Public Expenditure on Education and Resource Management: Case of Zambia

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Abstract

In many developing countries, one of the major challenges facing public institutions is the efficient and equitable reallocation of public resources. This paper addresses the issue of how public resources are employed efficiently and equitably in Zambia as a case study. First of all, the study examines the extent to which public resources for education are used efficiently, particularly as a linkage with educational outputs, in comparison to other sub-Saharan African countries. Secondly, because teachers' salaries constitute a large share of public spending on education and teacher themselves are very important inputs in the delivery of education services, the study investigates the degree to which public resources are disturbed efficiently and equitably by evaluating teacher allocation.

Introduction

Efficiency of education system is a term used to describe the relationship between inputs and outputs, and this relationship will be analyzed from several perspectives. From the public sector's perspective, internal efficiency is particularly concerned with the relationship between inputs and outputs within the education system or among individual institutions, as well as how public resources are used and how they influence student outcomes. Thus, the question of internal efficiency in education is ultimately linked to the issue of resource allocation and utilization. In many sub-Saharan countries, a large proportion of government expenditure is used for recurrent items, and among the recurrent expenditure, about 90 percent is used for teachers' and non-teachers' salaries (mainly teachers' salary) while the remaining 10 percent is allocated to other quality improvement measures, such as teaching and learning materials (World Bank 2001a).

Previous studies mention the importance of adequate public resource allocation to the education sector as well as the efficient usage of resources within the sector. Jung and Thorbecke (2001) find that an increase in public expenditure on education contributes to economic growth and poverty alleviation in Zambia and Tanzania. From the equity aspects, public resources in primary education in many sub-Saharan African countries are equally targeted to poor students but not for higher levels of education (Castro-Leal et al. 1999;

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[1] The arguments made in this paper do not reflect the views of the World Bank to which the author used to belong; they constitute the author's personal opinion.

Kelly 1998). Gupta and Verhoeven (1999) suggest that through the correction of inefficiencies of government spending towards education, the quality of educational attainment might improve conceivably. Samoff (1999) points out that in Africa's education sector, public resources are often misallocated while management and administration remain inefficient.

Using Zambia as a case study, this paper will review the input and output efficiency of Zambia, and compare her high level of education attainment with that of other sub-Saharan African countries. The paper will also examine how efficiently and equitably the Government of Zambia utilizes public resources in education. The public resource in education covers items such as the costs for teachers, books, school construction, and school operation. In addition, this paper will also spotlight teacher allocation since teacher salary comprises the largest proportion of education expenditure in Zambia (Kelly 1998).

Methodologies of the Study

In order to assess the efficiency and equitability of public resource usage in Zambia, the study will examine public spending on education as a percentage of GDP linked with educational outcomes. Educational outcomes are measured by school life expectancy, the expected number of years of formal education. Specifically, school life expectancy is calculated as the sum of age-specific enrollment rates for primary, secondary and tertiary education. The second part of the paper will focus on primary education, which has the largest share among the education levels within the education sector, and investigate the efficiency and equity of public spending through the distribution of teachers in schools in Zambia. It will also investigate whether equity issues lie between or within provinces.

Public Usage and Educational Attainment from International Perspectives

The overall challenge for the government lies in how public spending on education is linked to a higher level of educational outputs. School life expectancy is often used to measure the outcomes of education in a country. In Zambia, it is 7.8 years in 1995 and this figure remains relatively high by international standards (see Figure 1). From the 1995 international comparison indicators, school life expectancy is 4.9 years in the francophone African countries, 7.5 years in the anglophone African countries, 7.9 years in low-income Asian countries, and 9.1 years in Latin America. By looking at the neighboring countries of Zambia, for the year 1995 the school life expectancy is estimated to be 5.2 years in Tanzania, 5.6 years in Malawi, 4.6 years in Mozambique, 11.3 years in Zimbabwe, and 10.6 years in Botswana (World Bank 2003).

To get a sense of the efficiency in resource utilization, as far as coverage of education is concerned, it is useful to contrast this statistics (school life expectancy) with the amount of resources that is mobilized by the country for the sector. In 1995, total spending on education in Zambia represented 2.6 percent of the GNP. A very straightforward way to assess efficiency is to consider the ratio of coverage (school life expectancy) and spending;

the figure obtained for Zambia in 1995 is 3.0 (7.8/2.6). By Sub-Saharan African standard, the level of efficiency of this count in resource use in Zambia is relatively high. These statistics were on average (in 1995) 1.3 in francophone African countries, 2.1 in anglophone African countries, 2.8 in low-income Asian countries, and 3.7 in Latin America (World Bank 2003).

Another way to assess the level of efficiency of resource utilization for education coverage consists of plotting a graph of the school life expectancy on the Y-axis and education expenditure as measured by the share of GDP on the X-axis. Figure 1 shows the location of selected sub-Saharan African countries in these two dimensions around 1995. It is relevant to recognize where Zambia exist on this graph. In Figure 1, Zambia in 1995 is mapped as a large dot and it stays in approximately the exact location in 1998.

This cross-national comparison also shows how Zambia uses public resources efficiently. In 1995, Zambia spent 2.6 percent of the public expenditure on education as a percentage of its GNP and its school life expectancy was estimated as 7.8 years - at this point in time, the large dot representing Zambia was at the frontier line that links one of the most efficient public resources users among the sub-Saharan African countries (those whose coverage is maximum given what they spend). For instance, a country such as Burkina Faso spent similar public resources on education (2.5 percent of its GNP) but its education outcome is only 2.7 years. Countries such as Cameroon and Lesotho have similar education outcomes but spent more on education, 3.7 percent and 5.9 percent, respectively. Moreover, between 1995 and 1998, school life expectancy in Zambia has shown a slight improvement from 7.8

**Figure 1. School Life Expectancy by Public Education Expenditure
in Selected Sub-Saharan Countries**
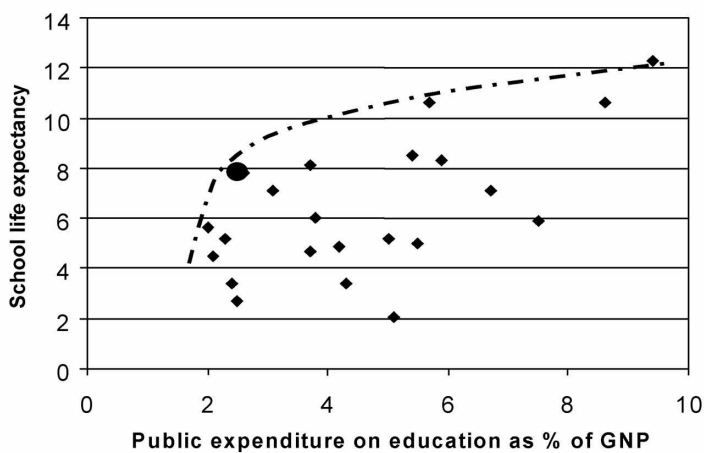
Source: World Bank (2003).

to 7.9 years while spending on education, as a proportion of its GDP, has declined comparatively from 2.6 to 2.3 percentage points. As a whole, Zambia appears to have achieved quite a high level of coverage given the amount of public resources it mobilizes and is therefore on the high side of efficiency on this count.

However, according to the World Bank (2001b), the current level of spending on education in Zambia is not adequate. The World Bank estimated that low-income African countries need to spend around 3 to 4 percent of GDP on primary education alone, especially to achieve universal primary enrollment. Zambia is currently spending around 1.6 percent of public expenditure (including donors' contribution) on primary education.

Allocation of Resources in Teachers to Individual Schools

Fundamentally, efficiency aspects in education consider the way resources are distributed and utilized. Concerning the allocation of resources, teachers are the most important factor. This paper also analyzes how teachers are deployed in the education system of Zambia, i.e., how they are allocated to both provinces and individual schools. There are two aspects about the policy on teachers: i) one is qualitative and concerns the characteristics of the teachers; ii) the second is quantitative with two complementary dimensions. The first dimension deals with the question of whether there are sufficient or an abundance of teachers in the country, given the needs to provide a reasonable quality of education to the youngsters of the country. The second dimension deals with the teachers currently available; are they already deployed in an efficient manner or should they be better deployed more consistently? This paper will analyze the latter point by using the Mingat method [see Chuard et al. 1995].

To gauge whether the current pattern of allocation of teachers is efficient and consistent, the study needs a general criterion by reference to which it can conduct the assessment. As far as the quantitative distribution of teachers is concerned, a clear yardstick is that the study should target different students that are reasonably comparable across different schools in the country. This means that there should be enough of a consistent relationship between the size of enrollment and number of teachers at the school level, or that schools with a similar size of enrolment should have a reasonably similar number of teachers. To what extent does the current allocation of teachers depart from this reference is central to the analysis. How are public resources in teachers allocated? How does this allocation vary by level of education and geographical location (rural/urban as well as province)? To answer these questions, the study refers to the national education statistics data (school census data).

Allocation of Teachers in Primary Education (Grades 1-7)

Overall in Zambia, the allocation of resources in teachers does not show a high level of consistency in approximately 4,000 public primary schools that existed in 1998. Figure 2 shows that even though there is a general tendency for a school to benefit from a larger number of teachers when the size of enrolment is larger ($R^2 = 79.7\%$), there is also a wide variability in the number of teachers for schools enrolling a similar number of pupils. For

instance, there are between 100 and 700 pupils for 10 teachers at the school level. Similarly, schools enrolling 500 pupils may have teachers numbering between 4 and 27. This wide variation suggests that activities could be undertaken so as to correct this condition.

Facing this relatively high level of inconsistency in teacher allocation to different primary schools, a key issue is to determine the extent to which this inconsistency stems from differences across provinces or from differences in the allocation of teachers to individual schools within each (or some) of the different provinces. Similarly, it may be of interest to document whether the urban or rural location of the schools makes a difference in the allocation of teachers. The study first turns to the latter point to investigate whether there is any disparity between urban and rural areas.
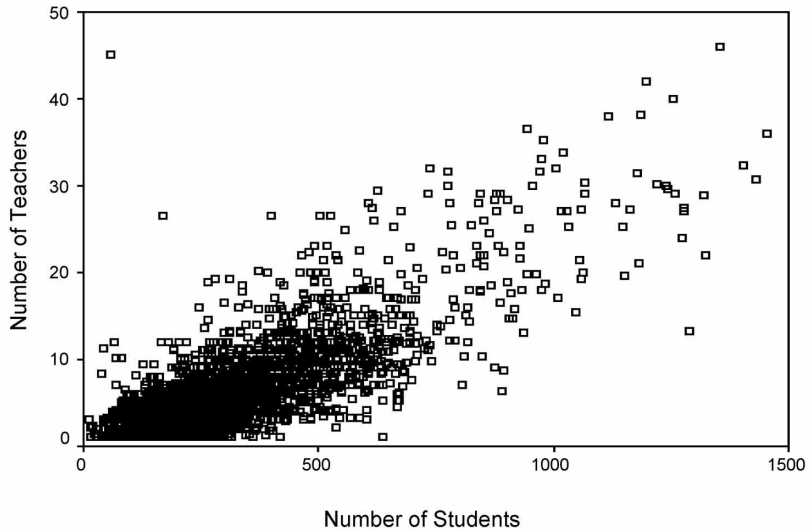
Figure 2. Teacher Allocation in Public Primary Schools in Zambia
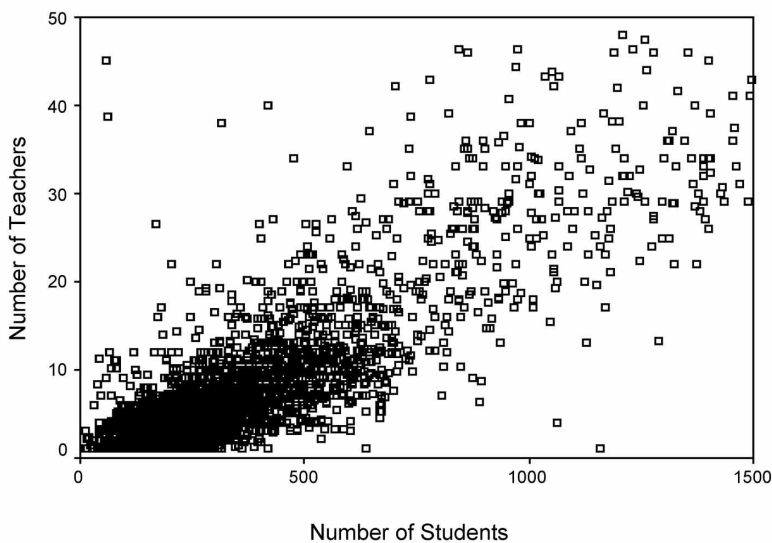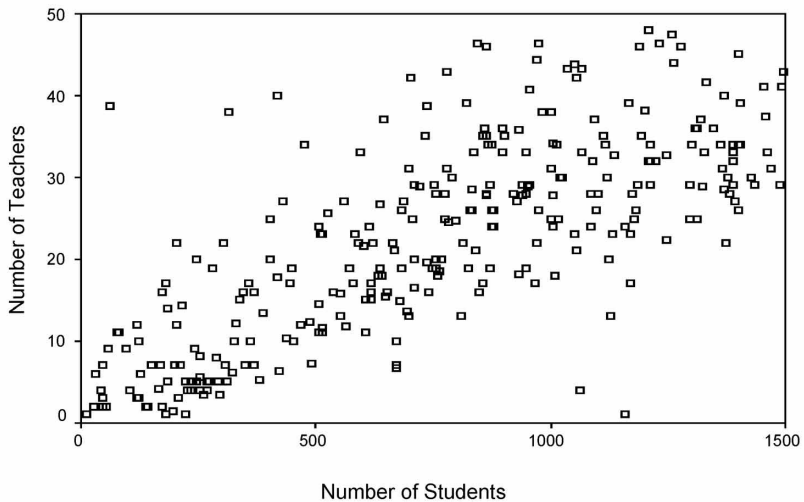

Source: School Census Data (1998)

As seen in Figure 3, in rural areas, even though there is a positive correlation between the number of pupils and teachers, the magnitude of the disparities is wider than that for the whole country as documented by the lower value of the R^2 (64.4% against 79.7% for the whole sample). On the other hand, in urban areas (see Figure 4), the magnitude of disparities is less conspicuous here as documented by the R^2 (70.1% against 79.7% for the whole country).

Figure 3. Teacher Allocation in Public Primary Schools in Rural Areas

Source: School Census Data (1998)

Figure 4. Teacher Allocation in Public Primary Schools in Urban Areas

Source: School Census Data (1998)

If the inconsistency in teacher allocation cannot be explained by the differences between rural and urban areas, one can conclude that the allocation of teacher resources appears to be an issue of how teacher resources are managed. If, indeed, this were a management issue, it is important to determine the extent to which the variance (or inconsistency) is similar across provinces - which reflects the way the budget is distributed across provinces - and whether this pattern of inconsistent allocation of teachers shows any differences within the different

provinces as a proxy for how well the resources are managed nationally and within the provinces.

To determine whether the issue lies between or within province, a relatively straightforward solution consists of using a set of dummy variables for the different provinces. Table 1 shows the variations existing between provinces in the allocation of teachers at the primary level. While Model 1 represents the variance within a province, Model 2 represents the variance between the provinces.

Table 1. Relation between the Number of Teachers and Pupils in Public Primary Schools

Provinces	No. of pupils	No. of teachers	Model 1		Model 2	
			Coefficient	T	Coefficient	T
Number of pupils	-	-	0.023	124.7	0.022	98.7
1. Copperbelt	278,868	6,739			Ref.	-
2. Central	180,010	4,073			-1.46	-3.8
3. Lusaka	252,233	5,830			-0.34	-0.7
4. Southern	178,483	3,943			-1.68	-4.5
5. Luapula	113,376	2,545			-156	-3.9
6. Northern	206,193	3,774			-2.84	-7.9
7. Eastern	162,876	3,683			-1.53	-4.2
8. North Western	121,577	2,323			-2.49	-6.5
9. Western	116,831	3,078			-0.64	-1.7
Intercept	-	-	- 0.19		1.66	
R2 (%)	-	-	79.7		80.2	

Source: School Census data (1998)

The study first considers the total number of pupils and teachers at the province level. It appears very clearly that some provinces benefit from a similar number of teachers although they may be servicing distinctly different numbers of pupils. This is the case of the Northern and Eastern Provinces: although they each have about 3,700 teachers, the Northern Province has an enrolment of 206,000 pupils whereas the Eastern Province has 163,000 pupils (43,000 pupils fewer than the Northern Province). Inversely, the Luapula and Western Provinces have about 110,000 pupils in enrollment respectively; however, the Western Province benefits from having 3,000 teachers while Luapula has 500 fewer teachers. These figures suggest that there is a significant level of inconsistency in teacher allocation among provinces and some provinces benefit more than others. For instance, the Western Province and Copperbelt appear to benefit from relatively generous endowments of teachers given the number of pupils currently enrolled (the teacher-student ratios in these two provinces are 37 and 41, respectively). On the other hand, the Northern and North Western Provinces reap lesser benefits (the ratio is 54 and 52, respectively).

With regards to the results of the two models, it appears that allowing variations between provinces helps reduce the residual variability of the model (R^2 increases from 79.7% to 80.2%). Model 1 shows that inconsistency in teacher allocation to individual schools

represents 20.3 percent (100%-79.7%) of the total variability in the number of teachers at the school level. Model 2 indicates that by allowing disparities in teacher allocation between provinces, the inconsistency (or variance) within each province accounts for 19.8 percent (100%-80.2%). This means that of the 20.3 percentage points of total inconsistency (or variance in the distribution of teacher resources), 19.8 percentage points correspond to inconsistency in the distribution of resources within the provinces. In relative terms, this indicates that 80 percent of total inconsistency is found within the provinces in the allocation of teachers to individual schools, and that only 20 percent stems from variations between the provincial allocation of teachers.

This does not imply that the allocation of resources between the provinces is adequate and efficient or that all provinces are characterized by an equal degree of inconsistency in allocating teachers to individual schools. To analyze the first point, a possibility consists of using the coefficients of the dummy variables for provinces in Model 2 as presented in Table 1. (Following this method, we would flag the Northern, North Western, and Southern provinces as provinces that are under-endowed in teachers given the number of pupils enrolled, while Lusaka and the Western provinces would be identified, in relative terms, as over-endowed). A second and preferred analysis (as it provides a better description of reality) consists of conducting the estimation of the relationship between teachers and pupils at the school level separately for each of the 9 provinces. Table 2 provides these estimates.

Based on the estimates, it is possible to simulate the average number of teachers in schools of a given size. Table 2 provides these simulations for schools of 400 pupils, a number that is close to the average size of primary public schools in the country. Inter-

Table 2. Relationship between the Number of Teachers and Pupils at the School Level by Province (Primary Education)

	No. of Schools (n)	Intercept	Coefficient*	R^2 (%)	N400**
Zambia	3,970	-0.90	0.0228	79.7	8.2
Provinces					
1. Coppperbelt	337	4.53	0.0187	67.4	12.0
2. Central	421	-3.15	0.0300	72.7	8.9
3. Lusaka	182	3.75	0.0204	80.2	11.9
4. Southern	493	-1.73	0.0269	69.2	9.0
5. Luapula	339	-2.21	0.0291	74.0	9.4
6. Northern	675	-0.09	0.0186	57.4	7.4
7. Eastern	596	-1.54	0.0282	77.1	9.7
8. North Western	445	-0.58	0.0212	68.3	7.9
9. Western	482	-1.36	0.0320	77.0	11.41

Source: School Census Data (1998)
* : all coefficients significant at the 0.001 level
** : N400 is the estimated number of teachers in a 400 pupil school (country average)

province disparities appear to be quite substantial; the Northern, North Western and Central provinces are clearly under-endowed in relative terms as schools of 400 pupils have on average of approximately 8 teachers. On the other hand, the provinces of Copperbelt, Lusaka, and the Western Province have on average of nearly 12 teachers for the same enrollment size. This means that it is necessary to increase the number of teachers in the three under-endowed provinces by more than 50 percent to reach a point where the conditions of schooling on this count can be made similar.

Table 2 shows that the degree of inconsistency in teacher allocation to individual schools (as documented by the R^2 statistics) may vary quite substantially across the different provinces. Lusaka, the Eastern, and Western Provinces appear to have been able to produce a more consistent pattern in teacher allocation than the Copperbelt, Northern, and North Western Provinces. However, within all the provinces, the degree of randomness in teacher allocation can and should be improved.

From the previous discussion, it follows that the global allocation of teachers is at considerable variance across the different provinces, which implies that the educational policies in Zambia require substantial deliberation in the years to come in order to resolve this discrepancy. It is possible that the procedure by which the budget is prepared is partly responsible for this state of affairs. However, there still exists a substantial degree of inconstancy in teacher allocation to individual schools within the different provinces. From the indicators presented in Table 2, it appears that the degree of inconsistency may differ from one province to another. If the study uses the value $[1-R^2]$ as a measure of inconsistency in teacher deployment, it follows that Lusaka shows reasonably high level of performance on this account with an R^2 that exceeds 80 percent in Zambia (less than 20 percent of inconsistency), while Nothern, Copperbelt, and North Western are characterized by a much higher degree of randomness in teacher deployment, demonstrating a relatively low level of performance in managing the public resources with which they are endowed.

To illustrate the existence of intra-province disparities in the allocation of teachers, Figure 5 below presents teacher allocation in the Southern Province, which exemplifies a relatively average case in the Zambian context [a case where randomness is moderate (R^2=69%)]. If the study uses the example of Copperbelt or the Northern Province, the pattern would be seen as more scattered.

The results obtained in this section strongly suggests that there is ample room for improvement in the allocation of teachers in public primary schools (probably more of resources), first, to the different provinces; and second, to the different public primary schools within the majority of the provinces. Adopting the criteria on both dimensions and finding ways of implementing them progressively over some period of time is clearly a direction to consider. Across provinces, the idea may be to define the criteria so that the budget allocation to provinces is in alignment with the needs of each province in an equitable manner. Within provinces, a similar mechanism needs to be set so that the conditions of schooling be reasonably equitable across the different locations and that the different schools get endowed with personnel and resources that are distributed in a consistent way. To do this will require

a plan to be implemented over time as it may be difficult to re-deploy the teaching force at the province and country levels overnight. An aspect to be considered is the benefit of attrition and recruitment of new teachers, (although this may not be sufficient) and incentives for teachers to move to other schools may have to be taken into account.

Figure 5. Teachers Allocation in Public Primary Schools in the Southern Province
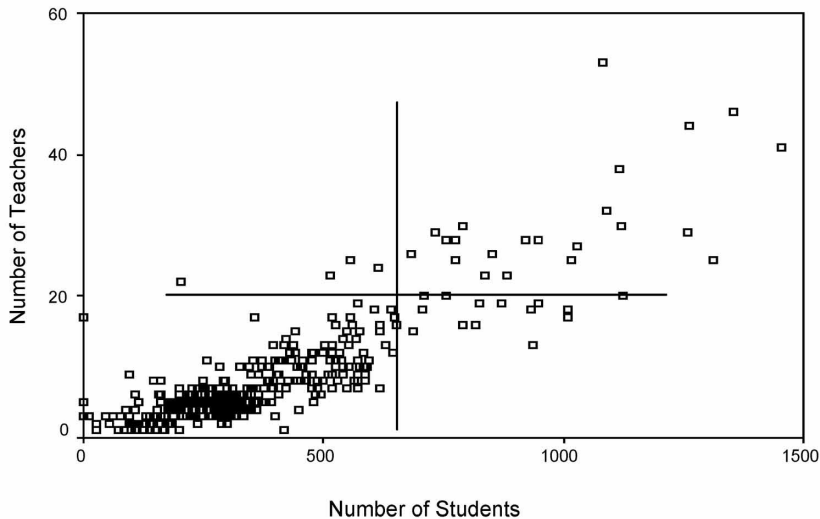
Source: School Census (1998)

Conclusions

Compared to other sub-Saharan African countries, the share of public education expenditure in Zambia is smaller even though its public resources are employed more efficiently than other sub-Saharan African countries. However, these public resources have not been used efficiently and equitably for the allocation of resources if the allocation of teachers had been examined. From the statistical results of this study, it is clear that there is a wide disparity of teacher-student ratio at the primary level across the country as well as among and within provinces. A standardized management approach to re-allocate the resources in teachers should be adopted for policy implementation in order to distribute public resources efficiently and equitably, and thus to increase access to schooling as well as to improve student promotion.

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