Fiscal Spending and Economic Performance: Some Stylized Facts[♣]

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Abstract

Using an "event analysis", this paper complements the cross-country approach to the study of fiscal correlates of growth. Data on fiscal expenditures and growth for a database of 140 countries (118 developing countries) over 1972-2005 on are reorganized around turning points providing a summary but encompassing description of "what is in the data". For this sample, the probability of occurrence of a fiscal event is about 10%, and, the probability of a growth event once a fiscal event had occurred is around 26%. For developing countries, fiscal events followed by growth events occur under situations of (i) significantly lesser deficit, (ii) fewer resources devoted to non-interest General Public Services and (iii) shift in primary expenditures towards Transport & Communication. After controlling for the growth-inducing effects of positive terms-of-trade shocks and of trade liberalization reform, probit estimates indicate that a growth event is more likely to occur in a developing country when surrounded by a fiscal event. Moreover, the probability of occurrence of a growth event in the years following a fiscal event is greater the lower is the associated fiscal deficit, confirming that success of a growth-oriented fiscal expenditure reform hinges on a stabilized macroeconomic environment (through limited primary fiscal deficit).

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1. INTRODUCTION

A renewed focus on fiscal policy and growth has spawned a lively debate over demands for what has been dubbed greater "fiscal space" to support growth. Besides a few case studies, so far the exploration of fiscal space and performance has proceeded along two paths: (i) studies of the efficiency of specific public sector expenditures - e.g. the several studies on infrastructure (Calderon and Serven (2004)) or on other components of social infrastructure (Estache et al.(2007)), and (ii) cross-country growth regressions in which government expenditures are included among the regressors (Devarajan et al. (1996), Adam and Bevan (2005)). Perotti (2007) reviews critically the contributions of the production function and growth regression approches. Among the more interesting lessons from these exercises, Kneller *et al.*, 2000, Bose *et al.*, 2003, and Adam and Bevan, 2005, using dynamic panels have persuasively shown that capital expenditure, as well as spending on education, health, transport and communication can be favorable to growth when the government budget constraint is *simultaneously* taken into account in the equation.

As pointed out in several studies (e.g. Easterly et al.(1993) and Jones and Olken (2007), growth tends to be highly instable in low-income countries. This makes it difficult to unveil the relation between growth and its fundamentals leading Hausmann, Pritchett and Rodrik (2005) to pay attention to turning points by relying on an event analysis. This paper applies this approach over a large data base of 140 countries over the period 1972-2005 providing a description of the correlates between significant public spending "shocks" and growth accelerations, reorganizing the data around turning points, or "events" (calendar time is transformed into "event time"). This descriptive analysis should be viewed as complementary to the approaches described above.

More specifically, we construct growth "events" along the lines of Hausman, Pritchett and Rodrik (2005). Lacking information on milestone events in fiscal reforms similar to those available for trade reforms as in Wacziarg and Welch (2003), we define an "event" on the fiscal side using an approach similar to the definition of an event on the growth side, i.e. based on conditional changes in primary fiscal expenditures but taking into account the government budget constraint. This descriptive approach should be informative as it provides an easy-to-understand exploration of the correlates between fiscal policy (here fiscal expenditures) and performance (here per capita GDP growth). It avoids imposing a single common linear model for all countries as done in cross-countries regressions. When applied to a large database, as done here, it gives a more encompassing description of "what is in the data" and is thus complementary to the three other approaches mentioned above.

To highlight the main findings, in this sample, the probability of occurrence of a fiscal event is about 10%, and the probability of a growth event once a fiscal event has occurred is in the 22%- 28% range. The probability of occurrence of a fiscal event is higher for the bottom half of the income distribution of countries. For the developing country group which is the focus of this study, fiscal events followed by growth events occur under situations of a significantly lesser deficit, and a shift in discretionary expenditures towards transport & communication is only observed for fiscal events followed by growth events. After controlling for the growth-inducing effects of positive terms-of-trade shocks and of trade liberalization reform, the statistical analysis in

which the probability of a growth event is conditioned on the occurrence of a fiscal event in surrounding years confirms that growth events are, on average, more likely when a fiscal event has occurred. Moreover, the probability of occurrence of a growth event in the five years following a fiscal event is greater the lower is the associated fiscal deficit, confirming that success of a growth-oriented fiscal- expenditure package likely hinges on a stabilized macroeconomic environment (through limited fiscal deficit).

The paper unfolds as follows. Section 2 presents the identification conditions of both growth and fiscal events (with details and sensitivity analysis left to the annex A.3). Section 3 studies the characteristics of growth and fiscal events, and the relation between the two. The descriptive analysis computes fiscal event (unconditional) probabilities and probabilities that fiscal events are followed (or not) by growth events. Section 4 investigate the characteristics of fiscal events, in particular the ones followed by a growth event, in terms of geography, underlying changes in expenditure composition, and in the level of associated primary deficit. Then the statistical analysis turns on the growth side, the objective being to see if, based on probit estimates, growth events are more likely to occur in a developing country when surrounded by a fiscal event. Section 5 concludes.

2. DEFINING EVENTS

We are interested in the relation between a "significant" change in fiscal spending and a "significant" change in GDP growth - what Hausmann, Pritchett and Rodrick (henceforth HPR, 2005), call "growth acceleration". Per capita GDP *growth* and primary fiscal expenditures (in GDP %) *growth* are then our two indicator values. Call these growth indicators, z. Average annual *changes*, $z_{t,n}$, are computed for each year over successive windows of length n. Here, because of the limited sample size for the fiscal data (1972 to 2005) we choose a succession of windows of $n = 5$ years. So we compute $\Delta z_{t,n}$:

$$\Delta z_{t,n} = z_{t,t+n} - z_{t,t-n}$$

If the change $\Delta z_{t,n}$ in the average indicator value satisfies certain conditions (see below), we will say that an "event" has taken place for z in t. The appendix details how we selected the parameter values defining an event and how sensitive our sample of events is to changes in the conditioning values so here we only describe the conditions for our 'benchmark' set of parameters starting with GDP per capita growth, and then turning to primary fiscal expenditures. In this benchmark case, the sample produces 58 growth events and 95 growth events. Sensitivity of the number of events to the choice of parameter values is reported in appendix table A1.

Growth events. As in HP, a growth event will have taken place in *t* if the following conditions are met:

(i) an increase in the average per-capita growth of 2 ppa or more (percentage points per annum, ppa),
(ii) growth acceleration sustained for at least 5 years *[t;t+4]*,

(iii) an average annual growth rate at least 3.5 ppa during the acceleration period *[t;t+4],*
(iv) a post-acceleration output exceeding the pre-episode peak level of GDP.

With this selection process, several events could follow one another over consecutive years capturing in fact the same event. To select the more "relevant" year, we fit a spline regression and choose the year for which the change in indicator value is statistically the most significant. Finally, we impose the restriction that two events must be separated by at least five years. This method is used for both growth and fiscal events.

Fiscal Events. The core of this study is the definition of a fiscal event. Ideally, we would like to carry out the equivalent of what Wacziarg and Welch (WW, 2003) have done for trade liberalization episodes, that is use a combination of criteria that qualify a fiscal reform to center an event which could then be checked against detailed reports identifying significant changes in the fiscal regime. In a second step a "before and after" analysis would be carried out around the fiscal event for selected outcome indicators (e.g. growth and other indicators like investment in the case of WW).

Unfortunately, carrying out a similar exercise for changes in fiscal policy is much more difficult. First is the issue of trying to disentangle the stabilization objective from the growth objective which is not addressed here. Second, there is much more fungibility in fiscal policy than in trade policy, so it is more difficult to identify the fiscal space levers, and it is much more difficult to identify the expected effects of changes in these levers. Here, we restrict fiscal reform to a change in total primary fiscal expenditures and, in a second step, we study the underlying evolution of many components of potential interest (e.g. education, health or transport and communication)

Faced with these limitations and with limited data availability, we rely on changes in consolidated central government total fiscal expenditures, TFE (taken from the GFS, see details in annex A1) as "event" changes in government expenditures. Since we are looking for autonomous fiscal expenditures, events are defined on expenditures purged of non-discretionary components such as wages and interest payments, IP.[1] Lacking information on the wage component for each functional expenditure category, we consider as discretionary TFE purged of interest payments. So, we define discretionary fiscal expenditure, DFE, as $DFE = TFE - IP$ which is equivalent to focusing on primary spending. We also compute the primary fiscal deficit, *def,* as the difference between the total revenues and *grants* and the discretionary fiscal expenditure, DFE (so a deficit is negative).

For the developing countries in the sample used here, average DFE is 24% of GDP and average central government primary fiscal deficit, *def*, is -2% of GDP. An increase in DFE will be declaring as fiscal event in *t* when the following conditions are met over the following five year window:

[1] Heller (2006) considers wages and interest payments as the 2 non-discretionary expenditures in developing countries. In our fiscal data set which is decomposed by "function" rather than "economic" use we do not have a wage component for each function so we cannot include wages as non-discretionary. See the annex A1 for the definitions of these components.

(i) an increase in DFE average growth of 1 ppa (percentage point per annum),
(ii) If in deficit (i.e *def*< -2% of GDP), deficit does not increase,
(iii) If in surplus (or in *def* > - 2% of GDP), the increase in DFE does not lead to a deficit exceeding 2% of GDP

The 5-year (rather than a longer period) window was dictated by the length of the time-series and our desire to have enough fiscal and growth events for statistical analysis. Sensitivity of events to parameters in the above conditions is discussed in the appendix.[2]
This first cut at defining a "fiscal event" could be improved upon in several ways. First, the objective is to capture the availability of budgetary room that allows a government to provide resources for a desired purpose "without any prejudice to the susceptibility of a government's financial position" (Heller, 2006). Hence, ideally one would define conditions (ii) and (iii) based on formal tests of debt sustainability such as those used by Chalk and Hemming (2001). However, lack of data on indebtedness lead us to use the value of the deficit level. Second, unfortunately, the "event" cannot be interpreted as entirely discretionary (or unanticipated). The large set of expenditures included in DFE implies that the fiscal event captures non-discretionary elements in the definition and more restrictive definitions of discretionary fiscal expenditures could certainly be built around one of the functional components of fiscal expenditures, although any greater volatility in narrower series may be difficult to interpret.[3] Thus, the most plausible interpretation of the constructed "events" is as significant changes in fiscal policy and refrain from attributing any government objective to the event.

Third, in view of the links we are seeking to establish between fiscal spending events and growth events, one might consider whether the selection of the fiscal event (in particular through conditions (ii) and (iii)) is biased towards selecting as fiscal events those that are followed by growth. Actually, due to the automatic response of government spending and taxes to output growth, a period of growth acceleration after the fiscal event will lead, other things equal, to a lower deficit. Hence, by construction, we are more likely to select as fiscal events those that are followed by growth since a condition is imposed on the evolution of the fiscal deficit (conditions (ii) and (iii)). This is certainly the case for OECD countries such as Finland, Sweden or Norway that appear in our event results (see figure 1 below) and that are known for their strong tax revenue elasticities to production (elasticities estimated to be greater than unity). However, as noted by Perotti (2007), among the papers that have studied the cyclical behavior of fiscal policy in developing countries (see e.g. Kaminsky et al., 2004, and

[2] Our desire to have a transparent and economically sensible homogeneous framework across countries led us not to use procedures that treat break dates as unknown variables to be estimated (see e.g. Bai and Perron, 1998, 2003). However, all turning points in GDP per capita growth or in primary expenditure growth that are qualified as "event" are significant at a 10% level. Hence, only smaller but statistically significant breaks may be identified by endogenous procedures. Moreover, as shown in the appendix, changes in "event" parameters do not affect results.
[3] As discussed by Perotti (2007), it is very difficult even in developed countries like the US where quarterly data and external information on GDP elasticities of revenues and transfers are both available to apply time-series methodologies to detect a fiscal discretionary policy shock (i.e. an unanticipated shock) in the data. Data requirements are too demanding to apply these (controversial) time-series methodologies to developing countries.

Gavin and Perotti, 1997), it seems widely accepted that fiscal policy in these countries is typically pro-cyclical, i.e. the budget deficit is positively correlated with economic growth.[4] Hence, according to this pro-cyclical effect, if a growth event occurs in the year following a fiscal event, this should increase the deficit, and hence weaken the probability of observing fiscal events followed by a growth event (recall that an increase in discretionary fiscal expenditure associated with an increase in the fiscal deficit does not qualify as a fiscal event). One might even suspect our definition of fiscal event to underestimate, for the developing countries, the correlation with subsequent growth.

Fourth, we would not want to exclude countries that sought fiscal space through highly confessional borrowing even if this led to an increase in their deficit (since, despite high grant percentage as a share of the loan, such loans are not treated as grants). This suggests that one might wish to take an estimate of the grant component of such loans and include that portion in government revenue thereby relaxing the budgetary constraint. However, there is no data on the grant component of these loans. As an alternative, we redefined our fiscal event with a fourth condition allowing Low-income countries to increase their fiscal deficit during the fiscal spending growth period up to 4% of GDP (considering that for low income countries, external borrowing is likely to be on highly concessional terms). Results are reported in next section.

Finally, with better indicators of performance of government expenditures than GDP per capita growth, this "event-type" analysis could be extended directly to the indicators of fiscal expenditure that concern the debate on fiscal space, e.g. health and/or education expenditures and expenditures on transport & communication (capturing then, for instance, event in budget reallocation between government functions for a given amount of total outlays).[5]

3. Patterns of Fiscal and Growth Events

Keeping in mind the shortcomings of this methodology, we take an exhaustive approach by constructing fiscal events for as many countries as possible. Since we are interested in the various components of fiscal expenditures, the best database is the IMF Government Financial Statistics (GFS). GFS statistics are available for a large number of countries since 1972 and up to 2005.[6] Following most previous studies on fiscal expenditures we use data on fiscal expenditures by function (instead of

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[4] Several explanations have been advanced to explain the procyclicality of fiscal policy in developing countries. Among others, Gavin and Perotti (1997) have argued that developing countries face credit constraints that prevent them from borrowing with slow growth. Tornell and Lane (1999) show that competition for a common pool of funds among different units (ministries, provinces) leads to the so-called "voracity effect" whereby expenditure could actually exceed a given windfall. Alesina and Tabellini (2005) show that procyclicality is an optimal behavior in the presence voters with imperfect information and corrupt politicians.

[5] However, as already mention, given the low quality of fiscal data, volatility in narrower series may be more difficult to interpret.

[6] There was a major change in the GFS in 1989 causing concern about the comparability of data before and after that date (see details on the data reconciliation in annex A.1.2, *not submitted for publication*). Using box-plots, we explored the possibility of lack of comparability for the series of interest. Fortunately, as discussed in the annex A.1.2 (see figure A1, *not submitted for publication*), this is not the case.

expenditures by economic classification---i.e. by current vs. capital expenditures).[7] As described in annex A1, after reconciling the fiscal data, our "fiscal sample" includes 140 countries, of which 118 are developing (i.e. non High Income OECD countries).
For the growth database, we use the Penn World Table PWT 6.2 as our baseline data source.[8] Hence, the "growth" database covers 187 countries over the same period as the fiscal data base, i.e. 1972-2004. Taking into account missing data, the sample includes 5380 observations hence 87% of the potential number of observations (=6171=187 countries*33 years).

Turn now to the construction of growth and fiscal events as defined in section 2 and in the appendix. As mentioned above, due to the limitations imposed by the availability of fiscal data, we choose 5-year periods for both fiscal and growth events, i.e. $n = 4$. This means that the exercise covers the period 1977-2000. Because there is missing data, we have also imposed that data be available for 4 out of the 5 years entering each "window". If this condition is not satisfied, a missing value is entered for that "window". Having computed the fiscal and growth events on their respective databases, we merge the two into a final dataset (see annex A.2 for details, *not submitted for publication*). The resulting database includes 107 countries (84 developing countries, i.e. all non- High Income OECD countries), over 1977-2000. This leads to 1452 observations hence 57% of the potential number (=2568=107 countries*24 years).

For this sample and for the parameter values selected here, we get 58 growth events and 95 fiscal events. This is our benchmark data set over which exploration takes place. As discussed in table A.1, the number of events is relatively insensitive to a range of plausible parameter values. Nor are changes in the pattern of events surprising when we change parameter values. Figure 1 plots a subset of events in this benchmark case: 25 fiscal events are simultaneous or followed by a growth event, 23 fiscal events are preceded by a growth event. The residual (47) events that are neither followed nor preceded by a growth event are not shown in the figure (also see the details in table A1).

Insert Figure 1 here. Growth events vs. fiscal events

Table 1 reports unconditional probabilities of these fiscal events.[9] For the whole sample and given our construction of a fiscal event, the probability of occurrence of a fiscal event is 9.7% and the probability of a growth event once a fiscal event has occurred is 26.3%. Table 1 also reports probabilities across countries ranked according to their income per capita and by region. Column 5 shows that, although the probability of occurrence of a fiscal event is fairly evenly spread across the income quartiles, the probability is higher for the lower quartiles (first and second). It is difficult to interpret

[7] 86% of the observations rely on data consolidated at the central government sector level and the remainder 14% at the budget central government level. See annex A.1.3 for further discussion.
[8] Using WDI database is an alternative. As shown by HPR, this does not affect the results.
[9] These probabilities are computed by dividing the numbers of events by the number of country-year observations in which an event could have occurred. The latter is calculated by summing all the observations in the sample and eliminating: (i) a 4-year window after the occurrence of each event since our qualifying conditions take this period as belonging to the same episode; (ii) the potential competing dates before the event that have been eliminated by the spline regression.

this pattern since, as explained above, this definition of a fiscal event does not distinguish between fiscal policy shocks and systematic fiscal policy. If one can assume that fiscal policy shocks are not more prevalent among low and middle income countries, then the pattern would seem to indicate that fiscal policy is more volatile among low-income countries. The probability that a fiscal event is followed by a growth event is much higher for the third quartile (i.e. for middle-income countries which are largely in Latin America). Note however, that the patterns suggest that fiscal policy may be pro-cyclical (but not destabilizing given our definition of fiscal event) in Latin America since, out of the 9 fiscal events associated with growth in Latin America, 4 are simultaneous (see figure 1), which seems to confirm earlier results (see e.g. Gavin and Perotti, 1997, Kaminsky et al. 2004 and Perotti, 2007). At the same time, It is clear that low-income countries have both a higher probability of having a fiscal event, but a lower probability of having a fiscal event followed by a growth event. This pattern is largely reflecting the distribution of fiscal and growth events in the Middle East and Sub-Saharan Africa. Suppose then that the success of a fiscal event can indeed be measured by whether or not it is followed by a growth event. One is then tempted to add that these patterns could reflect the quality of underlying institutions. Indeed, according to many indicators, Sub-Saharan Africa and the Middle East have bad scores on several indicators of institutional quality.

Note that when we use the alternative definition of fiscal event allowing Low-income countries to increase their average fiscal deficit during the fiscal spending growth period up to 4% of GDP, 3 additional fiscal events followed by a growth event are identified: Mali, Mauritius and Burkina Faso. Then, under this scenario, the probability that a fiscal event is followed by a growth event in Middle East and Africa increases from 11% to 21%.

Insert Table 1 here. Fiscal event probabilities

4. Understanding Fiscal Events:

The Anatomy of fiscal Events. The benchmark set of parameters selected 95 fiscal events. Table 2 describes the changes in the composition of fiscal expenditures around these events. The table shows average values and changes for the 5-year period preceding the event and the 5-year following the event, comparing between events that preceded a growth event and events that did not precede a growth event, focusing on "Low and Middle Income" countries.

Table 2: Characteristics of Fiscal Events in Developing countries According to Their Timing with Growth Events

First note that the level of the deficit in GDP is lower during fiscal events followed by a growth event, a result that is corroborated by the regression analysis below.[10]

[10] As discussed in section 2, insofar as the growth event occurs during the 5-year period when the fiscal deficit is computed, there could be a mechanical effect whereby the fiscal deficit will be lower during spells of high growth. On the other hand, the evidence for developing countries

Three other significant differences appear when one compares the evolution of fiscal expenditure for the two groups of events. First, fiscal events followed by growth events devote fewer resources to general public services. Second, fiscal events followed by a growth event are characterized by a growing share of transport and communication expenditure whereas the pattern is the opposite when the fiscal event is not followed by a growth event. Third, though the difference in means is not statistically significant, there is a higher growth in education expenditures when the fiscal event is followed by a growth event than when it is not (and the opposite pattern holds for health expenditures).

Correlates of Growth Events. As a final exercise, as in HPR, we check if fiscal events enter the set of growth event correlates. The dependent variable is then a dummy that takes the value of 1 in the 3-year window around the date of growth acceleration (and 0 otherwise), the 3-year window (as in HPR) reflecting the uncertainty attached to the identification of the first year of a specific growth event.[11] The comparison group for a growth event consists of the countries that have not had a growth episode in that same 3 years. We estimate the following probit[12] where the binary dependant variable (the 3-year window around the date of the year of the growth event, GE_{it}) is regressed on several determinants:

$$\Pr\left(GE_{it}=1\right)=\phi\left(\alpha_0+\alpha_1 FE_{it}+\alpha_2 WW_{it}+\alpha_3 TOT_{it}+\alpha_4 HI_{it}+\sum_{t-1}\beta_t D_t\right) \text{ for } i=1..104;\ t=1..24 \qquad (1)$$

where:

ϕ is the cumulative normal distribution;

FE_{it} is a dummy variable that takes the value of 1 at the date of the fiscal event as defined in the benchmark above and during the four years following this date;

WW_{it} is a proxy for trade (and other) reforms, i.e. a dummy taking the value of 1 during the first five years of a transition towards openness as defined by WW (2003);

TOT_{it} is a proxy for any external shock, i.e. a dummy taking the value of 1 if the change in the terms of trade for country i and year t is in the upper 90% of the entire

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shows that fiscal expenditures and fiscal deficits are higher during periods of high growth (more capital inflows and "voracity" effects in the political cycle).

[11] Growth events are computed according to the same benchmark with 58 growth events. Because we are interested in predicting the timing of growth events, we drop all data corresponding to years *t+2*...*t+4* of a growth event. The sample then consists of all countries for which the relevant data are available, including countries that have not experienced growth episodes.

[12] We also fit a *logit*. Both *probit* and *logit* fit maximum likelihood models with dichotomous dependent variables coded as 0/1. With a *logit* model, equation (1) would be identical except for ϕ which is the cumulative logistic distribution rather than the cumulative normal distribution. It is difficult to theoretically justify the choice between these two models. Note that the logistic distribution being very similar to the normal one, results are usually identical. However, some differences in results could appear in very unbalanced sample, i.e. in a sample in which there are many more 0s than 1s, which is our case. This is why, as a robustness check, we also present logit estimation results.

sample. Following HPR, this variable is introduced to capture exceptionally favorable external circumstances;[13]

HI_{it} is a dummy equals to one for High Income countries;

$\sum_{t-1} D_t$ is a full set of year effects.

In equation (1), the year dummies capture the effects of omitted time-related variables like common shocks across countries that could account for a growth event. As to the fiscal dummy event variable, FE_{it}, it is a way to test whether, on average, growth events are preceded by fiscal events. The inclusion of the WW_{it} dummy for trade reform is both to capture the potential growth effects of a trade reform, but also the effects of other ongoing reforms since, very often, trade reforms are part of a broader package of reforms. Finally, as pointed out by Easterly et al. (1993), it is also plausible that many growth acceleration are triggered by favorable external conditions, especially in our context where, due to the short length of time series, we defined growth events over a 5-year window.[14] To control for this, we introduce the TOT_{it} dummy.

Insert Table 3 here. Probit Estimates of Growth events

Before commenting on the results, one should caution about the endogeneity problems, especially of the fiscal event dummy. It could be that in country-events when growth is anticipated to be unusually high, one might think that policy-makers would increase discretionary public spending (simultaneous bias if this increase occurs with a decreasing associated deficit). Unfortunately, we lack appropriate instruments, so the results should be interpreted accordingly.

Cols. (1) and (2) in table 3 report the marginal coefficients corresponding to the estimation of (1) on the whole and on the "non high income" samples respectively. Hence, the reported coefficients give directly the change in the probability that a growth event occurs for a discrete change of the corresponding dummy variable from 0 to 1.

Col. (1) which reports estimates for *all* countries, shows that the coefficient associated with FE_{it} is significantly positive (at the 5% level) implying that, on average, a fiscal event increases the probability of experiencing a growth event in the five consecutive years by 3.8 percentage points. [15]

[13] The change in the terms of trade is computed as the first difference of the log of the terms-of-trade index , the latter defined as the ratio of export prices to import prices using the current and constant price values of exports and imports from WDI. We use this index instead of the more traditional net-barter index because of its broader coverage. However, this measure has the disadvantage that it includes the service export sector (see the discussion in Loayza and Raddatz, 2007).

[14] Easterly et al. (1993) showed that about 10 percent of the variation in GDP growth and a quarter of the variation in growth volatility can be explained by the observed differences in the volatility of terms-of-trade changes.

[15] As argued in section 2, in "non-high" income countries, evidence suggests that fiscal policy typically pro-cyclical. Hence, if a growth event occurs in the year following a fiscal event, this

Turning to the variable that captures the five years following economic reform (other than fiscal) through trade liberalization, WW_{it}, surprisingly, the coefficient is significantly negative. This coefficient was also negative but not significantly in HPR. However, this surprisingly negative coefficient does not necessarily contradict WW (2003) results since when they study the timing of the growth response to trade liberalization they find that, in the 3 pre-liberalization years, growth is slightly depressed and that, in the 3 years following liberalization, the effect is not significantly different from zero. However, an increase in growth becomes noticeable (of around 1.5 percentage point) after 4 years.[16]

As expected, we observe a strong conditional correlation between external shocks and the probability of a growth event: a large positive terms-of-trade shocks increases the probability of experiencing a growth event by 12.9 percentage points (significant at a 10% level). This confirms that the incidence of external shocks and, in particular, fluctuations in the terms of trade plays an important role. Finally, the high income dummy is not significantly different from zero so that when we limit our sample to "non high income" countries (see col. 2), coefficients remains very similar.

Recent literature assessing the effects of public expenditures on growth (e.g. Kneller *et al.*, 2000, Bose *et al.*, 2003, and Adam and Bevan, 2005) has emphasized the importance of incorporating the budget constraint. Here we check whether the impact of a fiscal event on the probability of a growth event is directly correlated with the level of the associated deficit by introducing the fiscal event dummy FE_{it} interactively with its associated deficit/surplus level $\overline{def}_{t_{FE},t_{FE}+n}$ (t_{FE} being the date of the fiscal event, n=4).[17]

Results reported in col. (3) and (4) show that the associated coefficient is significantly positive (at 1% level) indicating that the marginal impact of a fiscal event depends on both coefficients (associated to FE_{it} and $FE_{it} * \overline{def}_{t_{FE},t_{FE}+n}$). This means that the probability of occurrence of a growth event in the 5 years following a fiscal event is greater the lower the associated fiscal deficit, confirming the prima facie appropriateness of fiscal policy as a stabilizing device. It would however, be premature to read into these results that there may not be a trade-off between the stabilization and growth objectives of fiscal policy, since omitted variables correlated with the regressors are likely to influence these results. Coefficient values associated with WW_{it} and TOT_{it} remain unchanged.

To ease interpretation, table 4 reports for a typical Low and Middle Income country, the impact of a fiscal event on the occurrence of a growth event for different values of

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should increase the deficit, weakening the probability of observing fiscal events followed by a growth event.

[16] Remember that one of the conditions for a growth event in this paper is an increase in the annual growth rate of per capita GDP of at least 2 pp. Hence, if we redefine the dummy WW_{it} in order to capture the years [t+5 and more] after the trade liberalization instead of [t; t+4] as previously, we obtain a positive coefficient, though its value is not statistically significant.

[17] Of course, the fiscal deficit/surplus situation is implicitly already taken into account as one of the conditions defining what we call a "Fiscal event" is that a deficit situation must improve.

the associated deficit/surplus. As indicated in the table, for a typical Low or Middle Income country and in the absence of a fiscal event in the five preceding years, the probability of a growth event is around 7.8%.[18] This probability is quite similar in case of a fiscal event with an associated fiscal deficit equals to 3% of GDP (only 0.06 percentage point of difference).[19] The probability of a growth event increases to 9.6% in case of a fiscal event in a deficit situation of 2% of GDP, and reaches 16.9% in a surplus situation of 1%, implying an increase in growth event probability of 9.1 percentage point compared to the no-fiscal-event alternative. Remember that to be qualifying as fiscal event this deficit can not increase with public expenditure.

Insert Table 4 here. Interpretation of Probit Model Results [a/]

Finally, table 5 reports statistics of the predictive ability of this Probit model. It is customary to take a prediction rule with a threshold value is p* = 0.5, on the basis that we would predict a 1 if the model says a 1 is more likely than a zero :

$$\widehat{GE}_{it} = 1 \text{ if the predicted probability } \hat{\phi} > \text{p*}$$

However, because of the unbalanced sample with many more 0s than 1s, we set p* equal to the proportion of 1's in the sample (which corresponds to the average predicted probability in the sample).

Taking this criterion, table 7 suggests that the basic model as defined in table 5, column (4), successfully predicts 78% of the growth events (i.e. $GE_{it}=1$) and 62.3% of total cases of no growth events (i.e. $GE_{it}=0$). Hence, 64.2% of total growth event observations are correctly predicted. Since this measure of goodness of fit depends on the cutoff selected to classify the predicted $\widehat{GE}_{it}$, one should only interpret the results in table 7 as indicative orders of magnitude.

Insert Table 5 here. Prediction Accuracy of the Probit Model [a/]

We carry out two robustness checks. First, as discussed above, we estimate a logit function (which has fatter tails and may be more appropriate for our sample with many zero values for the dependent variable). Results in columns (5) and (6) of table 3 show that the logit specification does not change the qualitative conclusions based on results in col. (3) and (4). Second, we change the definition of FE_{it} with (i) the dummy that takes the value of 1 at the date of the fiscal event and during the 9 years following this date (instead of 4), giving more time for the effects of a fiscal event to have an impact on growth and (ii) different parameters in the "fiscal event" definition (corresponding to the sensitivity analysis in table A.1). Estimates are not qualitatively altered. We also

[18] Based on results in table 3, col.(4) with $FE_{it} = 0$, all other variables set at their sample mean.

[19] Based on results in table 3, col.(4) with $FE_{it} = 1$, all other variables set at their sample mean.

considered the dependent variable as censored at zero, using a tobit estimator, but without any further insights.[20]

5. Conclusions

This paper constructed growth and primary spending expenditures (i.e.net of interest payments) "events" over the period 1972-2005 for 118 developing and 22 High Income OECD countries. Fiscal expenditures were compiled by Government function, and "events" were sought over 5-year rolling windows. Significant "events" were approximately constructed as follows. For GDP per capita, acceleration in the average annual growth rate of 2 percentage point per annum (ppa) between any rolling 5-year window would qualify for a growth "event". For fiscal expenditures (expressed in GDP%), an increase in the average growth rate of approximately 1 ppa that would not be accompanied by an aggravation of the (consolidated central government) fiscal deficit beyond 2% of GDP would likewise qualify for a fiscal "event". The resulting benchmark constructed data set (merging both fiscal and growth databases) had 58 growth events and 95 fiscal events over a sample included 107 countries (84 developing countries) over 1977-2000 (1452 observations).

For this sample, the (unconditional) probability of occurrence of a fiscal event is about 10%, and, for a large range of parameter values for the selection of a "significant" event, the probability of a growth event once a fiscal event had occurred is in the 22%- 28% range. The probability of occurrence of a fiscal event is higher for the bottom half of the income distribution of countries, but the probability that this fiscal event is followed by a growth event is higher for the third quartiles, corresponding to middle income countries (which are largely in Latin America). The probability of a fiscal event *not* followed by a growth event is significantly higher for the Africa region, prompting us to note that this result is coherent with the view that the success of a growth-oriented fiscal expenditure package hinges on the quality of the institutional environment.

Concentrating on the Low and Middle Income sample of 84 countries, the paper investigates the differences in the pattern of functional expenditures for fiscal events followed by growth events compared to those not followed by a growth event. In addition to a significantly lower fiscal deficit for fiscal events followed by a growth event (which is partly an outcome of the way events were constructed), three other significant differences appear. First, fiscal events followed by growth events devote fewer resources to general public services. Second, fiscal events followed by a growth event are characterized by a growing share of transport and communication expenditure whereas the pattern is the opposite when the fiscal event is not followed by a growth event. Third, though the difference in means is not statistically significant, there is a higher growth in education expenditures when the fiscal event is followed by a growth event than when it is not.

This description of the anatomy of fiscal events and their relation to growth events is completed by statistical analysis where a few controlling factors are included in a probit estimate of growth events on fiscal events. On average, we find that a growth event is

[20] Reflecting poor-quality fiscal data, estimates from a Tobit regression using actual values for growth and primary spending yielded large standard errors.

more likely to occur when surrounded by a fiscal event. Second, controlling for the growth-related effects of other reforms and for favorable external conditions shocks, we estimate that for a typical developing country, the probability of occurrence of a growth event in the five years following a fiscal event is increased as the associated fiscal deficit is limited.

APPENDIX
FISCAL AND GROWTH EVENTS: DEFINITIONS AND SENSITIVITY ANALYSIS

Growth acceleration. The criterion is GDP per capita growth at time t over horizon t to $t+n$,. i.e. $g_{t,t+n}$ defined by the following:

$$\ln\left(y_{t+i}\right) = a + g_{t,t+n} * i, \quad i = 0, \cdots, n \tag{2}$$

y_t being the GDP per capita (from the PWT 6.2). The change in the criterion function is given by the change in the OLS estimated growth rate over horizon n across that horizon:

$$\Delta g_{t,n} = \hat{g}_{t,t+n} - \hat{g}_{t-n-1,t-1} \tag{3}$$

A growth acceleration will be identified when, during rapid growth episodes, the following conditions are all satisfied:

$$\begin{aligned} &\hat{g}_{t,t+n} \geq \alpha \ ppa \quad \textit{growth is rapid} \\ &\Delta g_{t,n} \geq \beta \ ppa \quad \textit{growth accelerates} \\ &y_{t+n} \geq \max\left\{y_i\right\}, i \leq t \quad \textit{post} - \textit{growth output exceeds pre} - \textit{episode peak} \end{aligned} \tag{4}$$

where ppa is percentage points per annum, α is minimum per capita growth that must be satisfied during the period (3.5 ppa for HPR and for us in our base case) and β is the minimum acceleration that must be satisfied (2.0 ppa in the benchmark case). Since several years of events could be following one another, the timing of the initiation of the growth acceleration episode is chosen by fitting for each candidate year the following spline regression:

$$\ln\left(y_{t+i}\right) = a_0 + g_{t-n-1,t+n} * i + a_1 DE + vg_{t+i,t+n} * i * DE, \quad i = -n-1, \cdots, n \tag{5}$$

where DE is a dummy variable that takes a value of 1 for the candidate event year. Equation (5) is estimated by OLS over each candidate year, and the selected event year is the one for the regression with the highest F-test (i.e. highest R^2).

Fiscal events. From the GFS data , we define primary expenditures (*dfe*) as total fiscal expenditures less interest payments (*ip*). The government budget constraint (small case variables represent variables expressed as a share of GDP) is:

$$trg \equiv dfe + ip + def \tag{6}$$

with *trg* the total revenue and grants in % of GDP, and *def* the fiscal deficit/surplus in % of GDP.[21] Using the same notation as above to define the length over which changes in the ratio of primary spending takes place:

$$\left(dfe_{t+i}\right) = a + g^{dfe}{}_{t,t+n} * i, \quad i = 0, \cdots, n \tag{7}$$

[21] *def*<0 is defined as a deficit and *def*>0 a surplus.

An acceleration in primary spending will be identified when there is an increase in the estimated growth of ratio of primary expenditures as a percentage of GDP, $\widehat{\Delta g^{dfe}}$. Define now $\overline{def}_{t,t+n}$ as the average deficit (as a % of GDP) over the period so that the change in deficit between two adjacent periods is

$$\Delta def_{t,n} \equiv \overline{def}_{t,t+n} - \overline{def}_{t-n-1,t-1} \tag{8}$$

We impose two criteria for an increase in ratio of primary expenditures growth, Δdfe, to qualify as a fiscal "event". The first criterion deals with situations when the increase in expenditures takes place from a situation of fiscal deficit. Take then the case of a fiscal deficit in the period preceding the candidate fiscal event and let δ be the selected threshold value for the central government deficit. In our sample, for developing countries, the average (central government) fiscal deficit was 2%. So, if increasing primary expenditures take place from a situation of deficit, i.e. when $\left(\overline{def}_{t-n-1,t-1} < \delta\right)$, we require an improvement in the fiscal deficit of λ (with $\lambda = 0$ corresponding to a situation of no deterioration) . This gives rise to the condition on the second line of (8).

$$\begin{aligned} &\Delta g^{dfe}_{t,t+n} \geq \phi,\ \phi > 0 \quad \textit{discretionary expenditure growth is rapid} \\ &\begin{cases} \Delta def_{t,n} \geq \lambda \ \textit{ if } \overline{def}_{t-n-1,t-1} < \delta \ \textit{ a deficit situation must improve} \\ \overline{def}_{t,t+n} \geq \gamma \ \textit{ if } \overline{def}_{t-n-1,t-1} > \delta \ \textit{ a limit on a growing deficit} \end{cases} \end{aligned} \tag{9}$$

In the case of a more favorable initial situation (i.e. $\left(\overline{def}_{t-n-1,t-1} > \delta\right)$), we wish to exclude events where the shift to a deficit results in an average deficit in excess of γ during the period $(t, t+n)$. This is the criterion in the third line of (9).

Sensitivity analysis. Table A1 reports the results of a sensitivity analysis. In the benchmark case, we choose $\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$ in equations (4). This case reported in row 1 yields 58 growth events. For the corresponding benchmark fiscal events, we settled for the following fiscal parameter set $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$ which yields 95 fiscal events. As shown in table A1, tighter conditions always lead to less qualifying events. However, the ratio of fiscal events followed by a growth event remains in the 22%-28% range, except when we require that the fiscal event be accompanied throughout by a fiscal *surplus* in which case 41% of fiscal events are followed by a growth event (row 8). Likewise, rows 9-13 carry out similar sensitivity analysis for the growth event parameters. Finally, note that if we define periods of 8 years instead of 5 (n=7), the benchmark set of parameters leads to 52 fiscal events and 18 growth events over the reduced period 1980-1997.

Table A.1: Benchmark Events and Sensitivity Analysis

	Total number of events in		**Growth events preceded by a fiscal event**		**Fiscal event**										
					followed by a growth event		*including the ones simultaneous to growth events*		*Also preceded by a growth event*		**only preceded by a growth event**		**w/o any growth event**		Total
	Growth	Fiscal													
	(1)	(2)	(3)	**(3)/(1)**	(3)	**(3)/(2)**	(4)	(4)/(2)	(5)	(5)/(2)	(6)	**(6)/(2)**	(7)	**(7)/(2)**	(3)+(6)+(7)/(2)
Benchmark Growth Event - unchanged $\left(\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\}\right)$															
Fiscal Event conditions:															
1. $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*7*	*7.4%*	23	**24.2%**	47	**49.5%**	100%
2. $\phi = 0.005; \lambda = 0; \gamma = -0.02; \delta = 0$	58	123	28	**48.3%**	28	**22.8%**	*6*	*4.9%*	*6*	*4.9%*	29	**23.6%**	66	**53.7%**	100%
3. $\phi = 0.02; \lambda = 0; \gamma = -0.02; \delta = 0$	58	49	14	**24.1%**	14	**28.6%**	*4*	*8.2%*	*1*	*2.0%*	11	**22.4%**	24	**49.0%**	100%
4. $\phi = 0.02; \lambda = 0; \gamma = -0.02; \delta = -0.02$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*6*	*6.3%*	24	**25.3%**	46	**48.4%**	100%
5. $\phi = 0.01; \lambda = -0.02; \gamma = -0.02; \delta = 0$	58	107	27	**46.6%**	27	**25.2%**	*7*	*6.5%*	*6*	*5.6%*	26	**24.3%**	54	**50.5%**	100%
6. $\phi = 0.01; \lambda = 0.01; \gamma = -0.02; \delta = 0$	58	81	23	**39.7%**	23	**28.4%**	*5*	*6.2%*	*4*	*4.9%*	19	**23.5%**	39	**48.1%**	100%
7. $\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0$; $ge_{t,t+n} > 0$	58	87	21	**36.2%**	21	**24.1%**	*3*	*3.4%*	*8*	*9.2%*	22	**25.3%**	44	**50.6%**	100%
8. $\phi = 0.01$; $\overline{def}_{t,t+n} \geq 0$	58	37	15	**25.9%**	15	**40.5%**	*3*	*8.1%*	*4*	*10.8%*	10	**27.0%**	12	**32.4%**	100%
Fiscal Event condition unchanged $\left(\phi = 0.01; \lambda = 0; \gamma = -0.02; \delta = 0\right)$															
Growth Event conditions:															
9. $\alpha = 0.035; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$	58	95	25	**43.1%**	25	**26.3%**	*6*	*6.3%*	*7*	*7.4%*	23	**24.2%**	47	**49.5%**	100%
10. $\alpha = 0.02; \beta = 0.02; y_{t+n} \geq \max\{y_i\}$	74	95	31	**41.9%**	31	**32.6%**	*5*	*5.3%*	*9*	*9.5%*	27	**28.4%**	37	**38.9%**	100%
11. $\alpha = 0.035; \beta = 0.01; y_{t+n} \geq \max\{y_i\}$	70	95	28	**40.0%**	28	**29.5%**	*6*	*6.3%*	*9*	*9.5%*	25	**26.3%**	42	**44.2%**	100%
12. $\alpha = 0.02; \beta = 0.01; y_{t+n} \geq \max\{y_i\}$	95	95	33	**34.7%**	33	**34.7%**	*6*	*6.3%*	*14*	*14.7%*	30	**31.6%**	32	**33.7%**	100%
13. $\alpha = 0.035; \beta = 0.02;$	72	95	29	**40.3%**	29	**30.5%**	*6*	*6.3%*	*6*	*6.3%*	25	**26.3%**	41	**43.2%**	100%

Source: Authors' computation from GFS and PWT 6.2 data.

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