013*			
Capexp	-0.084					-0.240**		
Capexp^2	0.022					0.045**		
Pubinv							-0.206*	
Pubinv^2							0.019*	
Govcon								0.071*
Govcon^2								-0.010*
N	74	75	75	81	81	79	110	109
adj R^2	0.78	0.83	0.80	0.84	0.82	0.82	0.83	0.83

Note: see note to table 1.

Table 7

Private investment and government expenditures:

combination of variables with correlation coefficients below 0.15

	1	2	3	4	5
log(1+bmp)	-0.526*	-0.223*	-0.236*	-0.432*	-0.280*
log(gdp)	5.664*	5.187*	5.213*	5.882*	5.586*
Wages	1.024*			0.841*	1.181*
Wages^2	-0.097*			-0.071*	-0.095*
Capexp	-0.352*				
Capexp^2	0.046*				
Intp				-0.498*	-0.348*
Intp^2				0.008	
Subs		-0.121*	-0.128*		
Subs^2		-0.0004			
Othgood		-1.232*	-1.235**		
Othgood^2		0.152*	0.152*		
N	74	75	75	75	75
adj R^2	0.82	0.79	0.79	0.83	0.84

Note: see note to table 1.

Table 8

Private investment and functional classification of government expenditures:

non-linear effects

	1	2	3	4	5	6
log(1+bmp)	-0.322**	-0.613*	-0.304*	-0.433*	-0.278*	-0.424*
log(gdp)	3.373*	4.048*	4.362*	-0.112*	4.338*	3.268*
Defence	-4.327*	-4.604*				
Defence^2	0.467*	0.533*				
Education	0.736		0.111			
Education^2	-0.160		-0.120			
Health	3.434			0.564**		
Health^2	-0.512***			-0.112*		
Econaf	-0.182				0.048	
Econaf ^{2}	0.050***				0.036**	
Socsec	0.54					0.204*
Socsec^2	-0.040*					-0.017*
N	66	72	73	73	73	68
adj. R^2	0.82	0.84	0.82	0.81	0.81	0.80

Note: see note to table 1.

Table 9

Private investment and functional classification of government expenditures, combination of variables with correlation coefficients below 0.15

	1	2	3
log(1+bmp)	-0.513*	-0.169**	-0.139
log(gdp)	3.784*	3.950*	4.006*
Defence	-4.944*		
Defence²	0.543*		
Education		-0.220	-0.770**
Education²		-0.081	
Health	1.956**		
Health²	-0.317*		
Socsec		0.484***	0.544***
Socsec²		-0.029*	-0.031*
N	72	67	67
adj. R^2	0.83	0.80	0.81

Note: see note to table 1.

Table 10

: Private investment and government revenues:

non-linear effects

	1	2	3	2	3	4	5
Log(1+bmp)	-0.744*	-0.779*	-0.771*	-0.607*	-0.481*	-0.633*	-0.591*
Log(gdp)	4.541*	4.984*	4.958*	5.059*	5.533*	5.891*	5.671*
Taxprof	1.100*	1.042*	1.014*	1.054*			
Taxprof²	-0.052**	-0.051*	-0.046*	-0.050**			
Domtax	-0.098	-0.574*	-0.307*		-0.705*		
Domtax²	-0.021	0.021			0.036*		
Taxinttr	0.329***	0.579*	0.590*			0.564*	
Taxinttr²	-0.080*	-0.089*	-0.090*			-0.069**	
Nontax	-0.360**						-0.533*
Nontax²	0.058*						0.060*
N	81	81	81	81	81	81	81
R^2	0.82	0.82	0.83	0.82	0.82	0.83	0.82

Note: see note to table 1.

Table 11

Government expenditures and revenues

	1	2	3	4
log(1+bmp)	-0.586*	-0.572*	-0.542*	-0.544*
log(gdp)	5.923*	5.694*	5.106*	5.150*
Wages	0.707***	0.582**	0.530***	0.540***
Wages^2	-0.083*	-0.073*	-0.064**	-0.064**
Capexp	-0.467**	-0.450*	-0.452***	-0.463***
Capexp^2	0.071*	0.069*	0.068*	0.069*
Taxprof	0.588***	0.515***	1.008***	0.995***
Taxprof^2			-0.029	-0.0278
Domtax	0.018			-0.002
Taxinttr	-0.315*	-0.357**	0.745*	0.731*
Taxinttr^2			-0.098*	-0.097*
Nontax	-0.047			
Threshold value for Wages	4.26	3.99	4.14	4.22
Threshold value for Capexp	3.29	3.26	3.32	3.36
N	74	74	74	74
adj R^2	0.81	0.82	0.82	0.81

Note: see note to table 1.

Table 12

: Correlation matrix government expenditures

	Wages	Intp	*Capexp*	*Subs*	*Othgood*	*Defence*	*Education*	*Health*	*Econaf*	*Socsec*
Wages	1.00									
Intp	-0.12	1.00								
Capexp	0.01	0.20	1.00							
Subs	-0.001	0.26	-0.16	1.00						
Othgood	0.28	0.28	0.44	0.03	1.00					
Defence	0.13	0.08	0.20	0.10	0.49	1.00				
Education	0.37	0.11	0.49	0.09	0.57	0.20	1.00			
Health	0.33	0.23	0.34	0.40	0.34	-0.06	0.65	1.00		
Econaf	0.01	0.26	0.88	-0.07	0.61	0.20	0.59	0.41	1.00	
Socsec	-0.08	0.22	-0.23	0.88	-0.03	-0.03	-0.03	0.38	-0.17	1.00

Table 13

Correlation matrix government revenues

	Taxprof	*Domtax*	*Nontax*	*Taxinttr*
Taxprof	1.00			
Domtax	0.10	1.00		
Nontax	0.32	0.09	1.00	
Taxinttr	-0.05	-0.10	0.10	1.00

Appendix A: list of variables

BMP: black market premium

Capexp: capital expendititures (% of GDP)

Defence: defense expenditures of government (% of GDP)

Domtax: domestic taxes on goods and services (% of GDP)

Education: education expenditures of government (% of GDP)

Econaf: government expenditures on economic affairs and services (% of GDP). This includes expenditures on 1) agriculture, forestry, fishing and hunting, 2) mining, 3) fuel and energy, 4) transportation and communication and 5) other economic affairs and services.

GDP:	initial value of real GDP per capita
Govcon:	government consumption (% of GDP)
Govexp:	total government expenditures (% of GDP)[23]
Govrev:	total government revenues and grants (% of GDP)[24]
Health:	health expenditures of government (% of GDP)
Intp:	interest payments of the government (% of GDP)
Nontax:	non-tax revenue (for government) (% of GDP)
Othgood:	other purchases of goods and services (% of GDP)
Privinv:	private investment (% of GDP)
Pubinv:	public investment (% of GDP)
Socsec:	government expenditures on social security and welfare (% of GDP)
Subs:	subsidies plus other current transfers (% of GDP)
Surplus:	*Govrev – Govexp*[25]
Taxinttr:	taxes on international trade and transactions (% of GDP)
Taxprof:	taxes on income, profits and capital gains (% of GDP)
Wages:	wages and salaries (employer contribution; % of GDP)

Data sources that have been used for the analysis are the folowing:

- William Easterly and H. Yu, *Global Development Network Growth Database*, Washington DC: The World Bank, 1999. (see also the website of the World Bank: http://www.worldbank.org/html/prdmg/grthweb/gdndata/htlm)
- IMF, Government Financial Statistics, CD-Rom.

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23 *Govexp = wages + othgood + intp + subs + capexp*. Note that the sum of *wages + othgood* equals current expenditures on goods and services (not used in estimations). Note also that the sum of *Defence, Education, Health, Econaf* and *Socsec* does not add up to *govexp*. The difference is made up by, amongst others, government expenditures on housing and recreation.

24 Note that *Taxprof + Taxinttr + Domtax + Nontax* are not equal to *Govrev*. Small differences are possible due to grants and some unimportant taxes.

25 Note also that *surplus* is not entirely equal to the overall government surplus. The difference is loans minus repayments.

- World Bank, World Tables, CD-Rom.

- Lawrence Bouton and Mariusz Sumlinski, *Trends in Private Investment in Developing Countries: Statistics for 1970-98*, Washington DC: International Finance Corporation, June 2000.

- Penn World Table 5.6.

Appendix B: list of countries used in the analysis

In the equations including *Govexp*, *Wages*, *Intp*, *Subs* and *Capexp* the following (33) countries are included:

Argentina; Belize; Bolivia; Brazil; Bulgaria; Chile; Colombia; Costa Rica; Cote d'Ivoire; Dominican Republic; Egypt; Guatemala; Guinea-Bissau; India; Indonesia; Iran; Korea; Madagascar; Malaysia; Mauritius; Mexico; Morocco; Panama; Paraguay; Peru; Poland; Romania; South Africa; Thailand; Tunisia; Turkey; Uruguay and Venezuela.

In equations including *Govrev*, *Taxprof, Domtax*, *Taxinttr* and *Nontax* 35 instead of 33 countries are included in the sample. For these variables Namibia and Pakistan are added to the standard sample of countries.

The number of observations for individual equations presented in the tables may not be equal to three times the number of countries due to missing data for some countries for one or more sub-periods.

References

Adam, Christopher S. and David L. Bevan (2000). *Fiscal Policy Design in Low-Income Countries*. Paper Presented at the UNU/WIDER Conference on "New Fiscal Policies for Growth and Poverty Reduction", Helsinki: United Nations University. November.

Addison, Tony (2000) *The Political Economy of Fiscal Policy in Low-Income Countries*. Paper Presented at the UNU/WIDER Conference on "New Fiscal Policies for Growth and Poverty Reduction", Helsinki: United Nations University. November.

Alesina, Alberto and Roberto Perotti (1997). *Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects*. IMF Staff Papers, 44, 2, pp. 210-248.

Alesina, Alberto, Roberto Perotti, and Jose Tavares (1998). "The Political Economy of Fiscal Adjustments". *Brookings Papers on Economic Activity*, 1, pp. 197-248.

Alesina, Alberto, Silvia Ardagna, Roberto Perotti, and Fabio Schiantarelli (1999). *Fiscal Policy, Profits, and Investment.* NBER Working Paper Series, 7207, Cambridge, MA: National Bureau of Economic Research. July.

Argimon, Isabel, Jose M. Gonzalez-Paramo, and Jose M. Roldan Alegre (1997). *Does Public Spending Crowd out Private Investment?* Evidence from a Panel of 14 OECD Countries, Banco de Espana, Working Paper, 9523. Madrid: Banco de Espana.

Aschauer, David A. (1989). Does public capital crowd out private capital?. *Journal of Monetary Economics,* 24, pp. 171-188.

Barro, Robert J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy,* 98, 1, pp. 103-125.

Barro, Robert J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics,* 106, 1991, pp. 407-444.

Barro, Robert J. and Xavier Sala-i-Martin (1992). Public Finance in Models of Economic Growth. *Review of Economic Studies,* 59, 4, pp. 645-661.

Bertola, Giuseppe and Allan Drazen (1993). Trigger points and budget cuts: explaining the efects of fiscal austerity. *American Economic Review,* 83, 1, pp. 11-26.

Blejer, Mario I. and Mohsin S. Kahn (1984). *Government Policy and Private Investment in Developing Countries.* IMF Staff Papers, 31, 2, pp. 379-403.

Buiter, Willem H. (1977). Crowding-out and the effectiveness of fiscal policy. *Journal of Public Economics,* 7, pp. 309-328.

Chhibber, Ajay and Mansoor Dailami (1993). Fiscal policy and private investment in developing countries: recent evidence and key selected issues, in Riccardo Faini and Jaime de Melo (eds*), Fiscal Issues in Adjustment in Developing Countries,* pp.121-150. London: St. Martin's Press.

De Oliveira-Cruz, Bruno and Joanilio R. Teixeira (1999). The impact of public investment on private investment in Brazil, 1947-1990. *CEPAL Review,* 67, pp. 75-84. April.

Devajaran, Shantayanan, Vinaya Swaroop and Heng-fu Zou (1996). The composition of public expenditure and economic growth. *Journal of Monetary Economics,* 37, 2, pp. 313-344.

Easterly, William and Sergio Rebelo (1993). Fiscal policy and economic growth. *Journal of Monetary Economics,* 32, pp. 417-458.

Ekpo, Akpan H. (1999). Public expenditure and economic growth in a petroleum-based economy: Nigeria 1960-1992. *South-African Journal of Economic and Management Sciences.* 2, 3, pp. 374-389.

Erenburg, S.J. (1993). The real effects of public investment on private investment. *Applied Economics,* 25, pp. 831-837.

Gemmell, Norman (2000). *Fiscal Policy in A Growth Framework.* Paper Presented at the UNU/WIDER conference on "New Fiscal Policies for Growth and Poverty Reduction", Helsinki: United Nations University. November.

Ghali, Khalifa H. (1998). Public investment and private capital formation in a vector error-correction model of growth. *Applied Economics,* 30, 6, pp. 837-844.

Ghosh, Atish R. and Steven Phillips (1998). *Inflation, Disinflation, and Growth.* IMF Working Paper, WP/98/68, Washington, DC: International Monetary Fund. May.

Ghosh, Atish R. and Holger Wolf (1998). *Thresholds and Context Dependence in Growth.* NBER Working Paper Series, 6480, Cambridge, MA: National Bureau of Economic Research. March.

Giavazzi, Francesco and Marco Pagano (1990). Can severe fiscal adjustments be expansionary?, in Oliver Blanchard and Stanley Fischer (eds), *NBER Macroeconomics Annual*, pp. 75-110, Cambridge MA: MIT Press.

Giavazzi, Francesco and Marco Pagano (1996). Non-keynesian effects of fiscal policy changes: international evidence and the Swedish experience. *Swedish Economic Policy Review*, 3, pp. 135-165.

Gramlich, E.M. (1994). Infrastructure investment: a review essay. *Journal of Economic Literature*, 32, pp. 1176-1196.

King, Robert and Sergio Rebelo (1990). Public policy and economic growth: developing neo-classical implications. *Journal of Political Economy*, 98, 1, pp. 126-151.

Kneller, Richard, Michael F. Bleaney and Norman Gemmell (1999). Fiscal policy and growth: evidence from OECD countries. *Journal of Public Economics*, 74, pp. 171-190.

Lienert, Ian and Jitendra R. Modi (1999). *A Decade of Civil Service Reform in Sub-Saharan Africa*. IMF Working Paper, WP/97/179, Washington, DC: International Monetary Fund. December.

Miller, Stephen M. and Frank S. Russek (1997). Fiscal structures and economic growth: international evidence. *Economic Inquiry*, 35, 3, pp. 603-613.

Monadjemi, Mehdi S. (1993). Fiscal policy and private investment expenditure: a study of Australia and the United States. *Applied Economics*, 25, pp. 143-148.

Nazmi, Nader and Miguel D. Ramirez (1997). Public and private investment and economic growth in Mexico. *Contemporary Economic Policy*, 15, 1, pp. 65-75.

Odedokun, Matthew O. (1997). Relative effects of public versus private investment spending on economic efficiency and growth in developing countries. *Applied Economics*, 29, pp. 1325-1336.

Odedokun, Matthew O. (2000). *Public Finance and Economic Growth: Empirical Evidence from Developing Countries.* Paper Presented at the UNU/WIDER conference on "New Fiscal Policies for Growth and Poverty Reduction", Helsinki: United Nations University. November.

Pereira, Alfredo M. and Oriol Roca Sagales (1999). Public capital formation and regional development in Spain. *Review of Development Economics*, 3, 3, pp. 281-294.

Perotti, Roberto (1996). Fiscal consolidation in Europe: composition matters. *American Economic Review*, 86, 2, pp. 105-110.

Ramirez, Miguel D. (1996). Public and private investment in Mexico and Chile: an empirical test of the complementarity hypothesis. *Atlantic Economic Journal*, 24, 4, pp. 301-320.

Rebelo, Sergio (1990). Long-run policy analysis and long-run growth. *Journal of Political Economy,* 99, pp. 500-521.

Sobhee, Sanjeev K. (1999). Crowding-out and the effectiveness of private investment and public investment: the case of Mauritius. *Indian Journal of Applied Economics,* 8, 3, pp. 143-162.

Stiglitz, Joseph E. (1998). *More Instruments and Broader Goals: Moving Toward the Post-Washington Consensus.* WIDER Annual Lectures 2, Helsinki, United Nations University. January.

Sturm, Jan-Egbert (1998). *Public Capital Expenditure in OECD Countries: The Causes and Impact of the Decline in Public Capital Spending.* Cheltenham: Edward Elgar.

Sturm, Jan-Egbert, Jan P.A.M. Jacobs and Peter D. Groote (1999). output effects of infrastructure investment in the Netherlands, 1853-1913. *Journal of Macroeconomics,* 21, 2, pp. 355-380.

Sutherland, Alan (1997). Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy? *Journal of Public Economics*, 65, pp. 147-162.

Toye, John (2000). Fiscal Crisis And Fiscal Reform In Developing Countries. *Cambridge Journal of Economics,* 24, 1, pp. 21-44.

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