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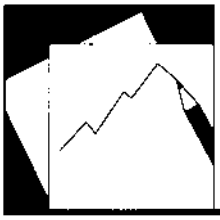

IMF Working Paper

Is Social Spending Procyclical?

Javier Arze del Granado, Sanjeev Gupta,
and Alejandro Hajdenberg

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Fiscal Affairs Department

Is Social Spending Procyclical?[1]

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Abstract

This paper studies the cyclical behavior of public spending on health and education in 150 countries during 1987–2007. It finds that spending on education and health is procyclical in developing countries and acyclical in developed countries. In addition, education and health expenditures follow an asymmetric pattern in developing countries; they are procyclical during periods of positive output gap and acyclical during periods of negative output gap. Furthermore, the degree of cyclicality is higher the lower the level of economic development.

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I. INTRODUCTION

Whether fiscal policy follows an economic cycle in industrial and developing countries has been the subject of several studies. Most studies reach the broad conclusion that fiscal policy is cyclical in developing countries and countercyclical or acyclical in industrialized ones.[2] While cyclicality can originate from revenues as well as expenditures, these results are mainly derived from the analysis of public expenditures. Cyclicality then reflects changes in expenditures arising from discretionary actions by policymakers or from the operation of automatic stabilizers. As far as we know, there is no study that analyzes the cyclical properties of public spending on education and health in developing countries. There is one study of health spending in OECD countries (Darby and Melitz, 2008) and several that assess variation in spending by economic classification.[3] The purpose of this paper is to fill this gap. This would help answer the question of whether these countries squeeze spending on social sectors during economic downturns. Such cutbacks (for example, in early-age education or nutrition programs) have been shown to have a permanent impact on human development.[4]

A number of hypotheses have been put forward to explain why the cyclical pattern of public expenditures differs in advanced and developing economies. One strand of the literature emphasizes the lack of access to international credit markets by developing countries during recessions, which constrains their ability to increase spending.[5] A second strand of studies focuses on political economy considerations. Developing countries are prone to a "voracity" effect, whereby the competition among various interest groups for a common pool of resources leads to a more-than-proportional increase in public spending in response to a positive income shock (Perotti, 1996; Velasco, 1997; and Tornell and Lane, 1999). Industrial and developing countries differ in the extent to which fiscal resources are a common pool, and the extent to which the institutional framework can restrain spending demands. In a similar vein, Hercowitz, and Strawczynski (2004) find evidence of "cyclical ratcheting" in OECD countries, that is, an asymmetric response of government spending over the cycle leading to higher spending over time. This owes to the inability of governments to resist pressure from interest groups to contain spending when revenues increase during boom times and the implementation of countercyclical expenditure policies during busts.[6]

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[2] For example, see Gavin and Perotti (1997), Tornell and Lane (1999), Agénor et al. (1999), Kaminsky, Reinhart, and Végh (2004), Alesina and Tabellini (2005), Akitoby et al. (2006), Stein et al. (1999), Talvi and Végh (2000), and Ilzetzki and Vegh (2008).

[3] Kaminsky, Reinhart and Végh (2004), and Akitoby et al. (2006), Galí and Perotti (2003).

[4] For further discussion of this point see IDB (2009) and references therein.

[5] For example, see Gavin and Perotti (2007), Riascos and Végh (2003), Caballero and Krishnamurthy (2004), and Susuki (2006).

[6] Buti and Sapir (1998) and Balassone, Francese and Zotteri (2008) find similar evidence in EU countries.

The above-noted arguments hold for discretionary fiscal policy, but differences in the cyclicality of fiscal policy between industrial and developing countries are also attributable to the operation of automatic stabilizers. The latter are typically smaller in developing countries owing to lower revenue-to-GDP ratios, and because tax systems and public expenditure structures are not very sensitive to the cycle.

The rest of the paper is organized as follows. The next section presents the empirical strategy and data. Section III provides the results. Section IV discusses policy implications and concludes.

II. THE EMPIRICAL STRATEGY AND DATA

Our estimation strategy, following the literature, consists of regressing the log difference of real government total spending, real public health spending, and real public education spending on log differences of real GDP[7] and selected control variables.[8] The source for the total spending variable is the IMF's World Economic Outlook (WEO) database. This dataset reflects central government data whenever general government spending is not available. Data on expenditures on education and health are compiled from various IMF reports and databases.[9] One weakness of this database is that in assembling it the country authorities may not have followed a common methodology. In any case, we checked our series for consistency against other datasets compiled by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the World Health Organization (WHO), and the World Bank Development Indicators (WDI) (see Annex 1 for the list of the countries covered in our database and the number of observations for each country).

The control variables, consisting of the lagged fiscal balance as a percent of GDP and the log difference of the terms of trade, are also obtained from the WEO database.[10] These control

[7] Alternatively, the output gap could be used. We explored this option; however, this specification did not pass the Hansen tests for S-GMM nor the Durbin-Wu-Hausman tests of exogeneity for an Instrumental Variables Fixed Effects model (IV-FE). Both, the fiscal variables and GDP growth could also be expressed as deviations from a long-run trend by using the Hodrik-Prescott filter. Yet there are well-known problems associated with detrending series in developing countries which could add substantial measurement error to our estimation. Both of the econometric methodologies employed in this paper control for country-specific effects, either by time-demeaning the variables or by first differencing, which helps to overcome this problem.

[8] Education and health spending were converted into constant prices in domestic currency using the GDP deflator. The conclusions of the paper do not change if CPI is used instead of GDP deflator. In any case, the GDP deflator is preferable since it also captures changes in prices of intermediate inputs.

[9] Data classified along the UN's COFOG functional classification of expenditure are also available in the Government Financial Statistics (GFS) database. However, country coverage therein is too spotty, and not suitable for the econometric analysis performed in this study.

[10] See Annex 2 for correlations among all variables used.

variables have been used in several studies on fiscal cyclicality (e.g., Gavin and Perotti, 1997; Clements, Faircloth, and Verhoeven, 2007; Jaimovich and Panizza, 2007). The lagged fiscal balance captures the potential effect of borrowing constraints on public spending. Countries with high initial fiscal deficits are perceived to be at a greater risk of debt default and as a result have a lower access to capital markets during recessions. They would be expected to exhibit a higher degree of procyclicality. The rate of change in the terms of trade is meant to capture the effects of external shocks on fiscal cyclicality. The impact of external shocks is often more pronounced in developing countries due to the close connection between the budget and the foreign sector.

We estimate the following equation:

$$d(\log EXP_{i,t}) = \beta_{0,i} + \gamma_t + \beta_1 d(\log Y_{i,t}) + \beta_2 DEF_{i,t-1} + \beta_3 d(\log TOT_{i,t}) + u_{i,t} \quad (1)$$

where β_0 is a country fixed effect which controls for heterogeneity across countries, γ is a year fixed effect capturing common shocks across countries at a given point in time, *EXP* is the real value of the government spending variable of interest; *Y* is real GDP; *DEF* is the overall fiscal balance as a percent of GDP, *TOT* is an index of the country's terms of trade, and *u* is an error term. The subscripts *i* and *t* denote country and time period, respectively.

The coefficient β_1 measures the degree of cyclicality of public spending. It measures the elasticity of government spending with respect to output growth. A positive value of β_1 implies procyclical behavior, a value above unity implies a more-than-proportionate response to output fluctuations, and a negative value indicates countercyclical behavior.

The literature has often found that public expenditures respond asymmetrically during good and bad times. Notably, Gavin and Perotti (1997), and later others, found that fiscal policy is asymmetrical in industrial countries but not in developing countries. We examine this hypothesis by estimating a variation of equation (1) where we take the real GDP growth variable (*Y)* depending on the cycle. *Good times* are defined as those periods when the output gap (actual minus potential GDP) is positive, and *bad times* when the output gap is negative.[11]

Finally, we examine the cyclicality of expenditures in countries at different levels of development. For this purpose, we classified developing countries into three subgroups according to their levels of per capita income.[12]

[11] Potential output for each country is computed with a Hodrick-Prescott filter.

[12] Countries are divided according to 2008 GNI per capita, calculated using the World Bank Atlas method. The groups are: low-income, $975 or less; lower-middle income, $976 - $3,855; upper-middle income, $3,856-$11,905. See Annex 1 for a list of the countries included in each group.

In the first instance, we estimated equation (1) by a fixed effects model (FE).[13] However, a problem with this specification, as highlighted, among others, by Rigobon (2004), is that it can only be considered a spending reaction function, providing a measure of the cyclicality of fiscal policy, if GDP were exogenous with respect to fiscal policy. To address the potential endogeneity problem we examined two different approaches. The first one consisted of estimating the equation by instrumental variables fixed effects (IV-FE).[14] Our second strategy consisted of estimating the model by the System-Generalized Method of Moments (S-GMM) proposed by Blundell and Bond (2000). S-GMM is our preferred model in light of the results obtained from various econometric tests, hence we focus our discussion on this model only.[15] Annex 4 reports estimation results from FE and IV-FE models.

Table 1 presents descriptive statistics for the variables used in the study. We use annual data for the period 1987-2007 covering 150 countries. This dataset includes 29 advanced countries and 121 developing countries.[16] The sample contains 35 higher-middle income countries, 47 lower-middle income countries, and 37 low-income countries.

On average, developed countries devote roughly the same share of spending to health and education (Table 2). In developing countries, however, the average expenditure share in health expenditures is substantially lower than that of education. Despite substantial volatility (Figure 1, left top and bottom panels), health and education spending seem to be following a mildly increasing trend since the mid 1990s, as indicated by the rising level of education and health expenditures as a percent of GDP, particularly since 2000 (Figure 1, right top and bottom panels).

[13] All models discussed in this paper included time period dummies to control for global shocks.

[14] Following Lane (2003) and Jaimovich and Panizza (2007), we instrumented the domestic output growth rate with two variables: one measuring external shocks equal to the real output growth of trading countries, weighted by their share of exports, and the other by the lagged real domestic output growth.

[15] See Annex 3 for additional notes on the econometric approach.

[16] The sample size corresponds to the number of countries for which data on total expenditures are available for univariate regressions. The sample size varies for multivariate as well as for education and health regressions.

Table 1. Descriptive Statistics

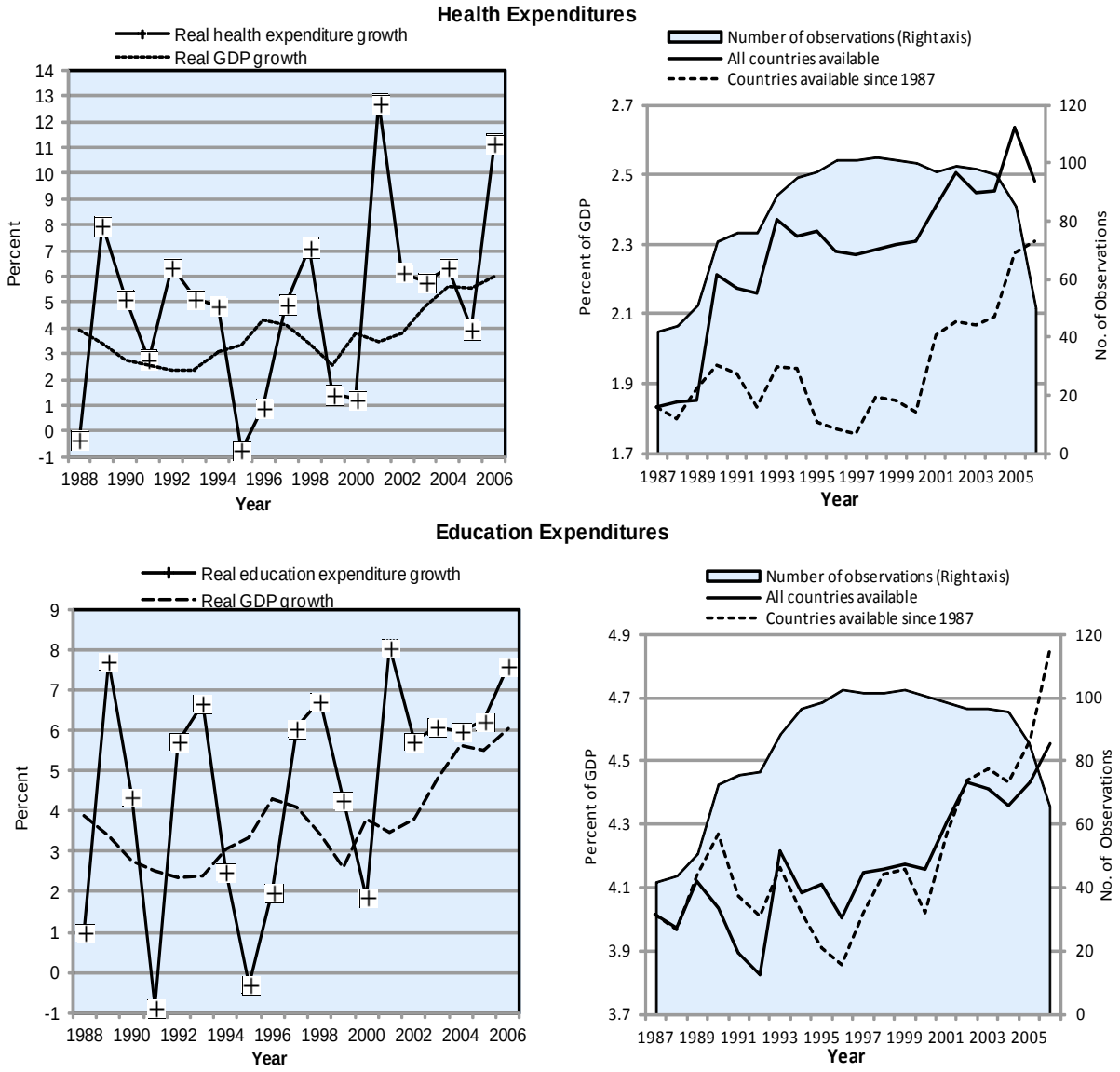
	Total Expenditure	Education Expenditure	Health Expenditure	GDP	Terms of Trade	Fiscal Balance 1/	Good Times 2/	Bad Times 2/
	Real growth (in percent)							
Developing Countries								
Mean	3.9	4.8	4.9	4.1	105.8	-3.0	0.1	0.0
Standard Deviation	11.4	14.1	17.4	4.2	38.2	4.2	0.0	0.0
Maximum	42.4	53.8	76.3	19.8	569.6	13.6	0.2	0.1
Minimum	-37.6	-49.1	-63.9	-12.7	22.2	-17.6	0.0	-0.1
Observations	2,096	1,409	1,397	2,096	2,096	2,062	1,119	961
Developed Countries								
Mean	2.6	3.4	4.5	3.0	100.3	-2.1	0.0	0.0
Standard Deviation	4.9	5.3	7.6	2.3	6.3	4.0	0.0	0.0
Maximum	36.0	32.1	72.3	11.1	140.1	12.1	0.1	0.0
Minimum	-34.5	-21.1	-34.2	-6.4	70.2	-14.5	0.0	-0.1
Observations	509	445	509	509	509	506	253	255
Higher middle income								
Mean	3.4	4.4	5.0	3.8	107.8	-2.1	0.1	0.0
Standard Deviation	9.9	10.6	13.0	4.2	46.7	4.5	0.0	0.0
Maximum	39.9	53.8	49.9	16.8	569.6	13.5	0.2	0.1
Minimum	-35.5	-41.4	-42.3	-12.7	22.2	-17.6	0.0	-0.1
Observations	585	369	361	585	585	575	312	263
Lower Middle Income								
Mean	4.1	4.7	5.2	4.2	99.8	-2.8	0.1	0.0
Standard Deviation	10.6	14.2	16.1	4.1	23.0	4.3	0.0	0.0
Maximum	41.1	52.9	76.0	19.8	300.0	13.6	0.2	0.1
Minimum	-37.6	-47.4	-62.1	-12.4	26.7	-17.1	0.0	-0.1
Observations	834	556	556	834	834	819	449	383
Low Income								
Mean	3.9	5.1	4.6	4.1	111.4	-3.8	0.1	0.0
Standard Deviation	13.4	16.2	21.4	4.2	43.7	3.6	0.0	0.0
Maximum	42.4	53.8	76.3	19.2	493.6	9.3	0.2	0.1
Minimum	-35.0	-49.1	-63.9	-12.0	39.5	-17.0	0.0	-0.1
Observations	677	484	480	677	677	668	358	315

1/ In percent of GDP.
2/ Statistics reported for this variable do not take into account zero values.

Table 2. Share of Education and Health Expenditures in Total Expenditures

	Average		St Dev.		Observations	
	Education	Health	Education	Health	Education	Health
All	14.5	9.6	4.5	4.5	1482	1482
Developed Countries	13.2	13.1	3.2	3.8	422	422
Developing Contries	15.0	8.1	4.8	3.9	1060	1060

Figure 1. Health and education Expenditure Trends



III. ESTIMATION RESULTS

Table 3 reports the estimation results of equation 1 without the control variables. For developed countries, the coefficients for GDP growth are statistically insignificant for all three spending categories, pointing to acyclicality. These results are in line with those found in the previous literature (inter alia, Gavin and Perotti 1997, Kaminsky, Reinhart and Végh 2004, Talvi and Végh 2005, and Jaimovich and Panizza 2007).[17] Regarding health spending, our findings differ from Darby and Melitz (2008), who found a countercyclical pattern in OECD countries. Our results are different for developing countries; all estimates are positive and statistically significant, signaling procyclical behavior. In what follows next, we focus our discussion on developing countries, as the result of acyclicality for developed countries was unchanged in all subsequent estimations.

Table 3. Cyclicality of Public Expenditures (Univariate model)

	Developed Countries			Developing Countries		
Dependent Variable:	Total Expenditures	Education	Health	Total Expenditures	Education	Health
Change in Log Real GDP	0.12	0.23	0.85	1.84**	3.04*	2.22**
	(0.24)	(0.36)	(1.17)	(4.02)	(2.34)	(4.02)
Hansen J Statistic (p-value)	0.12	0.01 /a	0.13	0.35	0.95	0.42
AR(2) in first differences (p-value)	0.17	0.70	0.28	0.29	0.06	0.49
Number of Instruments	3	3	3	3	3	3
Number of Countries	29	29	29	120	115	113
Number of Observations	623	448	512	2,443	1,687	1,661

Notes: ** p<.01, * p<.05, + p<.1. *t*-statistics reported in parentheses.
/a Hansen test rejects the validy of instruments using the second lag of GDP growth and also for further lag structures.

We report estimation of equation 1 with control variables in Table 4. The results are broadly similar to those reported above, with spending being procyclical in all three categories of spending studied. Our results differ from those found by Jaimovich and Panizza (2007) for total expenditures who, after controlling for endogeneity, find that public spending in developing countries is acyclical.[18]

We examined next whether cyclicality is symmetric in periods of high and low GDP growth. We divided real growth of health and education expenditures into two subsamples based on our criteria for good and bad economic times (i.e., positive and negative output gap,

[17] Hallerberg and Strauch (2002) find primary expenditures in EU member states to be countercyclical while Lane (2003) finds different degrees of cyclicality in OECD countries based on country-specific estimates of fiscal cyclicality.

[18] It should be noted that Table 4 reports results from S-GMM, whereas Jaimovich and Panizza use instrumental variables. This, together with our larger sample size, could explain the difference in results.

Table 4. Cyclicality of Total, Education, and Health Public Expenditures

	Total Expenditures	Education	Health
GDP Growth	1.30**	2.06**	1.25*
	(4.17)	(3.73)	(2.19)
Terms of Trade Growth	-0.08**	-0.07+	-0.06
	(-3.41)	(-1.67)	(-1.09)
Lagged Balance	0.01*	0.00	0.01**
	(2.19)	(1.35)	(3.12)
Constant	-0.00	-0.05	0.04
	(-0.15)	(-1.34)	(0.75)
Countries	119	106	105
Hansen J Statistic p-value	0.09	0.22	0.07
AR(1) in first differences	-6.43	-4.58	-6.47
p-value	0.00	0.00	0.00
AR(2) in first differences	-0.04	-0.11	-0.44
p-value	0.97	0.92	0.66
No. of Instruments	26	24	24
Number of observations	2,096	1,409	1,397

Notes: **, *, and + denote statistical significance at the 1, 5, and 10 percent respectively. *t*-statistics reported in parentheses. All regressions include time period dummies.

respectively). The average (median) real growth rates for education and health spending are close to each other within each subsample. However, they are substantially lower during bad times, with mean (median) education real spending growth at 2.5 (2.3) percent, and health at 4.0 (3.7) percent in bad times. During good times, the comparable numbers are 6.7 (6.6) for education spending and 7.3 (6.2) for health. A *t*-test conducted on the real growth for total expenditures, health, and education rejects the hypothesis that the means of these variables are the same in the subsamples defined by good and bad times.

Results from an estimation in which we use the GDP growth variable according to our definition of *good times* and *bad times* suggest that only total expenditure is procyclical in both good and bad times, with the coefficient being smaller in bad times (less than half of good times coefficient) (Table 5).[19] This result is broadly consistent with results from Gavin and Perotti (1997) who find procyclicality in both good and bad times. It differs from

[19] Table 5 reports results from S-GMM. We also explored the IV-FE methodology on two sub-samples: one for good times and another for bad times (following Jaimovich and Panizza, 2007). We find procyclicality for total expenditures in both good and bad times, but these specifications fail to reject the Durbin-Wu-Hausman test null when the dependent variables are education and health expenditures suggesting that the instrument is not valid.

Jaimovich and Panizza (2007), who find total public expenditures to be acyclical in developing countries in both good and bad times.[20] Education and health expenditures, on the other hand, are procyclical in good times but acyclical in bad times.[21] This result suggests that pro-cyclicality is triggered when real GDP growth is above potential. Education and health spending becomes acyclical when real GDP falls below potential (i.e. output gap becomes negative).

One plausible explanation for this asymmetry could be that countries protect social spending during bad times. The other explanation is traceable to the composition of health and education expenditures. While a breakdown of capital and recurrent components of health and education expenditures is not available, it is recognized that recurrent expenditures account for the largest share of these sectors' total spending. To examine whether the large share of recurrent expenditure has an effect on cyclicality, we ran total recurrent expenditures against real GDP growth and the same controls variables as in equation 1 (see results in Annex 5). The results suggest that recurrent spending is procyclical in good times but acyclical in bad times, akin to results obtained for education and health spending.

To further examine the role of economic development on cyclicality, we estimate equation (1) for three subsamples of developing countries classified by level of income. Once again, we first estimate the model without control variables.[22] The first three columns in Table 6 provide evidence that total expenditures are procyclical in all income groups. The coefficients for GDP growth in regressions with growth in health and education expenditures as dependent variables are positive and statistically significant in low and lower-middle-income countries. Table 7 presents estimation results of the same specification including the control variables. These results suggest procyclicality in health spending in all groups and education spending in middle-income countries as well as for total expenditures in higher-middle-income and middle-income countries. The size of the coefficients for GDP growth for health and education tends to be relatively higher in middle-income and low-income countries.

[20] Using the output gap, Clements Faircloth and Verhoeven (2007) also find that primary expenditures are procyclical only during bad times in Latin America.

[21] This result is broadly robust to the use of an alternative definition of good and bad times. The latter are defined as periods of positive and negative real GDP growth, respectively. These results are available from the authors upon request.

[22] Time dummies are not included in these specifications to preserve degrees of freedom because the number of observations is substantially lower when the sample is divided in groups by income level.

Table 5. Cyclicality in Good Times and Bad Times

	Total Expenditures	Education	Health
Good Times	1.17**	2.22**	1.51*
	(3.59)	(4.28)	(2.22)
Bad Times	0.50*	0.25	0.56
	(2.19)	(0.56)	(1.07)
Terms of Trade Growth	-0.07**	-0.05	-0.05
	(-3.05)	(-1.09)	(-1.06)
Lagged Balance	0.01**	0.00+	0.01**
	(8.08)	(1.92)	(3.08)
Constant	0.02	-0.01	0.04
	(0.94)	(-0.24)	(1.06)
Countries	119	106	105
Hansen J Statistic p-value	0.09	0.48	0.19
AR(1) in first differences	-7.31	-4.95	-6.34
p-value	0.00	0.00	0.00
AR(2) in first differences	-0.47	-0.20	-0.73
p-value	0.64	0.84	0.47
No.of instruments	28.00	26.00	26.00
Number of observations	2,096	1,409	1,397

Notes: **, *, and + denote statistical significance at the 1, 5, and 10 percent respectively. *t*-statistics reported in parentheses. All regressions include time period dummies.

Table 6. Cyclicality of Expenditures by Level of Development (Univariate model)

Dependent Variable:	Total Expenditures			Education			Health		
	Higher middle income	Middle income	Low income	Higher middle income	Middle income	Low income	Higher middle income	Middle income	Low income
Change in Log Real GDP	2.35*	0.90	3.40*	0.63	4.29*	1.12	0.97	1.27	2.86
	(2.57)	(1.05)	(1.98)	(1.25)	(2.11)	(0.67)	(1.58)	(0.87)	(1.08)
Hansen J Statistic (p-value)	0.10	0.90	0.73	0.11	0.91	0.46	0.19	0.91	0.44
AR(2) in first differences (p-value)	0.84	0.62	0.91	0.31	0.70	0.99	0.55	0.30	0.89
Number of Instruments	3	3	3	3	3	3	3	3	3
Number of Countries	35	47	37	28	42	36	28	41	36
Number of Observations	662	923	739	419	618	575	411	610	573

Notes: **, *, and + denote statistical significance at the 1, 5, and 10 percent respectively. *t*-statistics reported in parentheses.

Table 7. Cyclicality of Expenditures by Level of Development (Multivariate Model)

Dependent Variable:	Total Expenditures			Education			Health		
	Higher middle income	Middle income	Low income	Higher middle income	Middle income	Low income	Higher middle income	Middle income	Low income
GDP Growth	2.16**	1.37+	4.88	1.19	2.66**	2.05	1.75*	1.64*	3.02*
	(2.77)	(1.82)	(1.24)	(1.03)	(3.52)	(1.47)	(2.05)	(1.96)	(2.35)
Terms of Trade Growth	-0.20**	-0.06	-0.11	-0.10	-0.16**	-0.05	-0.09	-0.24*	0.02
	(-3.03)	(-1.36)	(-1.16)	(-1.28)	(-2.86)	(-0.58)	(-1.33)	(-2.50)	(0.19)
Lagged Balance	0.01*	0.00	-0.02	0.00	-0.00	-0.00	0.00	0.00	0.01+
	(2.54)	(1.17)	(-0.68)	(1.55)	(-0.90)	(-0.34)	(1.36)	(0.77)	(1.69)
Constant	-0.04	-0.00	-0.22	0.01	-0.08+	-0.04	-0.01	-0.01	-0.04
	(-1.05)	(-0.05)	(-0.89)	(0.16)	(-1.77)	(-0.49)	(-0.34)	(-0.14)	(-0.58)
Hansen J Statistic p-value	0.29	0.57	0.95	0.34	0.51	0.26	0.57	0.73	0.86
AR(1) in first differences	-3.59	-4.26	-1.58	-3.36	-4.09	-2.75	-3.22	-4.11	-3.59
p-value	0.00	0.00	0.11	0.00	0.00	0.01	0.00	0.00	0.00
AR(2) in first differences	0.37	-0.17	0.08	-0.50	-0.73	-0.10	0.14	0.92	-0.24
p-value	0.71	0.86	0.93	0.62	0.46	0.92	0.89	0.36	0.81
No. of Instruments	6	6	6	6	6	6	6	6	6
Number of observations	585	834	677	369	556	484	361	556	480

Notes: **, *, and + denote statistical significance at the 1, 5, and 10 percent respectively. *t*-statistics reported in parentheses.

IV. Conclusions and Policy Implications

This paper studied the cyclical behavior of public spending on health and education in a large sample of countries during 1985–2006. It finds that spending on education and health is procyclical in developing countries and acyclical in developed countries. In addition, our results suggest that in developing countries total expenditures are procyclical in both good and bad times, but more so during good times (good [bad] times are defined as periods in which the output gap is positive [negative]). Education and health expenditures follow an asymmetric pattern; they are procyclical during good times and acyclical during bad times. Finally, the degree of cyclicality tends to be higher the lower the level of economic development.

The notion that social expenditures are prone to cuts during recessions has led some policymakers to mandate a certain level of social spending irrespective of output variations, earmark part of tax revenues to social sectors, or maintain extra-budgetary funds to finance social spending. However, our results do not support the view that the growth of real outlays on health and education falls during periods of negative output gap. Hence, there seems to be little justification for using various fiscal devices to protect social spending. The cyclicality of total spending during bad times can be dealt by building up cushions during the good times. This would require breaking the pattern of procyclical behavior during good times.

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Annex 1. List of Developing Countries in the Sample by Income Level Group

Developed Countries		Higher Middle Income		Low Middle Income		Low Income	
Country	No. of Years	Country	No. of Years	Country	No. of Years	Country	No. of Years
Australia	20	Argentina	19	Albania	18	Burkina Faso	20
Austria	20	Barbados	21	Azerbaijan, Rep. of	13	Burundi	20
Belgium	20	Botswana	18	Bahamas, The	21	Cambodia	17
Canada	20	Chile	17	Belarus	12	Central African Rep.	16
Cyprus	20	Costa Rica	20	Belize	21	Chad	21
Czech Republic	20	Croatia	15	Bhutan	20	Comoros	21
Denmark	20	Dominica	21	Bolivia	21	Ethiopia	19
Finland	20	Equatorial Guinea	10	Brazil	16	Gambia, The	21
France	20	Estonia	14	Bulgaria	18	Guinea	20
Germany	20	Hungary	21	Cameroon	19	Haiti	19
Greece	20	Kuwait	6	Cape Verde	20	India	19
Iceland	20	Latvia	14	China,P.R.: Mainland	21	Kenya	21
Ireland	20	Lebanon	9	Colombia	21	Korea, Republic of	21
Israel	20	Libya	15	Congo, Republic of	17	Kyrgyz Republic	14
Italy	20	Lithuania	14	Djibouti	16	Lao People's Dem.Rep	21
Japan	20	Malaysia	21	Dominican Republic	21	Madagascar	19
Malta	20	Mauritius	21	Ecuador	20	Malawi	21
Netherlands	20	Mexico	20	Egypt	19	Mali	19
New Zealand	20	Namibia	21	El Salvador	21	Mauritania	19
Norway	17	Panama	21	Georgia	12	Mongolia	19
Portugal	20	Poland	21	Guyana	16	Mozambique	21
Singapore	18	Qatar	16	Honduras	7	Myanmar	21
Slovak Republic	12	Russian Federation	14	Indonesia	21	Niger	19
Slovenia	13	Saudi Arabia	12	Iran, I.R. of	21	Nigeria	19
Spain	20	Serbia, Republic of	7	Jamaica	21	Rwanda	13
Sweden	20	Seychelles	18	Jordan	21	Senegal	21
Switzerland	20	South Africa	21	Kazakhstan	14	Sierra Leone	20
United Kingdom	20	St. Lucia	21	Lesotho	20	Tajikistan	11
United States	20	St. Vincent & Grens.	21	Maldives	21	Tanzania	21
		Suriname	19	Moldova	14	Togo	21
		Trinidad and Tobago	21	Morocco	21	Uganda	20
		Turkey	19	Nicaragua	17	Uzbekistan	14
		United Arab Emirates	19	Oman	19	Vietnam	20
		Uruguay	21	Paraguay	21	Yemen, Republic of	16
		Venezuela, Rep. Bol.	19	Peru	17	Zambia	19
				Philippines	21		
				Romania	21		
				Samoa	20		
				Sri Lanka	21		
				Swaziland	21		
				Syrian Arab Republic	20		
				São Tomé & Príncipe	12		
				Thailand	21		
				Tunisia	21		
				Ukraine	14		
				Vanuatu	21		
Total	560	Total	607	Total	851	Total	663

Note: The year count reflects number of observations of regressions for total expenditure as the dependent variable in sample used in system GMM. Countries are divided according to 2008 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $975 or less; lower middle income, $976 - $3,855; upper middle income, $3,856 - $11,905.

Annex 2. Raw Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Real growth in total expenditures	1								
2. Real growth education expenditures	0.31	1							
3. Real growth health expenditures	0.29	0.41	1						
4. Real GDP growth	0.29	0.28	0.24	1					
5. Change terms of trade	-0.03	-0.05	-0.03	-0.04	1				
6. Fiscal balance	-0.10	0.08	0.08	0.22	0.00	1			
7. External shock (instrument)	-0.02	0.00	-0.02	0.21	-0.03	0.29	1		
8. Good times	0.21	0.18	0.17	0.80	-0.01	0.19	0.21	1	
9. Bad times	0.15	0.17	0.12	0.39	-0.06	0.07	0.01	-0.24	1

Annex 3. Econometric Approach: Additional Notes

Instrumental Variables Fixed Effects

We instrument the domestic output growth rate with the real output growth of trading partners, weighted by their share of exports, and with the lagged real domestic output growth. This instrument passes the Craigg-Donald Wald instruments F-test relative to the critical values suggested by Stock and Yogo (2002) for both developed and developing countries. However, IV-FE estimation fails to reject the null of the Durbin-Wu-Hausman (DWH) test in health expenditures specification. This suggests that the instrument used is not valid for these specifications. This is one of the reasons why we turned to S-GMM. Results for the DWH test do not improve when the lagged real domestic output growth is excluded from the set of instruments.

System-GMM

We determine the number of lags used in each particular specification (i.e., one for each of the three dependent variables studied) based on the degree of exogeneity of the explanatory variables used with respect to the dependent variable (i.e., whether they are a priori assumed to be predetermined or endogenous), and on whether this lag level passes the tests for validity of the instruments (Hansen-statistic) as well as of serial correlation of the disturbance term (evidence of an AR2 process in first differences indicates that the tested lag structure is invalid). In most cases, we used the second lag to instrument real GDP growth (second lag in the transformed equations; and first lag first differences in the levels equation, and the first lag to instrument the lag of fiscal balance as percent of GDP (first lag in the transformed equations; and contemporaneous first differences in the levels equation).

A large instrument count in system GMM models can overfit endogenous variables in finite samples and weaken the Hansen test used to check the validity of the instruments. Roodman (2008) illustrates this point. We address this problem—as suggested by him—by restricting the lag range used in the instrument matrix to only one lag as opposed to all available lag periods and by collapsing the instrument matrix so that there is only one instrument for each variable and lag distance.

Annex 4. Cyclicality of Total, Education, and Health Public Expenditures: Fixed Effects and IV-Fixed effects

	Total Expenditures		Education		Health	
	FE	IV-FE	FE	IV-FE	FE	IV-FE
GDP Growth	0.63**	1.15**	0.88**	2.30**	0.94**	1.69**
	(8.22)	(4.49)	(6.96)	(5.42)	(6.61)	(3.38)
Terms of Trade Growth	-0.06*	-0.07**	-0.05	-0.08*	-0.03	-0.05
	(-2.54)	(-3.32)	(-1.41)	(-2.28)	(-0.67)	(-1.11)
Lagged Balance	0.01**	0.01**	0.01**	0.00**	0.01**	0.01**
	(10.79)	(11.87)	(4.88)	(2.61)	(4.92)	(3.74)
Constant	0.04**		0.09**		0.05	
	(2.87)		(3.78)		(1.55)	
R-Squared	0.17		0.10		0.09	
Cragg-Donald Wald F-Statistic		64.95		43.69		41.52
DHW test p-value		0.03		0.00		0.12
Countries	119.00	118	106.00	106	105.00	105
Number of observations	2,096	1,987	1,409	1,409	1,397	1,397

Notes: **, *, and + denote statistical sigificance at the 1, 5, and 10 percent respectively.
t-statistics reported in parentheses
All regressions include year-fixed effects.

Annex 5. Cyclicality of Recurrent Expenditures

	Current Expenditures	
GDP Growth	1.30**	
	(3.24)	
GDP Growth High		1.55**
		(3.54)
GDP Growth Low		-0.15
		(-0.37)
Terms of Trade Growth	-0.06*	-0.06*
	(-2.27)	(-2.35)
Lagged Balance	0.01**	0.01**
	(5.35)	(5.58)
Constant	0.00	0.01
	(0.20)	(0.39)
Countries	110	110.00
Hansen J Statistic p-value	0.17	0.41
AR(1) in first differences	-6.16	-6.40
p-value	0.00	0.00
AR(2) in first differences	0.95	0.91
p-value	0.34	0.36
No. of Instruments	27.00	29
Number of observations	1,945	1,945

Notes: **, *, and + denote statistical sigificance at the 1, 5, and 10 percent respectively.

t-statistics reported in parentheses

All regressions include year-fixed effects and time period dummies.