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**Benefit incidence analysis, needs and demography.
Measurement issues and an empirical study for Kenya**

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Benefit incidence analysis, needs and demography Measurement issues and an empirical study for Kenya*

Isis Gaddis and Lionel Demery**

Abstract

Benefit incidence analysis is an extremely popular tool to assess the distribution of benefits from government expenditure in developing countries, particularly in the social sectors. The analysis describes the welfare impact of public spending on groups of people or households, typically along the income distribution. While benefit incidence analysis has generated useful insights into the distribution of benefits from public spending in a variety of sectors, many studies fail to take into account differences in needs for public services across population groups. This can lead to an inappropriate and potentially misleading assessment of equity in public spending. This article reviews the evidence and introduces techniques to account better for heterogeneous needs in benefit incidence analysis. Using the example of an empirical benefit incidence study of education expenditure in Kenya, we show that our understanding of the distributional implications of public spending is greatly improved if we account for demographic differences between population groups.

Key words: Benefit incidence, public spending, education, demography, population-normalization, stochastic dominance, Kenya

JEL classification: D3, I2, I3, H4,

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1. Introduction

Benefit incidence analysis (BIA) is a popular tool for assessing how public spending is distributed across the population. It brings together information from the public expenditure accounts on the services funded by the government with household survey data on the use of these services by the people. The idea is that households gain in-kind transfers when they use services subsidized by the government, which is equivalent to the unit cost of service provision. Benefit incidence reveals how these transfers are distributed across different population groups (Demery 2003). As a result of the improved availability of micro data in developing countries and an increased emphasis on public spending in the context of poverty-reduction strategies, benefit incidence has become a standard technique in public expenditure analysis. It is frequently applied, for example, in World Bank poverty assessments and related economic and sector work (e.g. World Bank 2003a, 2003b, 2005, 2006, 2007a, 2007b, 2007c, 2007d, 2008a, 2008b, 2008c, 2009, 2010). The findings from such analyses are often cited in national development, sector and donor strategies, and are increasingly used to guide public spending decisions.

Due to its simplicity, benefit incidence analysis has a number of conceptual and practical limitations (see Demery 2003, Sahn and Younger 2000, Lanjouw and Ravallion 1999 and Younger 2003). First, unlike impact evaluation, benefit incidence analysis is concerned with the targeting performance of a government-sponsored service, rather than its development impact. Second, the cost of service provision may be an unreliable proxy for economic benefit to the consumer. In standard micro-economic theory, the market price of a good or service is taken as a measure of economic value. However, benefit incidence deals with government provided services, which are typically rationed and subsidized, so that market prices (if they exist) provide a poor guide for actual benefits.¹ Third, even if we accept the cost of service provision as a proxy of economic benefit, there are numerous difficulties in accurately measuring the cost of public services, particularly in the context of developing countries. Accurate measurement of unit subsidies is often hampered by the poor quality of spending accounts (especially at the regional level), deviations between budget allocations and actual disbursements, inefficiencies in spending, and quality variations in service provision. In fact due to data limitations, most benefit incidence studies work with broadly aggregated services (such as primary health care) and unit cost at the level of large geographic areas. Some studies (for example Younger 2003) ignore unit subsidies altogether, and simply count users of a service—users are assigned unity and non-users zero. Fourth, standard benefit incidence analysis is silent on the more fundamental factors governing household behavior, such as the constraints that poor people face in accessing public services.

Fifth, and this will be the focus of this paper, most studies analyze the incidence of government spending as though it were simply a tool for income redistribution. Most applications of benefit incidence implicitly assume that an equitable share of government spending occurs when per capita benefits are the same across all groups. A distribution is considered equitable, for example, when every income quintile of the population gets 20 percent of the benefit. This approach is focused entirely on income and its distribution. It simply seeks to show how income distribution would change if we include the in-kind transfers households obtain from using government services. But public spending on many services (especially in the social sectors) is not meant simply to redistribute

¹ An alternative to using unit cost as a measure for benefit is to apply contingent valuation or demand estimations (Small and Rosen 1981, Cornes 1995, Gertler and Glewwe 1990, Younger 2003). It should be noted that a subsidized service provision will typically generate lower aggregate benefits than an equivalent cash transfer (combined with the option to purchase the service at the same unit cost). This is because there will be at least some households that value the service less than the unit cost of service provision and would thus prefer the monetary equivalent.

current incomes, important though that objective might be. For many sectors, the goal of public spending goes beyond income redistribution, and seeks to raise the capabilities of the population (to improve health and education outcomes). When this is the case, our concept of equality in the incidence of benefits must go further, and take into account the needs of the different groups. This paper explores the implications of this for the analysis of benefit incidence.

There are two senses in which ‘needs’ can differ across population groups. First, not all the population may be ‘eligible’ for a service subsidized by the government, but only those who are entitled to it. Only children of school age can be considered as eligible for using government school services, or only women of a certain age are able to use government peri-natal services. Such eligibility can, and often does, vary across population groups, and must be taken into account when assessing the equity of spending. Secondly, even if all the population is eligible for a government service, needs for it will vary. Some groups, for example, will suffer more from poor health than others, and will therefore have greater need of government health care. Both eligibility and needs can be expected to vary across groups, and should be taken into account when judging how equitably government spending is distributed.

While this has been noted by some authors (Selden and Wasilenko 1995, Glick and Razakamanantsoa 2005, O’Donnell et al 2008), much of the applied benefit incidence literature (e.g. World Bank or IMF policy papers) is silent on the issue. These studies often ignore eligibility and needs. Current practice in the benefit incidence literature is mostly about income and how it gets redistributed across income groups. But if the objective of public spending goes beyond just income redistribution, and seeks to raise capabilities—especially true of social sector spending—the analysis must take into account needs and eligibility. This deficiency of operational policy work is an important factor motivating this study.

Eligibility and needs often have a central demographic component. A household’s need of primary schools is determined by how many children of primary school age are in the household. Some health services only apply to specific demographic cohorts (women of child-bearing age, for example), and health needs more generally vary systematically by age and sex. Thus accounting for eligibility and need involves a degree of demographic disaggregation in benefit incidence analysis. The first contribution of this paper is to revisit the evidence on benefit incidence, needs and demography and to make the case that the distribution of potential beneficiaries for public services ought to be taken into account in assessing equity in public spending. Our second contribution is to propose a simple decomposition of overall benefit incidence shares into three proximate determinants: government behavior, household behavior and demography. This allows us to quantify just how important the demographic component is in explaining observed benefit incidence shares.

Our third contribution is to show that differences in eligibility and demography also have an implication for estimating the benefit incidence of changes in government spending. O’Donnell et al (2008) and Glick and Razakamanantsoa (2005) are important exceptions to the neglect of needs in benefit incidence analysis, but they deal only with the observed distribution of government spending—what we term below as *average* benefit incidence. They do not discuss the implications of needs and eligibility when analyzing changes in government spending—so-called *marginal* benefit incidence. We show that common approaches to estimating marginal benefit incidence shares can be misleading if eligibility is ignored in the way the participation in government services is measured. In particular we find that two important papers (Lanjouw and Ravallion 1999, Younger 2003) are open to criticism in the way they handle the demographic component. And it is difficult to judge how far these weaknesses have filtered into applications of the approach in policy settings (e.g. World Bank and IMF country studies), most of which fail to be explicit about the estimation method adopted. We

illustrate all these issues empirically using the example of the benefit incidence of education spending in Kenya.

2. Benefit incidence, needs and demography

Benefit incidence seeks to assess who is benefiting from public services and describes the welfare impact of government spending on different groups of people. The analysis imputes to those using the service that portion of the cost of providing the service that is met by the government.² Because these are seen as current transfers, typically only the recurrent budget of the government is used for this purpose.³ While average benefit incidence analysis is concerned with current users of services – describing the situation as it is, marginal benefit incidence analysis estimates how changes in budget allocations are likely to be distributed across population groups.

Most empirical benefit incidence studies use household income or expenditure per capita (or per adult) to rank households and individuals from the poorest to the richest – though other groupings are also possible.⁴ Stochastic dominance test can be used to compare the concentration of benefits from various categories of public spending to the Lorenz curve of income or expenditure per capita, and/or the 45 degree line (see figure 1). In line with the tax incidence literature, benefits are said to be *progressive in relative terms* if poor population groups receive a larger benefit in relation to their income than richer groups – that is if the benefit concentration curve lies above the Lorenz curve. If we consider public spending as equivalent to an in-kind transfer, progressive benefits reduce overall (relative) income inequality. Conversely, benefits are considered regressive in relative terms if the concentration curve lies below the Lorenz curve of income or expenditures. At the same time, it is widely acknowledged that government social spending should not just mimic the existing income or expenditure distribution, but rather benefit the poor disproportionately in absolute terms – this is often denoted as ‘*per capita progressivity*’ or ‘*absolute progressivity*’ and refers to a situation where the benefit concentration curve lies above the diagonal (Sahn and Younger 2000, Sahn, Younger and Simler 2000, Glick and Razakamanantsoa 2005, Haughton and Khandker 2009). The concept of ‘per capita progressivity’ is also (implicitly) used in most World Bank and IMF public expenditure analyses, where the share of benefits going to a specific group *j* are compared with the group’s total population share (e.g. 20 percent if the population is divided into quintiles).⁵ Accordingly, the 45 degree line is often referred to as the ‘line of equality’, alluding to the hypothetical case of a Lorenz curve ‘of perfect equality’ (for example World Bank 2005, World Bank 2007c, Haughton and Khandker 2009, Cubero and Hollar 2010).

However, whether the 45 degree line is an appropriate reference for an equitable distribution of public expenditures is less obvious than it at first appears. Consider the example of public spending on primary education. In most cases, the poorer quintiles have a disproportionate share of primary school age children due either to higher fertility rates, their stage in the life cycle or endogenous household composition. Hence a situation of proportionate *per capita* benefits might go hand in hand with inequality in benefits on a *per child* basis. A supposedly proportionate benefit share from primary education spending for the poorest quintile (at 20 percent) could thus easily mask two counteracting

² As households incur some costs when accessing public services (including user charges), the imputation is that portion of the full cost that the government meets—that being the unit subsidy. In what follows we use the terms unit *cost* and unit *subsidy* interchangeably, though this distinction needs to be kept in mind.

³ The main rationale is that investment spending benefits future rather than current users of the service.

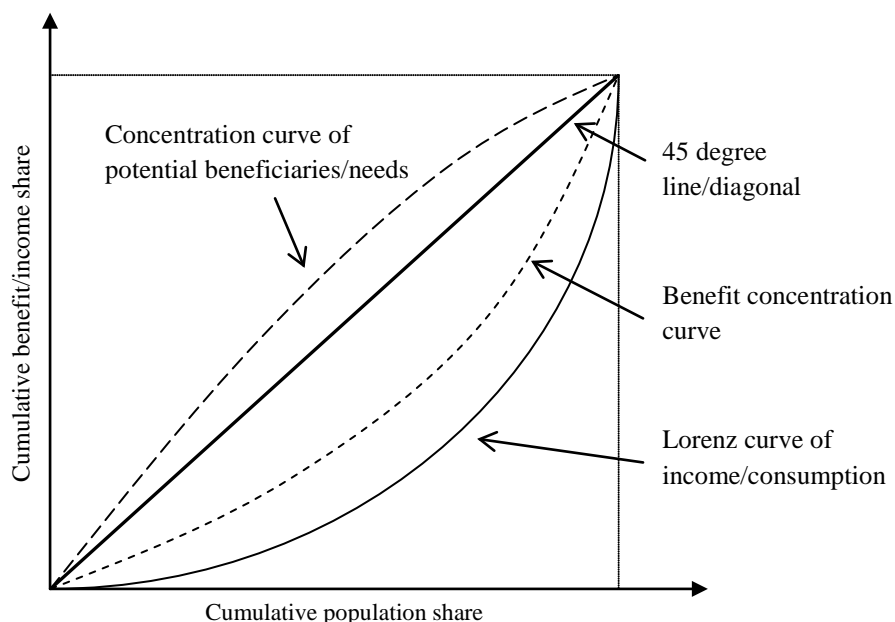
⁴ See Demery and Gaddis (2011) for a benefit incidence analysis using a taxonomy of households based on farming/livelihood groups.

⁵ In some cases, benefits that are per capita progressive are also described as ‘*pro-poor benefits*’.

forces – a disproportionate share of primary school age children and a below average gross primary enrollment rate amongst the poor. Similarly, many health services target children of a particular age (childhood vaccinations) or females of reproductive age (maternal health care). Failing to account for differences in needs across population groups may thus lead to an inadequate and potentially misleading assessment of the targeting performance of government programs (see Selden and Wasylenko 1995, Castro-Leal, Dayton, Demery and Mehra 1999, Glick and Razakamanantsoa 2005 for studies that explicitly distinguish between per capita and per child subsidies). Likewise, comparing benefit concentration curves or quintile-specific benefit shares for a particular service across countries can be misleading if there are cross-country differences in the distribution of the population in need for the service.

Our call for greater attention to needs in the context of benefit incidence analysis also resonates well with Amartya Sen's capability approach (Sen 1992, 1999). He maintains that heterogeneous needs can compromise the ability to translate goods and services into basic functionings and capabilities. In our example of primary education spending, the population groups may differ in their ability to translate a given fraction of the education subsidy into educational outcomes, depending on their specific needs for primary education services (which in turn depends on their share of primary school age children). This is why we emphasize that benefit shares need to be compared with potential beneficiary shares (see also Glick and Razakamanantsoa 2005). In the case of primary education the concentration curve of school age children is a more relevant benchmark, which will for many government programs lie above the 45 degree line (see figure 1). In the following, we will call this more stringent comparison of the benefit concentration curve to the needs concentration curve '*beneficiary progressivity*'.

Figure 1: Concentration curves, Lorenz curve



This does not imply that one should not report the distribution of benefits across quintiles or other population groups – knowing the percentage of spending going to the various groups will still be useful for a number of purposes, such as the potential of public spending in a given sector to reduce overall inequality. Yet budget allocations that look equitably targeted on a per capita basis may not

necessarily be consistent with equal allocations per potential beneficiary. It is interesting to note that even amongst those studies that do comment on differences in needs between population groups, most view them as an explanation for the observed distribution of benefit incidence and not as a benchmark for assessing the equity dimension of public spending (e.g. World Bank 2008c). The fact that the poorest quintile has a disproportionate share of primary school age children is then regarded as an explanation for the progressive nature of primary education spending, but not as a benchmark for defining progressivity and targeting performance per se. As mentioned earlier, this approach is reasonable if one views public social spending essentially as a tool to redistribute income, but it appears less appropriate if public social spending is meant to raise capabilities. As we will show in the next section, simple decomposition techniques can greatly enhance our understanding of the role of demography for the observed distribution of benefits across population groups.

The remainder of this paper explores the implications of the above for benefit incidence analysis. Section 3 presents a simple decomposition that quantifies just how important needs and demography are in explaining benefit incidence. Section 4 shows how estimates of marginal benefit incidence following a methodology proposed by Lanjouw and Ravallion (1999) and further developed by Younger (2003) can be misleading if normalization issues and program eligibility are not taken into account. Section 5 illustrates these issues focusing on education spending in Kenya. Section 6 concludes with the observation that eligibility and needs have been largely ignored in operational policy work.

3. Decomposing benefit incidence shares

The benefit incidence of government spending in a sector can be formally written as:

$$X_j = \sum_{k=1}^K B_{kj} \frac{S_k}{B_k} = \sum_{k=1}^K \frac{B_{kj}}{B_k} S_k \quad (1)$$

where X_j is the amount of government spending in a sector that benefits group j (in what follows, the groups are quintiles of the income distribution). S refers to government spending on that sector, the subscript k denoting the specific service (or sub-sector) that is subsidized—for example primary, secondary and tertiary education, or primary and hospital health care—there being K services distinguished. B denotes the number of individuals receiving the subsidized service. S_k/B_k is the *mean* unit subsidy in the delivery of that service.⁶

The *share* (x_j) of total sector spending (S) imputed to group j is:

$$x_j = \sum_{k=1}^K \frac{B_{kj}}{B_k} \left(\frac{S_k}{S} \right) = \sum_{k=1}^K b_{kj} s_k \quad (2)$$

This depends on two major determinants:

- The b_{kj} 's which are the shares of the group in total service use.

⁶ We relax the assumption of a constant unit subsidy across regions in appendix 2.

- The s_k 's, which denotes the allocation of public sector spending across the different types of service.

The s_k 's are determined by government policy and by the forces which influence how budgets are allocated within a sector.⁷ The b_{kj} 's depend on two basic factors: first, the number of *potential* or *eligible* beneficiaries within the group; and second, the likelihood that a potential or eligible beneficiary will in fact claim the subsidy by using the service in question. Again this can be written formally as

$$x_j = \sum_{k=1}^K \frac{B_{kj}}{B_k} \frac{P_{kj}}{P_k} \left(\frac{S_k}{S} \right) = \sum_{k=1}^K \left(\frac{B_{kj}}{P_{kj}} \frac{P_k}{B_k} \right) \left(\frac{P_{kj}}{P_k} \right) \left(\frac{S_k}{S} \right) = \sum_{k=1}^K \frac{g_{kj}}{g_k} \cdot p_{kj} \cdot s_k \quad (3)$$

where P_{kj} is the population in group j that is entitled to benefit from the service provided by sub-sector k (P_k is total population entitled to use service k). According to (3), the share of total sector spending that benefits group j depends on the following three proximate determinants:

- g_{kj}/g_k : This is the group specific likelihood that potential or eligible beneficiaries will use the subsidized service divided by the same likelihood for the population as a whole (what Lanjouw and Ravallion (1999) call the *average odds of participation*). In the case of education, this is simply the group specific gross enrollment rate relative to the overall gross enrollment rate. This is the *household behavioral* component.
- p_{kj} : This represents group j 's share of the population of potential beneficiaries (for each type of service k). This is the *demographic* component. Again for education, this would be group j 's share of the school-aged population at a particular level of schooling.
- s_k : The share of public spending going to the different types of services provided; reflecting *government behavior*.

Clearly, both demographic and household behavioral factors are behind the observed distribution of education spending benefit. These can be quantified in the following decomposition:

$$x_j - \bar{x} = \sum_{k=1}^K \left(\frac{g_{kj} - g_k}{g_k} \right) \cdot \bar{p}_k \cdot s_k + \sum_{k=1}^K (p_{kj} - \bar{p}_k) \cdot s_k + \sum_{k=1}^K \left(\frac{g_{kj} - g_k}{g_k} \right) \cdot (p_{kj} - \bar{p}_k) \cdot s_k \quad (4)$$

where $\bar{x} = \frac{1}{J}$ and $\bar{p}_k = \frac{1}{J}$

Equation (4) takes the difference between the observed share of the group (quintile) in education spending and its proportionate share (which for a quintile – $J = 5$ – would be 20 percent). This difference is decomposed into three effects (from left to right):

- The household behavior component: insofar as the participation rate of group j differs from the overall average participation rate, its share of education spending will not be proportionate.

⁷ In some cases, government spending allocations can be endogenous. For example, governments may provide service providers with a fixed subsidy per user, thereby endogenizing sub-sector budget allocations (e.g. the capitation grant in the education sector). This needs to be kept in mind when interpreting the results.

- The demographic component: this arises when group j 's share of total beneficiaries differs from its proportionate share (given by $1/J$).
- The interaction of both effects.

It should be noted that the decomposition in (4), and its application in the context of Kenya in section 5, relate to a single point in time, so that government behavior is taken as given. Sub-sector spending allocations thus matter only when we apply the decomposition to the overall sector, where government spending allocations serve as weights to sum over the sub-sectors.

How does this decomposition relate to how other studies have incorporated demography into benefit incidence analysis? An alternative approach is to assess directly benefits per potential beneficiary or to relate group j 's benefit incidence share to its share of potential beneficiaries (see Selden and Wasylenko 1995, Glick and Razakamanantsoa 2002). For example, group j 's benefit per potential beneficiary is given by

$$X_j^P = \sum_{k=1}^K \frac{B_{kj}}{P_{kj}} \frac{S_k}{B_k} = \sum_{k=1}^K g_{kj} \frac{S_k}{B_k} \quad (5)$$

which can be interpreted as the average subsidy accruing to a potential beneficiary belonging to group j . Similarly, we can relate the share of benefits going to group j to its share of the eligible population:

$$x_j^P = \sum_{k=1}^K \frac{B_{kj} / B_k}{P_{kj} / P_k} \left(\frac{S_k}{S} \right) = \sum_{k=1}^K \frac{b_{kj}}{p_{kj}} s_k = \sum_{k=1}^K \frac{x_{kj}}{p_{kj}} \quad (6)$$

In (6), a value greater than unity implies that group j receives a disproportionate share of benefits in relation to its share of potential beneficiaries. Both (5) and (6) provide useful information on the distribution of benefits across the eligible population, though they depart from the standard benefit incidence approach in that they no longer show the overall share of the sector budget going to a specific group j and to what extent the in-kind transfer associated with service k influences the overall distribution of income.⁸

4. Accounting for demography in estimating marginal benefit incidence

Benefit incidence analysis as described in the previous section simply portrays the situation as it is—how spending by the government is distributed across the groups on average. *Changes* in spending may not be distributed in the same way. Yet often the important policy question concerns who would benefit from an expansion (or contraction) in the services subsidized in a particular sector.

Lanjouw and Ravallion (1999) have developed a widely used approach to estimate benefit incidence at the margin by utilizing cross-sectional variations in overall and quintile-specific participation rates (applied for example in World Bank 2003a, Murgai and Zaidi 2005, World Bank 2008b, Jha, Bhattacharyya and Gaiha 2009, Mogues, Petracco and Randriamamojoy 2011). The implicit

⁸ The normalizations in (5) and (6) are also useful if the groups are not of equal population size (e.g. if one uses livelihood groups, instead of quintiles).

assumptions of this approach are that variations in average participation rates mirror differences in public spending in the respective (sub-) sectors (which follows directly from the notion of a uniform sub-sector unit subsidy), and that cross-sectional variations can be used as a basis for predicting changes over time.⁹ Regression analysis can then shed light on the quintile-specific responses to an increase (or decrease) in public funding to the (sub) sectors. This is based on estimating a regression of the following form:

$$g_{d,r,j} = \alpha_j + \beta_j g_r + \mu_{d,r,j} \quad \text{for } j = 1, \dots, J \quad (7)$$

where d denotes a low-level administrative division (e.g. a district), j a group (there being J groups) and r a higher-level administrative division (e.g. a province). The left-hand side variable is the average participation rate for a given district and group. The right-hand side variable is the average participation rate at the provincial level. The regression is estimated separately for each group j . Using OLS to estimate the above equation would result in an upward bias of the β_j coefficients because the district-quintile specific participation rates are also captured under the province-level participation rates. Ravallion and Lanjouw (1999) use a TSLS estimation, in which the ‘left out mean’ (excluding the respective district and quintile) serves as an instrument for the province-level participation rate. The parameter β_j then shows how group j ’s participation rate responds to an increase (or decrease) in the overall participation rate (estimated on a cross-section of data)—the latter being an indication of overall government spending in the sector.

As an analogue to average benefit incidence analysis (equation (3)), where we defined the *average* odds of participation in sector k as the ratio of the quintile participation rate to the overall participation rate (g_{kj}/g_k), we now define the *marginal* odds of participation as the change in the quintile participation rate divided by the change in the overall participation rate (dg_{kj}/dg_k), given by the slope coefficients β_j in equation (7).

Two issues immediately emerge from this. The first concerns the measure of participation used in the regression. Lanjouw and Ravallion (1999) apparently chose the net enrolment rate as their measure, since they admit to neglecting late entry enrolments. Only enrolments of children of school age are included in their measure. Yet, as an indicator of who benefits from government subsidies on services, the gross enrolment should be preferred—children of non-school age would also gain the in kind transfer implicit in attending school.¹⁰ Using the net rate will inevitably lead to bias, since enrolments among the poorer quintiles are likely to include far more children outside the prescribed school age. Not counting such enrolments would lead to a misleading upward bias in the degree of inequality in the benefit incidence of public spending on education. A choice also has to be made concerning the denominator in the participation variable. Using the net enrolment rate, Lanjouw and Ravallion (1999) normalize enrolments on the appropriate school-age population. That is, their measure of participation is normalized on the *eligible* population in each group. Younger (2003), on the other hand defines participation in per capita terms, normalizing gross enrolments on the *total* population of the group. As we shall see, estimates of the marginal benefit incidence are sensitive to the enrolment measure used in the estimation model.

⁹ The latter assumption is clearly problematic if there is unobserved heterogeneity between geographic areas, and preferably the analysis should rely on repeated cross-sections (to form a pseudo panel at the regional level), or household-level panel data (see van de Walle 2003 for a discussion).

¹⁰ One could perhaps make the case that over- or under-age children benefit less from public education spending than children of official school age – but clearly not that they receive no benefits at all. However, even this would be a significant departure from traditional (average) benefit incidence analysis, which takes unit cost as a proxy for benefits and counts all users of a service.

The second issue concerns how marginal shares of any increase in government spending are obtained from regression equation (7). The average odds of participation (g_{kj}/g_k) given in (3) define program participation by normalizing on the population of potential or eligible beneficiaries. It is clear from (3) that to obtain estimates of quintile shares of public education spending (x_j) from the average odds of school enrolment (normalized on the school age population), the average odds must be multiplied by the group's share of the school age population (p_{kj}). The same applies to obtaining marginal shares— β_j should be multiplied by group j 's share of the eligible population (the school age population in the case of education) to obtain the group's share of any increment in government spending. While this is precisely how Lanjouw and Ravallion (1999) defined the odds of participation, they mistakenly multiply the marginal odds of participation by one fifth (the quintile share of the total population) to obtain the marginal benefit incidence *shares*. This is valid only when the participation rate is expressed in per capita terms. When the average and marginal odds are obtained from participation measures normalized on the total population, quintile *shares* are indeed obtained by dividing the average (and marginal) odds by five. Conversely, when the odds of participation are obtained from participation measures normalized on the eligible population, both average and marginal odds need to be multiplied by the group's share of potential beneficiaries. Failing to convert average and marginal odds of participation into benefit incidence shares correctly can lead to misleading conclusions. Using data for Kenya we will show in the next section that the share of benefits from education spending going to the richest quintile is significantly overestimated if we do not take into account the distribution of school age children across the quintiles.

5. An empirical benefit incidence study of education spending in Kenya

We now use the 2005/06 Kenya Integrated Household Budget Survey (KIHBS) and Government of Kenya public spending accounts to estimate the benefit incidence of education sector spending, and thereby illustrate the points made in the previous section. Data for the KIHBS were collected over a 12-month period—from May 2005 to April 2006. The survey, which has a total sample size of 13,430 households, is designed to deliver representative estimates at the national, provincial and district levels (see KNBS 2007 for further details). The survey was conducted just two years after the introduction of Free Primary Education (FPE) in 2003, which had seen significant surges in primary school enrollments.¹¹

Estimating the average benefit incidence

Using government recurrent spending by level of education and survey-based estimates of school enrolment, unit subsidies were obtained for the three broad levels of schooling in Kenya—primary, secondary¹² and tertiary (see table 1). The tertiary unit subsidy (at KSh 157,380 per pupil per annum) was some 22 times the primary subsidy (KSh 7,046) in 2005/06. These unit subsidies, which in effect

¹¹ Administrative data from the Ministry of Education show an increase in public enrolments at the primary level from 5.9 million in 2002 to 7.1 million in 2004. However, as argued by Bold, Kimenyi, Mwabu and Sandefur (2011), survey based estimates for 1997 and 2005/06 do not show a similar increase. Since our analysis relies on a single cross-section of data we cannot directly assess changes in the number of public enrolments over time.

¹² The secondary subsidy includes vocational training. This is why we combine secondary and technical education for the analyses in this paper.

act as weights when computing the benefit incidence of overall government education spending, correspond reasonably well to Ministry of Education (MoE) estimates (see appendix 1 for details).¹³

Table 1: Public spending on education and unit subsidies by sub-sector, 2005/06

	<i>Public spending***</i>		<i>Enrolments (KIHBS)</i>	<i>Unit subsidy (KShs)</i>	<i>Ratio of subsidy</i>
	(KShs Mio.)	(Percent share)			
Primary education	57,183	59.6	8,115,781	7,046	1.0
Secondary education*	23,903	24.9	1,401,696	17,053	2.4
Tertiary education**	14,837	15.5	94,273	157,380	22.3
All education	95,923	100.0	9,611,750		

Notes: * Includes technical education. **Includes teacher training. ***Actual recurrent public spending on primary education in 2005/06, and estimates for other sub sectors based on sub-sector ratios in 2004/05. Administration spending assigned pro-rata.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table 2 shows average benefit incidence according to the approach described in equations (2) and (3) and based on population quintiles ranked by household consumption per adult equivalent. Poorer Kenyan's are clearly able to secure a large share of the primary budget: the share of the poorest quintile in the primary budget was 24.7 percent in 2005. The richest quintile enrolled far fewer children at the primary level, its share of the primary budget being just half of that obtained by the poorest quintile. Poor Kenyans gain much less from secondary education spending—only 9.5 percent of the secondary subsidy goes to the poorest quintile, in contrast to 27.2 percent appropriated by the richest group. As is typical in Africa, the poorest groups do not benefit from spending on tertiary education—at about 2 percent of the tertiary budget. The richest quintile secures an astonishing 70 percent of tertiary education spending.

Table 3 shows the benefit incidence by gender. It appears that while boys only have a slight advantage over girls in the distribution of the primary education budget, biases against girls are greater for the other subsectors, driven particularly by the middle quintiles.¹⁴ Girls gained 47 percent of the total secondary budget, and just 38 percent of the tertiary budget. Given the emphasis in the budget on primary education (where gender differences are minimal) education spending overall is not subject to marked gender inequality (boys gaining 53 percent of total sector spending).

Assessing beneficiary progressivity

As described in the previous sections, these benefit incidence shares ought to be compared with the distribution of needs for education services to get a fuller picture of how equitably spending is distributed. In the case of education, needs are typically approximated by the distribution of the official school-age population in each sub-sector – which is the target group for education services. In fact, the most widely applied international indicators of education coverage—net and gross enrolment rates—are both normalized on the official school-age population. However, the school-age population may not always be the most suitable indicator of need for education services. In countries with

¹³ Appendix 2 relaxes the assumption of a constant unit subsidy across regions and computes district-level unit subsidies. However, this has very little impact on the estimated benefit incidence shares.

¹⁴ The proximate cause is clearly household decisions to enrol girls versus boys, but what explains any gender difference in those decisions is not clear. They do not necessarily arise from biases in the education system itself.

significant numbers of over-age enrolments (e.g. due to grade repetitions, late enrolments or drop outs) or under-age enrolments, the distribution of the official school-age population may be only weakly linked to the distribution of de-facto needs for education services.

Figure A1 shows the distribution of (public and private) school enrolments by age based on the KIHBS 2005/06, highlighting that there is a large proportion of enrolments outside the official school age (the latter being 6-13 years for primary education and 14-17 years for secondary education, see CBS, MOH and ORC Macro 2004, KNBS and ICF Macro 2010, MOE 2012).¹⁵ At the primary level, 68 percent of enrolments are within the official primary school-age interval; just 2 percent are under-age enrolments, and the remaining 30 percent are over-age enrolments. At the secondary level (which includes vocational training) the deviations are even larger, only 37 percent of enrolments fall within the official secondary school age, while close to 57 percent are over-age students. In other words, about one third of primary enrolments and almost two thirds of secondary enrolments are outside the official school age. Table A3 also shows that particularly the bottom three quintiles have a very large share of enrolments outside the official school age, indicating that there are sizeable needs for education services beyond the official school age amongst poorer Kenyans.

Bearing this in mind we conduct the analysis in this section based on two different school age definitions. The de-jure school-age population is based on the official definition of 6-13 years for primary education, and 14-17 years for secondary education. In addition we use the concept of the de-facto school age, where we consider significantly larger (and thus overlapping) age intervals for the primary and secondary education sub-sectors to account for the large numbers of enrolments outside the official school age – 6-16 years for primary education and 14-21 years for secondary education. Clearly our de-facto definition is fairly generous – designed to minimize the exclusion error at the expense of potentially large inclusion errors. Nonetheless we view it as a useful complement to gauge the sensitivity of estimates to a specific (to some degree arbitrary) definition of school age.

In the tertiary education sub-sector, eligibility and needs are much less clearly defined compared with the other sub-sectors, as there is no official school age for higher education. Moreover, in contrast to primary and secondary education, tertiary education is typically not viewed as a universal service that ought to be provided to the entire population of a pre-defined age group, but rather as a service that ought to be allocated based on some form of merit selection as signaled in graduation from secondary school. However, restricting tertiary education needs to current secondary school graduates would enshrine historic inequities in access to primary and secondary education in the needs distribution, which does not seem justifiable. We here use a rather pragmatic approach by approximating needs for tertiary education by the distribution of the population aged 18 to 24 years (without any de-jure vs. de-facto distinction).¹⁶ This is not necessarily incompatible with merit selection, as long as the distribution of the former is proportional to the distribution of the population in this age group. Nonetheless, the decomposition for the tertiary education sector ought to be regarded with some caution.

When we consider the education sector as a whole, we approximate the distribution of needs by the ‘grand’ school-age population (6-24 years). We consider two versions – an unweighted distribution, which is simply the quintile’s proportion of individuals aged 6-24 years, and a weighted distribution,

¹⁵ Benefit incidence analysis is concerned with the distribution of public spending and thus we only consider public enrolments to estimate benefit shares. However, to gauge needs in the education sector it appears preferable to consider both public and private enrolments.

¹⁶ Clearly there are also a number of tertiary enrolments beyond the age of 24. However, we want to avoid here that the distribution of needs for the education sector is excessively dominated by the distribution of working age adults.

where each school-age individual is given a weight according to the unit subsidies shown in table 1 (which are also used to aggregate spending across sub-sectors).¹⁷ This takes into account that a child of primary school-age requires less spending to meet its education needs than a child of secondary or even tertiary school-age (taking government sub-sector spending allocations as given). Using the same weighting scheme for the distribution of needs as for the distribution of benefits also corresponds more closely to the decomposition in (14), where the overall household behavior and demographic component is computed as the (unit-subsidy) weighted average of sub-sector components. On the other hand, the unweighted distribution has the advantage that it is not influenced by government spending allocations and thus not dominated by the large tertiary subsidy.

We now compare the distribution of benefit shares with the distribution of the school-age population, starting with the de-jure (official) definition (table 2). Clearly the fact that the poorest population quintile is able to secure 24.7 percent of the education subsidy appears less favorable if we consider that the quintile also comprises 23.5 percent of the official school-age population (though it is still a disproportionate share). In contrast, the richest quintile only comprises 14.8 percent of the school-age population, which can partly explain its low share of the primary education budget at just 10.2 percent. In secondary education, comparing the benefit and needs distributions makes public spending appear even more unequal, as the poorer quintiles, despite gaining less than proportionately from secondary spending, have a disproportionate share of the school age population. It is interesting to note that while the poorer quintiles contain a disproportionate share of the primary and secondary school-age population, the richer quintiles contain a larger share of the tertiary school-age population. Disaggregating benefit incidence shares by gender (table 3) shows that this is caused predominantly by females – who are overrepresented in the richer quintiles between the ages of 18 to 24 years, which probably reflects that young, unmarried Kenyan women are less likely than men to set up their own household. Table 3 thus also shows that gender inequality in education amongst the richer quintiles is more pronounced than it seems at first glance. Nonetheless the striking concentration of tertiary education amongst the top quintiles is not predominantly caused by demography but rather by the fact that there are negligible numbers of university enrolments (per population aged 18-24 years) amongst the poorer quintiles.

For the education sector as a whole, the poorer quintiles have a slightly larger share of the unweighted school age population, while the richer quintiles have a slightly larger share of the weighted school age population. This reflects that the poorer quintiles comprise a larger share of the primary school-age population (which receives a very low unit-subsidy), while the richer quintiles comprise a larger share of the population of tertiary school age (which receives a much larger unit subsidy). In fact, the benefit shares in the overall sector are distributed similarly to the weighted school-age population, but somewhat more regressive in relation to the distribution of the unweighted school-age population. Nonetheless we will show below that irrespective of which school-age population distribution we chose, education spending as a whole is beneficiary regressive, in the sense that the benefit concentration curves are less concentrated amongst the poor than either of the two school-age population concentration curves.

Table 3 also shows the distribution of the de-facto school-age population, which takes into account that there are large numbers of school enrollments outside the official school age. For primary education, the distribution of the de facto school-age population mirrors very close that of the de jure population – which is comforting in the sense that reasonable changes in the definition of the eligible population do not change the assessment of equity in the primary education sector. The differences are, however, larger for secondary education. While the ratio of the secondary school-age populations

¹⁷ There is thus no de-facto / de-jure distinction.

of the poorest to the richest quintile is 1.6 (23.4 percent / 14.5 percent) using the de jure school-age definition, it is only 1.2 (21.4 percent / 17.7 percent) using the de facto definition. However, given that the benefits from secondary education are fairly strongly concentrated amongst the richer quintiles, these differences between the official and de-facto school-age definitions do not change the overall assessment of equity in secondary education spending. We thus conclude that the distinction between the de jure and de facto school-age population makes little difference for the analysis of average benefit incidence, and will restrict the discussion that follows to the de jure (official) school-age definition. However, we will revisit the distinction later in the context of marginal benefit incidence analysis, where estimates appear to be much more sensitive to the distribution of the school-age population.

Decomposing benefit incidence

To quantify the extent to which demography and household behavior can jointly explain benefit incidence shares table 4 decomposes each group's deviation from the proportionate share into three components – a demographic component (here based on the de jure school-age definition), a household behavior component and an interaction effect (according to equation (4)).

The table shows that the distribution of primary education is to a significant extent influenced by demography – in fact 3.5 percentage points of the poorest quintile's disproportionate share of primary education spending can be explained by the distribution of the school-age population, while only one percentage point is due to household behavior. Conversely, the fact that the richest quintile contains less than 15 percent of the primary school-age population can explain half of the quintile's disadvantaged position in primary education benefits (-5.2 percentage points). The remaining differential is due to the fact that the richest group has a below average gross enrolment rate in public facilities, reflecting a preference for private providers amongst richer Kenyans, and the interaction of demography and household behavior. For the secondary and tertiary sub-sectors, household behavior is clearly the more important proximate determinant of education spending, as demography can only explain a small proportion of the observed difference between each quintile's share in benefits and the proportionate share of 20 percent.

Dominance analysis

To assess the degree of progressivity or regressivity in each sub-sector we go beyond the quintile representation of benefit incidence shares and employ dominance test on the benefit concentration curves (see also figure A2). As described in section 2, beneficiary progressivity implies that the concentration curve dominates the concentration curve of needs, in our case the distribution of school-age children. We feel that this is the appropriate benchmark to judge to what extent the distribution of the education budget meets the needs of the different quintiles for education services. However, we also report tests of absolute progressivity, where we test whether the concentration curve lies above the diagonal, and relative progressivity, where we test whether the concentration curve dominates the Lorenz curve of consumption (per adult equivalent). The dominance analysis is carried out using the Distributive Analysis Stata Package (DASP) (Araar 2006, Araar and Duclos 2009). Since statistical dominance tests rarely deliver significant results at the extremes of the distribution we follow Glick and Razakamanantsoa (2005) in restricting the test to the 5th to 95th percentiles of the distribution.

Table 5 shows that primary education spending meets the criteria of relative and absolute progressivity, because the concentration curve of primary education benefits dominates both the Lorenz curve and the diagonal. However, it crosses the needs concentration curve and hence fails to meet the criterion of beneficiary progressivity. Secondary education, on the other hand is regressive according to the criterion of absolute progressivity (and hence also according to the more demanding criterion of beneficiary progressivity). Moreover, the concentration curve of benefits from secondary education crosses the Lorenz curve of consumption. Tertiary education is regressive according to all three progressivity criteria – mirroring that tertiary education spending not only fails to meet the needs of the poorer groups but even reinforces existing income inequalities. Education spending as a whole is regressive according to the criteria of absolute and beneficiary progressivity, irrespectively of whether we chose the weighted or the unweighted school-age population distribution. However, education spending still dominates the Lorenz curve of consumption (relative progressivity). This is also shown in table A4, which reports the in-kind transfers that the poorest Kenyans received by sending their children to state schools amounted to 36 percent of their income (in per capita terms). Although larger in absolute terms, the transfers to the richest quintile amounted to just 5 percent of its income.

Table 2: Average benefit incidence of public education spending and school-age population by sub-sector and quintile, 2005/06 (percent)

	<i>Primary education</i>			<i>Secondary education</i>			<i>Tertiary education</i>		<i>All education</i>		
	<i>Share of subsidy</i>	<i>Share of school age population</i>		<i>Share of subsidy</i>	<i>Share of school age population</i>		<i>Share of subsidy</i>	<i>Share of school age population</i>	<i>Share of subsidy</i>	<i>Share of grand school age population</i>	
		<i>de jure</i>	<i>de facto</i>		<i>de jure</i>	<i>de facto</i>				<i>unweighted</i>	<i>weighted*</i>
Poorest quintile	24.7	23.5	23.5	9.5	23.4	21.4	1.9	17.5	17.4	21.6	18.2
Quintile 2	25.2	22.1	22.2	15.9	22.7	21.4	2.0	19.1	19.3	21.3	19.5
Quintile 3	21.6	20.8	20.9	21.9	20.4	19.8	7.0	18.9	19.4	20.1	19.1
Quintile 4	18.2	18.8	18.9	25.5	19.0	19.7	19.1	21.1	20.2	19.6	20.8
Richest quintile	10.2	14.8	14.5	27.2	14.5	17.7	70.0	23.4	23.7	17.5	22.3
Kenya	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: De jure school-age (in years): 6-13 (primary), 14-17 (secondary). De facto school-age (in years): 6-16 (primary), 14-21 (secondary). School-age for tertiary education always defined as 18-24 years. Grand school-age population always defined as 6-24 years. * Weighed by sub-sector unit subsidies.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table 3: Gender differences in average benefit incidence of public education spending and school-age population by sub-sector and quintile, 2005/06 (percent)

	<i>Primary education</i>				<i>Secondary education</i>				<i>Tertiary education</i>				<i>All education</i>					
	<i>Share of subsidy</i>		<i>Share of school-age population</i>		<i>Share of subsidy</i>		<i>Share of school-age population</i>		<i>Share of subsidy</i>		<i>Share of school-age population</i>		<i>Share of subsidy</i>		<i>Share of school-age population</i>			
	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>	<i>M</i>	<i>F</i>
Poorest quintile	12.8	11.9	12.0	11.5	4.8	4.7	11.5	11.9	1.9	0.0	9.4	8.1	9.1	8.3	11.1	10.6	9.7	8.6
Quintile 2	12.9	12.3	10.9	11.2	9.2	6.8	11.9	10.7	1.4	0.6	10.1	9.0	10.2	9.1	10.9	10.4	10.3	9.3
Quintile 3	10.8	10.9	10.2	10.6	12.7	9.2	10.4	10.0	5.8	1.2	9.8	9.1	10.5	9.0	10.1	10.0	9.8	9.3
Quintile 4	9.3	9.0	9.5	9.3	12.4	13.1	9.3	9.8	15.6	3.5	9.6	11.5	11.0	9.2	9.5	10.1	9.6	11.3
Richest quintile	5.1	5.1	7.3	7.5	13.6	13.6	7.0	7.5	37.6	32.4	10.0	13.4	12.2	11.4	8.1	9.4	9.7	12.6
Kenya	50.9	49.2	49.9	50.1	52.7	47.4	50.1	49.9	62.3	37.7	48.9	51.1	53.0	47.0	49.6	50.4	49.0	51.0

Notes: M denotes males; F denotes females. Based on de jure school-age definition: 6-13 years (primary), 14-17 years (secondary), 18-24 years (tertiary). * Weighed by sub-sector unit subsidies.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table 4: Decomposition of average benefit incidence of public education spending, 2005/06

	<i>Primary education</i>				<i>Secondary education</i>				<i>Tertiary education</i>				<i>All education</i>			
	Δ	Δ due to			Δ	Δ due to			Δ	Δ due to			Δ	Δ due to		
	<i>from 20%</i>	<i>hh behavior</i>	<i>demo-graphy</i>	<i>inter-action</i>	<i>from 20%</i>	<i>hh behavior</i>	<i>demo-graphy</i>	<i>inter-action</i>	<i>from 20%</i>	<i>hh behavior</i>	<i>demo-graphy</i>	<i>inter-action</i>	<i>from 20%</i>	<i>hh behavior</i>	<i>demo-graphy</i>	<i>inter-action</i>
Poorest quintile	4.7	1.0	3.5	0.2	-10.5	-11.9	3.4	-2.0	-18.1	-17.8	-2.5	2.2	-2.6	-5.1	2.6	-0.1
Quintile 2	5.2	2.9	2.1	0.2	-4.1	-5.9	2.6	-0.8	-18.0	-17.9	-0.9	0.8	-0.7	-2.5	1.8	0.0
Quintile 3	1.6	0.8	0.8	0.0	1.9	1.5	0.4	0.0	-13.0	-12.5	-1.1	0.6	-0.6	-1.1	0.4	0.1
Quintile 4	-1.8	-0.6	-1.2	0.0	5.5	6.9	-1.0	-0.4	-0.9	-1.9	1.1	-0.1	0.2	1.1	-0.8	-0.1
Richest quintile	-9.8	-6.2	-5.2	1.6	7.2	17.5	-5.5	-4.8	50.0	39.9	3.4	6.7	3.7	6.8	-3.9	0.8

Notes: Deviations in percentage points. Based on de jure school-age definition: 6-13 years (primary), 14-17 years (secondary), 18-24 years (tertiary).

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table 5: Stochastic dominance tests of public education spending, 2005/06

	Relative progressivity	Absolute progressivity	Beneficiary progressivity		Primary education	Secondary education	Tertiary education	All education
	<i>Lorenz curve</i>	<i>45 degree line</i>	<i>needs concentration curve</i>		<i>benefit concentration curve</i>	<i>benefit concentration curve</i>	<i>benefit concentration curve</i>	<i>benefit concentration curve</i>
Primary education	(+)	(+)	X		n.a.	(+)	(+)	(+)
Secondary education	X	(-)	(-)		(-)	n.a.	(+)	X
Tertiary education	(-)	(-)	(-)		(-)	(-)	n.a.	(-)
All education	(+)	(-)	uw*: (-) / w***: (-)		(-)	X	(+)	n.a.

Notes: Dominance test refer to the 5th to 95th percentile. (+) denotes that the curve 1 (left) is more concentrated amongst the poor than curve 2 (top). (-) denotes that it is less concentrated. X indicates rejection of the null hypothesis (concentration curves cross). Needs concentration curve based on de jure school-age definition: 6-13 years (primary), 14-17 years (secondary), 18-24 years (tertiary).

* uw denotes unweighted school age population. ** w denotes weighted school age population.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Estimating marginal benefit incidence

We now turn to the estimation of marginal benefit incidence shares. We follow Lanjouw and Ravallion (1999), but instead of running separate regressions by quintile, a constrained linear regression with group-fixed effects (α_j) and group-specific interaction effects (β_j) is estimated:

$$g_{d,r,j} = \alpha + \beta g_r + \sum_{j=2}^J (\alpha_j Q_j + \beta_j g_r Q_j) + \mu_{d,r,j} \quad (7)$$

where the left-hand side variable ($g_{d,r,j}$) is the district-level participation rate of quintile j . The right-hand side variable is the average participation rate at the *province* level (g_r).¹⁸ We also follow Lanjouw and Ravallion (1999) in that we use the ‘left out mean’ (which excludes quintile j in district d) as an instrument for the province-level participation rate. However, estimating just one regression with interaction effects allows us to constrain the coefficients so that the group-specific marginal effects account for the total change in participation (as in Younger 2003):

$$\alpha + \frac{P_j}{P} \sum_{j=2}^J \alpha_j = 0 \quad \text{and} \quad (8)$$

$$\beta + \frac{P_j}{P} \sum_{j=2}^J \beta_j = 1 \quad (9)$$

If the participation measure (g_r) in (7) is normalized on the school age population, P_j is the school-age population in group j and P is the total school-age population of the respective subsector in (8) and (9). If the participation measure is normalized on the overall population P_j/P is simply the overall population share of group j . Effectively these two constraints enforce estimated marginal benefit incidence shares to sum to 100 percent.

As will be recalled from section 4, Lanjouw and Ravallion (1999) use net enrolments per school-age population, while Younger (2003) uses gross enrolments per population. It is clear from the preceding discussion that gross enrolments are to be preferred to net enrolments—otherwise the analysis excludes the large number of primary and secondary enrolments that occur outside the official school age but still benefit from public education spending. But what of the normalization? In principle estimates using enrolments normalized on the school-age population are to be preferred to those using per capita enrolments. Equations (6) and (7) seek to capture household behavioral responses to an increase in government spending. Yet it is also clear that the demographic structure is likely to condition those responses. Households with many children of school age are likely to respond more to an increase in government spending, than those with fewer such children. Groups that already send most of their children to school are far less likely to raise enrolments when government spending increases than those with lots of school-age children not yet enrolled. Variations in the gross enrolment rates across groups will best capture such differences in responses. Using per capita enrolments would ignore them (as does Younger, 2003).

A second concern with the Younger (2003) normalization is that it compares geographic areas on the basis of enrolments per capita. Recall that the marginal odds of participation seek to capture how group j ’s participation rate is affected by an increase in overall program coverage (and spending). Since enrolments per school-age population would be a better indicator of program coverage (and total

¹⁸ In estimating (7) we exclude observations where there are less than 5 school-age individuals in a specific district and quintile.

government spending in the sector) than enrolments per capita, this is also the more appropriate specification for estimating equation (7).

These considerations assume significance because the results obtained in estimating equation (7) can be very sensitive to the choice of participation variable. Table 6 reports estimates of the marginal odds of participation and marginal benefit incidence shares for government spending on primary and secondary education in Kenya.¹⁹ We show the results for three different measures of participation in government-funded schooling (all taking school enrolments to include over- and under-aged children):

- Gross school enrolments of quintile j divided by the population of quintile j .
- Gross school enrolments of the quintile j divided by the official school-age population (6-13 years for primary and 14-17 years for secondary)—what we call the de-jure school-age population.
- Gross school enrolments of the quintile j divided by the de-facto school-age population introduced earlier in this section. This is 6-16 years for primary and 14-21 years for secondary.

Consider the predicted shares from an increment in government education spending for the poorest and richest quintiles. At the primary level, the results using alternative participation variables are similar for the poorest quintile—the poorest get 33 of the increment when using enrolment rates (both under the de jure and de facto concepts) and 35 percent using per capita enrolments. But the richest quintile is predicted to get around 20 percent of an increment in primary spending based on per capita enrolments, but just 11 percent using enrolment rates normalized on the official school-age definition (using the de facto definition gives a slightly higher share for the richest quintile, at 13 percent). However, despite the differences, the estimates at the primary level tell a fairly consistent story that the poorest quintile benefits disproportionately from an increase in spending on primary education and that the estimated marginal benefits for the poorest quintile are even larger than its average benefits. As a corollary, a reduction in primary education funding is predicted to affect the poorest sections of Kenyans most.

We now turn to the results for secondary education. Here the normalization has much stronger implications for the assessment of which groups benefit mostly from an increase in sector funding. Using per capita secondary enrolments, the poorest quintile is predicted to get 16 percent of an expansion in secondary education. When enrolment rates (normalized on the official school age population) are used in the regression, it is predicted to get around 20 percent of the increment. Similarly, the richest quintile gets 24 percent of an increment in secondary spending when per capita enrolments are used, but just 14 percent based on enrolment rates. And while both normalizations suggest that the third quintile benefits disproportionately from an increase in spending on secondary schools, the benefit incidence shares estimated using enrolment rates are much more progressive than those estimated on the basis of per capita enrolments. The results using the de-facto school-age population come out in between the two others but are, somewhat surprisingly, closer to the population normalization than to the de-jure school-age normalization.

This demonstrates that predictions about the distribution of increments in government spending based on the Lanjouw-Ravallion-Younger approach can be sensitive to the regression specification. But which of the regression specifications is to be preferred? Since equation (7) seeks to estimate household enrolment responses to a change in government spending, and since such responses are

¹⁹ We restrict the analysis to the primary and secondary education sub-sectors because university enrolments are largely restricted to a few districts with higher education institutions.

certain to be constrained by the numbers of children of school age they have (and of these, how many are already enrolled), our preference would be to take estimates based on gross enrolment rates in the regression specification. But whichever specification is used, caution must be counseled in interpreting the findings given the sensitivity to the measures used.

The benefit incidence shares at the margin reported in Table 6 were correctly obtained—the marginal odds of participation were multiplied by 0.2 to obtain marginal shares when using the per capita enrolment specification, and by the share of the school-age population when using enrolment rates. Using the wrong transformation (as did Lanjouw and Ravallion 1999) can be misleading (Table 7). For example, we would mistakenly predict that the poorest quintile would get 28 percent of an increase in primary education spending (compared with a correct estimate of 33 percent). In the primary and secondary education sectors, where the poor typically have disproportionate school-age population shares, failure to adequately convert the marginal odds of participation into marginal benefit incidence shares leads to an underestimation of the benefits going to the poorer quintiles.

Last but not least it is important to note that the considerations discussed in the paper also apply to a situation where marginal benefit incidence shares are estimated using individual panel or region-level pseudo panel data (see Younger 2003). Such data would be clearly advantageous to address potential biases in the estimated coefficients arising from latent regional heterogeneity, because they would allow controlling for regional fixed effects in the regression and identifying the marginal odds of participation on the basis of over-time variation (rather than cross-sectional variation, as in the example here). However, even when the analysis is based on panel data, estimating marginal benefit incidence shares requires a decision about the normalization of the participation measure, and the correct transformation of the marginal odds of participation.²⁰

Finally, needs and demography are also relevant in sectors other than education, such as health or targeted social assistance programs, though in some of these cases needs can be considerably more difficult to measure than in the education sector (see O'Donnell et al 2008 for an extensive discussion on estimating needs distributions for the health sector; see also Demery and Gaddis 2012 for a discussion using data for Kenya).

²⁰ It is possible that the differences between alternative normalization approaches would be somewhat less important in a panel data context because there may be less variation in demographics over time than across space, at least if we consider short time intervals. On the other hand, the normalization of the participation measure could easily have a bearing on whether we consider that a region saw an increase or a decline in education coverage (and spending) over time and thus still significantly affect the results.

Table 6: Estimates of marginal odds of participation and marginal benefit incidence shares under alternative measures of program participation, 2005/06

<i>Normalization:</i>	<i>Primary education</i>						<i>Secondary education</i>					
	<i>Coefficients (marginal odds)</i>			<i>Marginal benefit incidence shares</i>			<i>Coefficients (marginal odds)</i>			<i>Marginal benefit incidence shares</i>		
	<i>School-age population</i>	<i>School-age population</i>	<i>Population</i>	<i>School-age population</i>	<i>School-age population</i>	<i>Population</i>	<i>School-age population</i>	<i>School-age population</i>	<i>Population</i>	<i>School-age population</i>	<i>School-age population</i>	<i>Population</i>
	<i>(de-jure)</i>	<i>(de-facto)</i>		<i>(de-jure)</i>	<i>(de-facto)</i>		<i>(de-jure)</i>	<i>(de-facto)</i>		<i>(de-jure)</i>	<i>(de-facto)</i>	
Poorest quintile	1.385	1.413	1.744*	0.326	0.332	0.349	0.857	0.780	0.778	0.201	0.167	0.156
Quintile 2	1.107	1.013	0.874	0.244	0.225	0.175	0.835	0.718	0.730	0.189	0.154	0.146
Quintile 3	0.856	0.826	0.459*	0.178	0.172	0.092	1.377	1.321	1.122	0.281	0.262	0.225
Quintile 4	0.737	0.757	0.949	0.139	0.143	0.190	1.019	1.142	1.192	0.194	0.225	0.238
Richest quintile	0.764	0.875	0.975	0.113	0.127	0.195	0.935	1.089	1.178	0.136	0.193	0.235

Notes: Signifies statistically different from unity at 0.05 level.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table 7: Estimates of marginal benefit incidence shares using correct and incorrect transformation (based on de-jure school age definition), 2005/06

<i>Normalization:</i>	<i>Primary education</i>				<i>Secondary education</i>			
	<i>Coefficients (marginal odds)</i>	<i>Share of school age population</i>	<i>Marginal benefit incidence shares</i>		<i>Coefficients (marginal odds)</i>	<i>Share of school age population</i>	<i>Marginal benefit incidence shares</i>	
			<i>Correctly estimated using school-age population shares</i>	<i>Incorrectly estimated using total population shares (0.20)</i>			<i>Correctly estimated using school-age population shares</i>	<i>Incorrectly estimated using total population shares (0.20)</i>
Poorest quintile	1.385	0.235	0.326	0.277	0.857	0.234	0.201	0.171
Quintile 2	1.107	0.221	0.244	0.221	0.835	0.226	0.189	0.167
Quintile 3	0.856	0.208	0.178	0.171	1.377	0.204	0.281	0.275
Quintile 4	0.737	0.188	0.139	0.147	1.019	0.190	0.194	0.204
Richest quintile	0.764	0.148	0.113	0.153	0.935	0.145	0.136	0.187

Notes: Based on de jure school-age definition: 6-13 years (primary), 14-17 years (secondary), 18-24 years (tertiary).

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

6. Conclusion

Average and marginal benefit incidence analysis is a popular tool to assess the targeting performance of programs funded by the government and to inform development policy operations. Yet in many cases, the analysis is carried out mechanically – analyzing the incidence of government spending as though it were simply a tool for income redistribution. But when the objective of government-sponsored programs is to raise capabilities of the population – particularly true of the social sectors – the benefit incidence analysis must go further and take into account differences in needs and eligibility for public services across the population. The paper has discussed the implications of this for the analysis of benefit incidence and highlighted three key concerns, illustrated each with reference to education spending in Kenya:

First, we argue that while the distribution of the population (often referred to as the ‘line of equality’) might be an appropriate yardstick for judging government programs concerned with income transfers, for analyzing government programs which seek to address specific needs and to raise capabilities, the distribution of potential beneficiaries (i.e. the population eligible or in need for a specific service) is the more relevant benchmark. Second, we have proposed a simple decomposition which can show clearly just how important needs and eligibility are in determining (in a proximate sense) average benefit incidence outcomes.

Finally, we have demonstrated that estimates of marginal benefit incidence shares can be very sensitive to the normalization of the participation measure. Given that education coverage is best measured using enrolments per school-age population, Younger’s (2003) per capita specification calls for reconsideration, and might well have influenced the results he obtained. And while Lanjouw and Ravallion (1999) use the preferred normalization specification, they do not use the correct transformation to derive marginal benefit incidence shares and thus underestimate the share of benefits going to the poorer quintiles. Careless analysis can thus lead to misleading conclusions.

Unfortunately, much of the applied benefit incidence literature overlooks eligibility and needs. Table A5 in the appendix presents an overview over some of the more recent (2002-2012) World Bank and IMF operational policy studies (such as from World Bank poverty assessments and IMF working papers), which show benefit incidence estimates for the education sector. Two issues stand out: First, most studies only show the distribution of benefits across population quintiles (absolute progressivity) in analyzing government spending on education – thereby entirely ignoring that the poorer quintiles have a larger share of the school-age population in virtually all developing countries. Only three of the 16 studies surveyed assess benefits relative to the distribution of school-age children (beneficiary progressivity), while another three studies at least commented on the fact that children of school age are concentrated amongst the poorer quintiles. Second, the studies pay little attention to the normalization of the participation measure in estimating marginal benefit incidence shares. Of those three studies that used the Lanjouw and Ravallion (1999) method to estimate the marginal odds of participation – one used net enrolment rates, another used net and gross enrolment rates, while the third did not provide any information on the participation measure. Given that we have shown that marginal benefit incidence shares can be very sensitive to the regression specification, these issues should receive greater attention. Even policy-oriented analysis of the kind used in World Bank and IMF operations work must be explicit about the assumptions made and the data constructs used.

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Appendix 1: How accurate are the household survey estimates of school enrollments?

In this annex, the suitability (and accuracy) of the KIHBS data for this type of analysis is assessed. Table A1 compares school enrolment estimates from the KIHBS with those of the Ministry of Education (MoE). The large sample means that KIHBS obtained robust estimates of school enrolments in public schools. There is an acceptable correspondence between the survey and the MoE estimates of both primary and secondary enrolments. Survey estimates tend to be higher than MoE data for all provinces (except primary enrolments in Nyanza and Central). The estimates are substantially higher in North Eastern province. The reasons for this are not entirely clear and call for further investigation. The differences may be due to weaknesses in school enrolment reporting, or to sampling (or non-sampling) errors in the household survey. Investigating which of these applies is beyond the scope of this paper. The objective here is to demonstrate that the KIHBS enrolment data are sufficiently accurate for benefit incidence estimates. Finally, the KIHBS 2005/6 estimates enrolments at the tertiary level to be 94,273. This compares with the enrolments in public universities reported by the Ministry of Education for 2004/05 of 81,491. Given that tertiary enrolments are a relatively rare event in national surveys, these data (along with the survey estimates of primary and secondary enrolments) give confidence in the use of the 2005/06 KIHBS in assessing the benefit incidence of government spending on education.

Table A1: Survey estimates of public enrolments vs. administrative data by province, 2005/06

	<i>Primary enrolments</i>		<i>Secondary enrolments</i>	
	<i>KIHBS</i>	<i>MoE</i>	<i>KIHBS</i>	<i>MoE</i>
Nairobi	254,856	216,228	64,434	28,536
Central	900,366	904,029	203,014	181,610
Coast	724,718	559,325	62,630	48,824
Eastern	1,520,002	1,359,981	187,101	173,591
Nyanza	1,235,188	1,295,415	226,636	170,557
Rift Valley	2,050,642	2,019,077	279,771	206,897
Western	1,206,592	1,160,915	148,617	118,051
North Eastern	223,417	82,316	16,393	6,084
Kenya	8,115,781	7,597,286	1,188,596	934,149

Sources: Authors' estimates based on Ministry of Education (MoE) administrative data and KIHBS 2005/06 enrolments (here excluding vocational training).

Appendix 2: Accounting for geographic inequalities in unit subsidies

The analysis conducted in section 5.1 neglects quality differences in education services. The basic benefit incidence estimates were based on equation 2, and assumed that government spending per enrolled pupil does not vary geographically. The objective of the unit subsidies was to give public expenditure based weights to the different levels of schooling which enabled us to report how the education budget as a whole is distributed (summing across sub-sectors). But another influence on the distribution of the subsidy has been neglected in these estimates—this being *geographical* inequalities in the way the education budget is disbursed. We therefore re-estimated benefit incidence of education spending based on the following equation

$$x_j = \sum_{d=1}^D \sum_{k=1}^K \frac{B_{dkj}}{B_{dk}} \left(\frac{S_{dk}}{S} \right) = \sum_{d=1}^D \sum_{k=1}^K b_{dkj} S_{dk} \quad (2a)$$

where d denotes the region specified in the unit cost estimate, there being D regions (here districts).

Education spending data at the district level are not available. But using information on the allocation of teachers (whose salaries dominate the government education subsidy), and the KIHBS 2005/06 estimates of school enrolments, we compute estimates of how the unit subsidies varies by district.²¹ And there is significant variation across the districts. Although 34 districts are within +/- 20 percent of the average primary subsidy, 35 are outside these bounds; 17 of these receive unit subsidies that are less than KSh 5,600 (see Demery and Gaddis 2009 for further details). Somewhat surprisingly however, the level of unit subsidy is only weakly correlated to estimates of poverty at the district level. This implies that with the exception of some of the very poor and remote districts in Northeastern Kenya, poor districts do not receive systematically lower unit subsidies. For that reason disaggregating unit subsidies only has a very small impact on overall benefit incidence; a similar exercise for secondary schooling gives the same result (table A2).

Table A2: Uniform versus district-specific unit subsidies: average benefit incidence of primary and secondary education spending, 2005/06

	<i>Primary education</i>				<i>Secondary education</i>			
	<i>District-specific unit subsidies</i>		<i>Uniform unit subsidy</i>		<i>District-specific unit subsidies</i>		<i>Uniform unit subsidy</i>	
	<i>Primary subsidy (M Ksh.)</i>	<i>Share of subsidy (percent)</i>	<i>Primary subsidy (M Ksh.)</i>	<i>Share of subsidy (percent)</i>	<i>Secondary subsidy (M Ksh.)</i>	<i>Share of subsidy (percent)</i>	<i>Secondary subsidy (M Ksh.)</i>	<i>Share of subsidy (percent)</i>
Poorest quintile	13,499	23.6	14,128	24.7	2,237	9.4	2,262	9.5
Quintile 2	14,531	25.4	14,423	25.2	3,842	16.1	3,807	15.9
Quintile 3	12,719	22.2	12,370	21.6	5,512	23.1	5,229	21.9
Quintile 4	10,741	18.8	10,427	18.2	6,408	26.8	6,105	25.5
Richest quintile	5,693	10	5,835	10.2	5,904	24.7	6,501	27.2
Kenya	57,183	100	57,183	100	23,903	100	23,903	100

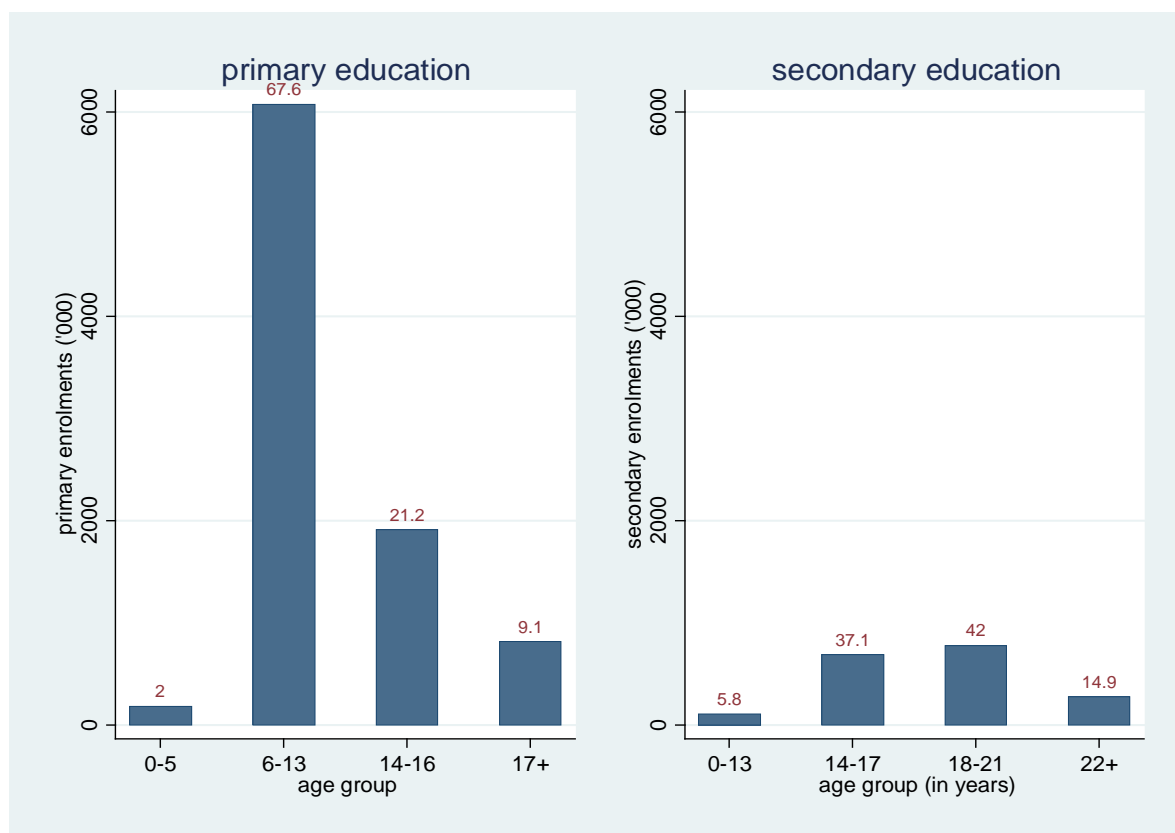
Notes: District-specific unit subsidies assume that 80% of sub-sector spending is allocated according to the regional distribution of teachers, while another 20% (capitation grant) is allocated according to the regional distribution of students.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

²¹ The district-specific unit subsidies do not distinguish between urban and rural schools. If we were to take such differences into account, the benefit incidence analysis would most likely reveal greater inequality. However, we do not have information about the allocation of teachers between urban and rural schools within a district.

Appendix 3: Figures and tables

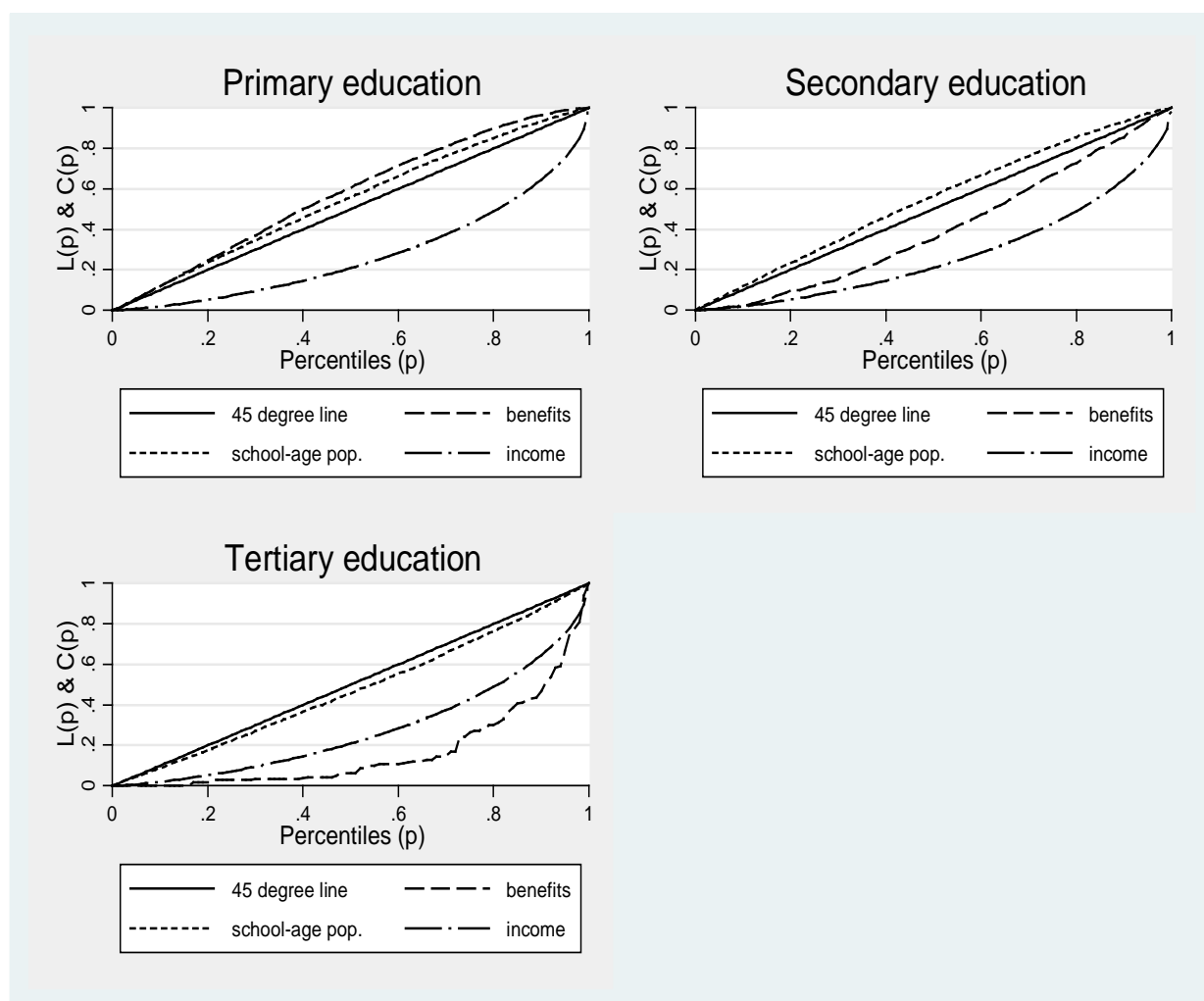
Figure A1: Enrolments by age group and sub-sector, 2005/06



Notes: Figures above the bars in percent.

Source: Authors' estimates based on KIHBS 2005/06 enrolments.

Figure A2: Concentration curves by sub-sector, 2005/06



Notes: Needs concentration curve based on de jure school-age definition: 6-13 years (primary), 14-17 years (secondary), 18-24 years (tertiary).

Source: Authors' estimates based on KIHBS 2005/06 enrolments.

Table A3: Enrolments outside the official school age by quintile, 2005/06

	<i>Primary</i>	<i>Secondary</i>
Poorest quintile	38.2	67.2
Quintile 2	36.9	67.2
Quintile 3	32.3	66.5
Quintile 4	28.1	59.2
Richest quintile	20.9	60.2
Kenya	32.4	62.8

Notes: As percent of all enrolments of that quintile. Public and private schools.

Official school-age population: 6-13 years (primary), 14-17 years (secondary).

Source: Authors' estimates based on KIHBS 2005/06 enrolments.

Table A4: Average benefit incidence of public education spending (absolute and relative to consumption) by sub-sector and quintile, 2005/06 (percent)

	<i>Primary education</i>		<i>Secondary education</i>		<i>Tertiary education</i>		<i>All education</i>	
	<i>Share of subsidy</i>	<i>Subsidy relative to consumption</i>	<i>Share of subsidy</i>	<i>Subsidy relative to consumption</i>	<i>Share of subsidy</i>	<i>Subsidy relative to consumption</i>	<i>Share of subsidy</i>	<i>Subsidy relative to consumption</i>
Poorest quintile	24.7	30.4	9.5	4.9	1.9	0.6	17.4	35.8
Quintile 2	25.2	17.0	15.9	4.5	2.0	0.3	19.3	21.8
Quintile 3	21.6	10.0	21.9	4.2	7.0	0.8	19.4	15.1
Quintile 4	18.2	5.5	25.5	3.2	19.1	1.5	20.2	10.2
Richest quintile	10.2	1.2	27.2	1.3	70.0	2.1	23.7	4.6
Kenya	100.0	6.1	100.0	2.5	100.0	1.6	100.0	10.2

Notes: Consumption per capita.

Sources: Authors' estimates based on Ministry of Finance expenditure data and KIHBS 2005/06 enrolments.

Table A5: Average and marginal benefit incidence estimates of education spending in World Bank and IMF operational policy analysis

<i>Study</i>	Average benefit incidence analysis					Marginal benefit incidence analysis	
	<i>Sectors</i>	<i>Progressivity criterion</i>			<i>Comments on needs</i>	<i>Sectors</i>	<i>Normalization</i>
		<i>REL</i>	<i>ABS</i>	<i>BEN</i>			
Cubero and Hollar (2010: 22-28)	PRI, SEC, TER	X	X		No	--	--
Cuesta, Kabaso, and Suarez-Becerra (2012: 22-23)	PRI, SEC, TER		X		No	--	--
Davoodi, Tiongson, and Asawanuchit (2003: 21-23)	PRI, SEC, TER	X	X		No		
Muñoz and Sang-Wook Cho (2003)**	PRI	X	X		No	PRI	net / gross enrolment rates
Wilhelm and Fiestas (2005: 13-15)	PRI, SEC		X		Yes	--	--
World Bank (2003a: 160-167)	PRI, SEC, TER	X	X		No*	PRI, SEC, TER	net enrolment rates
World Bank (2003b: 109-114)	PRI, SEC, TER	X	X		No	--	--
World Bank (2005: 63-66)	PRI, SEC		X		No	--	--
World Bank (2006: 50-51)	PRI, SEC		X		No	--	--
World Bank (2007b: 62-63)	PRI, SEC, TER		X		Yes	--	--
World Bank (2007c: 251-260)	PRI, SEC, TER	X	X		Yes	--	--
World Bank (2007d: 33-35)	PRI, SEC, TER		X	X	--	--	--
World Bank (2008a: 82-84)	PRI, SEC, TER			X	--	--	--
World Bank (2008b: 15-21)	PRI, STI	X	X	X	--	STI	no information
World Bank (2008c: 104-109)	PRE, PRI, SEC, TER, VOC	X	X		No	--	--
World Bank (2010: 11-12, 147)	PRI, SEC, TER		X		No	--	--

Notes: Progressivity: REL denotes relative progressivity, ABS denotes absolute progressivity (per capita), BEN denotes beneficiary progressivity (per school age child). Sectors: PRI denotes primary, SEC, denotes secondary, TER denotes tertiary/university education, VOC denotes vocational/technical, PRE denotes pre-school, STI denotes stipend program. * Discusses needs in terms of students/capita in the context of private spending on education. ** Benefit incidence estimates refer to an external source (Seifu 2002), which we could not access.

Source: Authors' compilation.