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Cost-effectiveness with equity:

Raising learning for
marginalised girls
through Camfed's
programme in
Tanzania

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Summary

This policy paper provides a cost-effectiveness analysis of Camfed's programme in Tanzania. Camfed's programme adopts a multidimensional approach that is aimed at reaching marginalised girls at risk of dropping out from secondary schools by using interventions that are aimed at both increasing their chances of staying in school and learning. This paper highlights three issues that are relevant for these types of equity-led interventions:

- (i) *Higher cost provision is necessary to reach the most marginalised.* Programmes focused on the most marginalised are often more costly. Judging them based purely on cost may not result in investment in programmes that reach those who need the most support.
- (ii) *The higher cost necessary to accomplish equitable outcomes could, however, still result in higher overall cost-effectiveness.* Raising learning of interventions targeted at the most marginalised could be of a magnitude such that, despite higher costs, they are still of reasonable overall effectiveness.
- (iii) *But can these programmes be sustained in the long run? Are they replicable and scalable in other contexts?* There are important considerations that need examining particularly as these programmes potentially have higher costs.

Using data from a quasi-experimental design linked with detailed programme financial information, this paper undertakes a cost-effectiveness analysis to measure Camfed's programme costs in relation to the programme's estimated impact. Camfed's programme shows that, while it may be more costly to reach the most marginalised, the impact is impressive. We find that:

- (i) for all children supported through Camfed's programme, the cost-effectiveness analysis finds that the impact is equivalent to an extra 1.7 years of schooling per \$100 spent.
- (ii) taking equity considerations explicitly into account with respect to the additional benefits of increasing access to the most marginalised girls through the provision of bursaries, the estimates are equivalent to 2 additional years of schooling per \$100. This implies that equity considerations, measured by improved access combined with improved learning, improves effectiveness by an additional 0.3 years of schooling per \$100 spent.
- (iii) with respect to sustainability, cost effectiveness increases by 33% (to 2.2 additional years of schooling per \$100 spent; and for scalability and replicability it increases by around 43% (to 2.4 additional years of schooling per \$100 spent).

One of the key messages to emerge from the analysis in this paper is that, whilst it may cost more to reach the most marginalised, taking into account equity considerations (namely related to the costs of a bursary that enables them to stay in school, along with other interventions aimed at enhancing their learning environment in school), the impact per dollar spent on Camfed's programme in Tanzania provides even more value for money than when only learning gains are considered. Comparisons with other interventions in Africa show that Camfed's programme has been able to attain similar cost-effectiveness outcomes to ones that have not included the aim of reaching the most marginalised.

Finally, by addressing the needs of the most marginalised, programmes such as Camfed's can be seen to address the needs of all: inclusive education systems will function for everyone if they function for the most marginalised.

1. Introduction

Focusing on secondary schooling for girls is important as completing this level of education has been shown to have far reaching benefits. Benefits include ones related to an individual's health, employment and earnings as well as empowering them with skills needed not only for their own economic and life outcomes but also in relation to the country's overall development (UNESCO, 2014). While benefits are high, girls are more at risk of dropping out of education at this life stage. Therefore, efforts to retain those girls most at risk can act as a powerful equaliser in a context where girls and boys do not necessarily have access to similar life choices and opportunities.

Targeted interventions are needed to reach the most marginalised. Amongst the poorest quintile in Tanzania, the percentage of adolescents of lower secondary school age who are not in school is 65%, and for females it is 70%, compared with just 34% of lower secondary school aged males and females of the richest quintile (UNESCO, 2018). Secondary school age girls in Tanzania from the most marginalised households who do make it to school are at high risk of drop-out due to multiple disadvantages such as poverty, early marriage and pregnancy. With respect to learning, 65% of poor girls enrolled in schools are learning the basics, compared with 85% of girls from the richest households, and the learning gap is even larger if lack of access to education is considered (Rose, et al 2016).

Camfed's programme aims to address the numerous obstacles disadvantaged girls face in accessing secondary school and, once in secondary school, barriers which place them at risk of dropping out and affect their learning. These hindrances include considerations such as the direct costs of schooling (tuition fees, uniform, textbooks, distance to school etc.) and issues such as safety, pregnancy, child marriage, disability, higher opportunity costs in terms of forgone paid-labour income, higher household chores and caring responsibilities, lack of study materials, low parental-education input and low self-esteem, among others. Reaching the most marginalised, therefore, requires specific focus which is likely to come at additional cost.

Camfed's interventions are focused on supporting the most marginalised girls in remote, under-served rural communities. Regardless of the type of intervention provided, a higher cost is likely to be required to support the most marginalised girls in the most marginalised rural communities. Financial support is needed to promote retention in secondary school. In addition, learning support (both pedagogical and pastoral) is required to enhance the knowledge and skills enabling them to progress at the same pace as other less marginalised girls and boys.

Financial support by Camfed is exclusively based on needs, and not subject to academic performance or potential. Bursaries are given to the most marginalised girls, who are likely to be most at risk of dropping out. These girls are identified by community leaders based on different dimensions of marginalization, which include income, disability, demographic situation of the household and cultural factors. The different dimensions of marginalisation utilised by Camfed for targeting purposes are grounded in government definitions of marginality as laid out in the National Guidelines for the Care and Support of Most Vulnerable Children in Tanzania. Financial support is given to cover the cost of schooling, materials as well as the cost of living as many girls have to board in order to attend secondary schools. In addition to financial support, the programme includes other interventions such as with individual support to these girls from previous Camfed graduates to promote their self-confidence and learning.

Targeting mechanisms to identify at-risk girls and designing interventions to support them are complex tasks. For instance, targeting girls using a needs-based approach is a process that requires the involvement of several stakeholder groups, community participation and transparency mechanisms to generate fair identification, selection and distribution of resources. In addition, the design of any intervention requires a system for the administration of the support, which incorporates rigorous and accountable mechanisms for tracking progress during the intervention.

What this policy paper discusses: This policy paper focuses on the case of Camfed in Tanzania and provides a detailed analysis of the cost effectiveness of Camfed's intervention. Importantly, we also incorporate equity into the cost effectiveness analysis, drawing on experience from analysis of health interventions as it tends to be absent in such analysis of educational interventions. As highlighted in a major systematic review of 216 education programmes in 52 low and middle income countries, very few of these studies included analysis from an equity perspective, and even fewer addressed issues of cost-effectiveness (Snilstveit, et al. 2016). Finally, this paper provides a discussion of this intervention's cost-effectiveness in relation to its sustainability, replicability and scalability in the context being studied.

2. Camfed in Tanzania

With support from DFID's Girls' Education Challenge¹ programme, Camfed's work in Tanzania provides an innovative example of interventions tackling the multiple dimensions of disadvantage for adolescent girls who make it to secondary school in rural communities. Camfed's support targets a range of barriers to girls' secondary education at an age when they are at a great risk of dropping out due to factors such as poverty, early marriage and teenage pregnancy. It also provides further support to tackle the barriers that marginalised girls face *within* schools that potentially impede their learning.

The multidimensional programme includes five core components:

- financial support, covering direct and indirect costs of schooling, is provided for secondary school girls who are identified as most in financial need;
- supplementary learning materials for core subjects (study guides) are provided to all children in Camfed supported schools;
- life skills educational resources, are also provided to all children in Camfed supported schools;
- the life skills programme and learning support is delivered by young women previously supported by Camfed because of their own disadvantaged circumstances who provide mentoring support as 'Learner Guides' in their local schools;
- psycho-social and other forms of support through school-community engagement, including training of teacher mentors, parent support groups and local community authorities, is provided in all schools and communities where Camfed supported schools are located.

As part of the Girls' Education Challenge, a quasi-experimental approach was adopted to identify the impact of the programme. For this, 81 government schools to be supported by Camfed were randomly selected from six districts within four regions (Iringa, Morogoro, Pwani and Tanga). For comparison with schools for which no intervention took place, four districts within two regions (Dodoma which neighbours regions in which Camfed supports schools, as well as Pwani in which Camfed was working in other districts) were identified. Within these districts, 60 schools were randomly selected using the same procedure as for Camfed-supported schools.²

Once the schools were selected, the whole class within a targeted grade was selected for evaluation purposes and tracked over time. When more than one class was available, one was selected randomly.³ In addition, for the purposes of identifying girls most in need, Camfed collected information from 20 indicators of marginalisation in both treatment and control schools using information related to government definitions of marginality as laid out in the National Guidelines for the Care and Support of Most Vulnerable Children in Tanzania. These indicators of marginalisation reflect those used for targeting girls in most financial need. If a girl's situation is captured by any one of the 20 scenarios, Camfed would consider her to be 'marginalised'.

This paper focuses on the cost-effectiveness of the programme drawing on data that link the financial costs of the interventions with learning and retention at the individual student level. For each girl supported financially during the academic years 2014 and 2015, we are able to identify the amount of support given per year. We are also able to identify the costs associated with other aspects of the intervention, such as provision of learning and educational materials, mentoring support and community involvement. Between 2013 and 2015, Camfed provided financial support to 25,938 marginalised girls in 201 secondary schools in Tanzania. In total, Camfed reached more than 64,869 girls and 78,330 boys within the schools supported with activities other than financial support.

The data collected on programme costs from Camfed's intervention in Tanzania is important in many ways. Firstly, it enables linking each of the costs to the different components of the intervention thereby allowing the disaggregation of Camfed's costs accordingly. Secondly, greater support is provided to girls in most financial need which allows the identification of the higher cost of provision to this specific group. Thirdly, the programme costs can be disaggregated by start-up, fixed and variable types, allowing a forecast of different cost scenarios associated with the scalability, replicability and sustainability of Camfed's model from a financial perspective. Fourthly, it is possible to identify the costs that are directly and indirectly associated with this intervention and given that the population of beneficiaries is known it is possible to provide a more accurate estimate for the unit cost of the intervention. Finally, it is possible to link the cost information with the quasi-experimental data on individual background information, access to schooling and learning outcomes for a group of girls on whom data was collected for evaluation purposes. Therefore, it is possible to undertake cost effectiveness analysis and to also incorporate equity considerations into the discussion.

3 Cost-effectiveness methods

Cost-effectiveness analysis allows complex programmes to be summarised in terms of a simple ratio of costs to impact thereby creating a common measure through which different programmes (from different contexts and in various time periods) can be compared and evaluated. The analysis relies on information on the average unit cost of delivering a programme and an estimate of the average impact of that intervention on the desirable outcome. This gives an estimate of 'average unit cost per unit gained on the outcome' or 'incremental cost per unit of incremental effect' known as the cost-effectiveness ratio. In short, the two key elements of cost-effectiveness analysis are the costs of the intervention and its corresponding impact.⁴

3.1 Measuring Programme Costs

Camfed's total costs incurred for this intervention can be divided according to the two main groups of girls supported. First, the most marginalised girls are supported financially, but are additionally also supported with the provision of learning and educational materials and mentoring and community support. The less marginalised girls, and by far the largest group (82%), are supported with only learning and educational materials, mentoring and community support. It should be noted that in other interventions, these girls would be classified as 'marginalised' by virtue of their family situation, community and/or school. These girls are in remote, dispersed, rural communities, not in peri-urban and accessible rural communities, which means that distances and costs are a significant consideration. In particular, this will affect the comparability of Camfed's programmes to other interventions.

To supplement this analysis, individual level data on the cost of financial support can also be linked to data collected from individual students from the grade and class of randomly selected schools to evaluate the effectiveness of Camfed's programme in Tanzania. As mentioned, as part of the Girls' Education Challenge, data were collected using a quasi-experimental design for a group of government schools (60 schools from 4 districts) with similar characteristics as the Camfed-supported government schools (81 schools located in 6 districts). This data set contains information on 2,588 girls who were supported by Camfed during 2 academic years (from which we had information on learning outcomes before and after the intervention for 2,104 girls out of which 1,307 received financial support) and 1,558 girls in control group schools (from which we have information from 1,212 girls on learning outcomes before and after the intervention). Therefore, individual level data on the cost of financial support is linked to each girl from this experimental dataset (with information on learning outcomes and access to schooling among other key variables) to obtain estimates of the cost of financial support.

A key feature of Camfed's financial data is that it allows programme costs to be associated with each component of the programme. In addition to this, these costs can be differentiated by category, namely costs associated with start-up activities, fixed costs and variable costs. With this information it is possible to provide disaggregated estimates of the potential cost to Camfed if the programme is to be scaled up, replicated or simply sustained in its current format over time.

3.2 Measuring Programme Cost-effectiveness

The second key element in cost-effectiveness analysis is the estimate of the impact of the intervention. To estimate the impact on retention and learning outcomes, we draw on Camfed's quasi-experimental research design, which collected information before and after the intervention on a number of individual and family variables which are related to the socioeconomic circumstances of these girls.

In our estimation of the impact of the intervention on learning we are able to deal with two aspects of girls' selection into secondary schools that may affect our results. First, there is a *composition effect* in that Camfed's intervention aims to enhance retention of the most marginalised girls in secondary school. This results in a change in the composition of girls who remain in school. This change in composition is not found in the control schools that do not receive Camfed support. The comparison between girls in Camfed schools versus girls in control schools must address this compositional issue. We deal with this by using imputations techniques on the learning outcomes two years after the start of the intervention (Groenwold et al., 2014; Mitra and Reiter, 2016; Sterne et al., 2009).⁵

Second, although Camfed identified girls in most need of financial support in Camfed supported schools, the identification of the most marginalised girls was not obtained in control group schools. Therefore, the comparison between girls who received financial support with girls in control group schools required matching methods to achieve a comparable sample based on their observable characteristics (see, for instance, Lacus et al., 2011).

Since we have reliable estimates of the cost of providing support to the most marginalised girls and their corresponding impacts in terms of retention rates and learning outcomes as well as the cost of providing support to the less marginalised girls and their

corresponding impacts in terms of retention and learning outcomes, we are able to provide an estimate of the cost effectiveness of Camfed's intervention. To do this, we follow the methodology developed by the Abdul Latif Jameel Poverty Action Lab, J-PAL (J-PAL, 2014).⁶ This results in a measure of costs in US dollars and impact in standard deviations (with respect to the control group) on learning outcomes which are used to estimate the cost effectiveness ratio for Camfed. Using J-PAL's approach allows a comparison with related interventions in similar contexts to Tanzania.

In our analysis that follows, we adopt two formulae to calculate the cost-effectiveness of Camfed's programme. The first of these is comparable to the approach used in other analysis, but with some consideration of equity by differentiating between the populations being supported. The second formula takes the analysis according to equity further.

Formula 1: Weighted cost effectiveness ratio

$$CER = \frac{TC_{FS}}{impact_{FS} \times N_{FS}} \left(\frac{N_{FS}}{N} \right) + \frac{TC_{NFS}}{impact_{NFS} \times N_{NFS}} \left(\frac{N_{NFS}}{N} \right)$$

Formula 1 includes:

1. the total cost (TC)
 - to the most marginalised girls who receive financial support (FS), identified as TC_{FS} . This contains the cost of the bursary itself and its administrative costs, as well as the cost of providing learning and educational materials, mentoring and community support;
 - and
 - to less marginalised boys and girls (NFS): TC_{NFS} . These are young people who do not receive financial support but do receive other aspects of the intervention by being in Camfed-supported schools.
2. Impact is measured by the standard deviation increase in learning outcomes using the relative difference in test scores between young people in Camfed-supported schools and those in control group schools before and after the intervention. This impact is measured separately for girls in Camfed-supported schools who receive financial support and for girls and boys in Camfed-supported schools who do not receive financial support.
3. The cost-effectiveness ratio for the Camfed intervention is then weighted according to the number (N) in each of the groups supported:
 - N_{FS} is the total number of girls who received financial support
 - N_{NFS} is total number of girls and boys in all Camfed schools excluding those who received financial support.

Contrary to other estimates in the empirical literature, Formula 1 takes account of equity with respect to the fact that the core of Camfed's support is to provide additional resources to those in most financial need who would not otherwise attend school. By contrast, most cost-effectiveness ratios in the literature assume homogeneity of the population of supported beneficiaries and do not divide between the population of beneficiaries with additional support and those less support.

However, Formula 1's consideration is only partial. Notably it only contains estimates of the learning gains due to Camfed's support targeted at improving learning, and thus ignores the fact that a significant proportion of girls in Camfed-supported schools are now able to learn because they have been able to stay in school thanks to the financial support provided.

In order to address this important issue, we use Johri & Norheim's (2012) methodology which integrates equity concerns into their cost-effectiveness analysis of health interventions. Specifically, we include an equity weight in the cost-effectiveness ratio that takes account of improvements in retention for each of the populations of beneficiaries: those who receive financial support; and all those who attend Camfed supported schools (including all children not receiving financial support). It is possible that retention is improved for both groups, but the key equity element that is taken into account in this analysis is that Camfed is prepared to spend more on girls in financial need.

Formula 2: Weighted cost effectiveness ratio, taking account of retention of the most marginalised girls

$$CER = \frac{TC_{FS}}{impact_{FS} \times [OR_{FS} \times N_{FS}]} \left(\frac{N_{FS}}{N} \right) + \frac{TC_{NFS}}{impact_{NFS} \times [OR_{NFS} \times N_{NFS}]} \left(\frac{N_{NFS}}{N} \right)$$

Building on Formula 1, Formula 2 is weighted using:

4. an estimate of the odds ratio of the reduction in drop out/increase in retention:

– for girls supported financially by Camfed relative to comparable girls in the control group: OR_{FS}

and

– for girls and boys who are not supported financially relative to equivalent girls and boys in the control group: OR_{NFS}

The difference between Formula (2) and (1) provides an estimate of the effectiveness gains for improving retention.

4. Costs of reaching the most marginalised girls

Of the total 143,199 student population supported by Camfed in 2015, 18% were the most marginalised girls who received financial support (25,938) while the remaining 82% (117,261) were boys (78,330) and girls (38,931) supported with Camfed activities not linked to direct financial support.

The direct cost of the group receiving financial support is a major component of the total cost. Until the abolition of secondary school fees in Tanzania in 2016, Camfed's direct financial support covered the costs for supported girls related to school fees and examination fees, lodging for some of them and other items (e.g. costs associated with a bed, blanket, mattress, sanitary wear, shoes,

and clothes). However, given that education legislation in Tanzania eliminated school and examinations fees for secondary school in 2016,⁷ we have excluded these costs from the direct financial support as they no longer need to be covered. As such, our cost-effectiveness calculations are valid for future forecasts of the Camfed model.

Camfed supports all children attending partner government secondary schools with activities such as supplementary learning materials (known as Study Guides), life skills educational resources, mentoring support known as Learner Guides, and fostering school-community engagement. The unit cost for these activities tend to be lower than for the direct financial support as these activities are spread over a much larger population of beneficiaries, including all girls and boys attending government secondary schools supported by Camfed.

Table 1 provides an estimate of the average annual unit cost (in US dollars at current values) for the two years in which Camfed supported girls in secondary schools and for which we have information on the impact of the programme (2013/14 and 2014/15 academic years).⁸ Over the course of these two years, Camfed provided around \$99.36 in direct financial support per girl, per year on average (Column A). Excluding school and examination fees reduces the direct financial support to \$83.46 per girl, per year on average (Column B). Indirect unit costs associated with costs of providing financial support, including targeting costs and other activities related to delivering financial support, amounted to \$15.65, per year on average.

Table 1 also presents the unit cost for other activities provided by Camfed. The unit cost for these activities is assumed to benefit all learners in secondary schools supported by Camfed and so, as mentioned, the unit cost is lower than for financial costs which is targeted at a sub-set of the school population.

Table 1: Average unit cost (current US\$) per year

Costs	Girls supported financially		All Other Girls & Boys Supported
	Full unit cost	Excluding school & examination fees	
Direct financial support	99.36	83.46	N/A
Indirect financial support	15.65	15.65	N/A
Study Guides	3.86	3.86	3.86
Life Skills	3.78	3.78	3.78
Learner Guides	2.38	2.38	2.38
School Community	5.38	5.38	5.38
Total unit cost	130.41	114.50	15.40

Notes: The cost of direct financial support is estimated as the annual average cost over three financial years (2013 to 2015), which spans two academic years (2013/14 & 2014/15). We include financial data for the year 2013 as this contains information on start-up costs for the intervention.

As Table 1 illustrates, the direct financial support component accounts for more than 70% of the total unit cost. As noted, there are fewer girls who received direct financial support as this is a targeted mechanism to support the most marginalised. We could use the proportion of girls who receive direct financial support (18%) and the rest of girls and boys who benefited from the wider programme (82%) as relative weights in the estimation of the weighted unit cost for Camfed. Using this approach, the overall weighted average unit cost is \$33.24 per year.

Unit costs are likely to vary according to whether the intervention has just started (and so includes start-up costs); is being sustained (excluding start-up costs); or is being scaled-up to a larger population (for which the fixed costs will be spread across a larger number of beneficiaries); or, once established, is replicated by other organisations, including the government (by which time, it is assumed start-up costs and fixed costs have been covered). To enable an analysis of cost-effectiveness according to sustainability, scalability and replicability, unit costs have been separated into start-up costs, fixed costs and variable costs for each of the activities (Table 2).

Table 2: Average unit costs by start-up, fixed and variable costs (US\$ Per Year)

Component	Start-up	Fixed	Variable	Total
Direct financial support	n/a	n/a	83.46	247
Activities	n/a	n/a	n/a	n/a
Financial support	5.02	1.30	9.33	n/a
Learner Guide	1.74	0.36	1.76	n/a
Life Skills	1.90	0.38	1.50	n/a
School Community	1.19	0.21	0.98	n/a
Study Guide	2.69	0.54	2.16	n/a
Total (including direct financial support)	12.54	2.78	99.18	114.51
Total (excluding direct financial support)	7.52	1.48	6.40	15.40
Proportion of total unit cost (including direct financial support)	11.0%	2.4%	86.6%	n/a
Proportion of total unit cost (excluding direct financial support)	48.8%	9.6%	41.6%	n/a

Note: Costs exclude school and examination fees.

Start-up costs were classified as one-off costs that are required to set up the programme. In the case of Camfed, this included the development of a new life skills curriculum or training materials, for example. Fixed costs were then classified as those costs which did not depend on the number of girls and boys being reached for each of the activities, for example office rent, yearly insurance premium, office equipment. Finally, variable costs, which depend on the number of girls and boys beneficiaries of the programme, such as bursaries, incentives, materials and transportation costs of mentors were also identified and classified for each of the activities. For girls supported financially, 11% of the total unit yearly costs relate to start-up costs with an additional 2.4% relating to fixed costs and the majority of total costs (86.6%) relating to variable costs. For the remaining students who benefit from the rest of the activities of the Camfed programme, 48% of costs relate to start-up costs, 9.6% to fixed costs and 41.6% to variable costs.

Table 3 presents the estimated impact of the intervention for each of the two groups (girls supported financially and girls and boys receiving all other support) on English and Maths scores, as well as on the scores combined.⁹ Compared to similar education in developing countries, the impact of Camfed's intervention is high (e.g., compared with studies by Duflo et al. 2011; Kremer et al., 2009, 2013). J-PAL (2014) proposes that interventions with effect sizes of more than 0.5 standard deviation are considered as having very large impact. Therefore, an estimated impact of around 0.58 for English and 1.16 for Maths would be considered very large.

For estimation of the cost effectiveness of the Camfed programme we only use results from English test scores. Since the improvement in English as measured by tests scores is lower than maths, the results presented here are a conservative estimate of the effectiveness of the programme. A reason for the much larger impact in maths is because the control group showed only a very small, if any, improvement in learning.¹⁰

Table 3: Impact of Camfed's interventions on English and Maths tests scores (standard deviations) and likelihood to dropout (odds ratio)

	Maths ^(A) (SD)	English ^(A) (SD)	Combined (SD)	Dropout ^(B) (SD)
Girls receiving financial support	1.195**	0.572**	0.883**	0.75**
Other girls and boys receiving all other support	1.162**	0.586**	0.874**	0.95

Notes:
 (A) Maths and English test scores are presented in standard deviations (SD). Estimates are based on difference in differences estimation techniques controlling for factors including wealth and location, for example.
 (B) Likelihood of dropout is based on a logit model. Results are presented as odds ratio (OR).
 Asterisks indicate statistical significance at ** 1% level.

Additionally, learning benefits were only realised for the subgroup of girls and boys who remained in school during the period of the intervention. Hence, improving retention was another important aim of the Camfed programme, in particular for girls who received financial support. Results from Table 3 show that the programme reduced the likelihood of drop out for girls who received financial support. For every 100 of the most marginalised girls who dropped out of the control group, only 75 girls receiving Camfed's financial support would have dropped out. For the rest of girls and boys not supported financially by Camfed, the odds of dropping out from school were similar to other boys and girls in control group schools.

5. Cost Effectiveness and Equity in Cost Effectiveness

The cost effectiveness ratio, representing the incremental cost per unit of incremental effect, are obtained from combining the costs of for both the groups who receive the financial support and those who do not with their corresponding impacts on learning (Table 4). For comparability with interventions in other studies (see Section 7), we focus here on the cost-effectiveness ratio presented as a standard deviation increase for every \$100 (column 2 in Table 4).¹¹ For every \$100 the standard deviation increase in English scores is 0.25 for girls receiving financial support (i.e. those in most need), 1.90 for other girls and boys in Camfed-supported schools, resulting in weighted average of 0.87 for all students in the programme.¹²

The reason for the apparent lower cost-effectiveness for financially-supported girls is because of the inevitable higher cost of reaching these girls, not because of lower gains in their English scores compared with other girls and boys in those schools. As has been shown, the impact of this spending on their retention in school and learning has been significant. As the later part of this paper makes clear, such financial support is vital to enable these girls to stay in school, and so benefit from the reforms that all children in the school are receiving. Without the financial support, the cost-effectiveness ratio might appear higher, but this would only reach a sub-set of girls and boys who are already able to be in school, and so not amongst the most disadvantaged.

The final column converts this standard deviation into an equivalent estimate in terms of additional years of schooling per \$100 spent. Converting standard deviations into equivalent years of schooling provides a more accessible understanding of the cost-effectiveness of programmes. Evans and Yuan (2017) report results in equivalent years of schooling, based on a one standard deviation increase of an intervention being equivalent to between 4.7 to 6.9 equivalent years of schooling if this difference is maintained over the schooling cycle. Romero, Sandefur and Sandholtz (2017) indicate that there is huge variation in international benchmarks of how much children learn per year measured in standard deviations, ranging from 0.18 of a standard deviation for English in Rwanda to 0.6 of a standard deviation also for English in Kenya. Therefore, Romero Sandefur and Sandholtz (2017) use an increase in learning from one year of the control group as the basis for converting their results of the evaluation of the partnership Schools for Liberia into additional years of schooling.¹³

We follow the methodology by Romero, Sandefur and Sandholtz (2017) to contextualise results in terms of additional years of schooling using results from the control group. For Camfed's programme in Tanzania, English test scores increased by 0.52 of a standard deviation for the control group. Using Romero, Sandefur and Sandholtz's approach, this therefore means we assume that, in general, it is expected that spending one year in school is equivalent to 0.52 standard deviations. From this, we can estimate the overall cost-effectiveness of girls receiving financial support. Given their English test scores improve by an additional 0.25 standard deviations per \$100 compared to the control group, this is equivalent to an additional half a year in school (an addition of 0.25 standard deviations divided by 0.52 standard deviations for the control group equals 0.48 additional years in school). For all other girls and boys who received other support, the equivalent increase per \$100 would be 3.66 additional years in school.

In summary, for all students, for every \$100 spent, Camfed's programme improves English learning outcomes equivalent to spending an additional 1.7 years in school. This is considerably higher than the Partnership for Liberia programme, which results in roughly 0.56 additional years of schooling for English, on average.

Table 4. Cost-effectiveness analysis (in current US\$), per year for English

	Cost-effectiveness ratio (cost per additional standard deviation)	Additional standard deviation per \$100	Additional Years of Schooling per \$100
	USD	SD	Years
Girls supported financially	\$400	0.25	0.48
Other girls and boys supported	\$53	1.90	3.66
Weighted CER ^(A)	\$116	0.87	1.66

Notes: (A) The weighted cost-effectiveness ratio is obtained from formula 1. CER = Cost-effective ratio.

We now turn to measuring equity in cost effectiveness more explicitly, as measured in Formula 2. As noted, the analysis so far (using Formula 1) has not considered the fact that for learning gains to be achieved girls have to be able stay in secondary school. For the most marginalised girls, this requires the removal of financial constraints that would otherwise mean they would be likely to drop out. By taking into account the reduction in dropout rate into our estimate of cost-effectiveness using Formula 2, we find that for the same amount of money, Camfed's cost-effectiveness is even stronger.

In order to calculate this revised estimate, reduction in dropout rates are estimated using odds ratios comparing dropout rates amongst girls who received financial support relative the most marginalised girls in control schools. Including this odds ratio in the analysis, as shown in Formula 2, presents a new cost-effectiveness ratio estimate for Camfed's programme (Table 5). This results in an increase in English test scores of 1.05 standard deviations per \$100 (compared to 0.87 estimated previously). Translating this into years of schooling, we estimate that **the effectiveness of Camfed's programme that takes account both improvements in access and learning is equivalent to an additional two years of schooling for all girls and boys per \$100** (compared with 1.7 years in the previous calculations).

Table 5: Weighted Cost-effectiveness for Access and Learning (All Girls and Boys)

	Cost-effectiveness ratio (cost per additional SD)	Additional SD per \$100	Additional Years of Schooling per \$100
	English USD	English SD	English Years
Ignoring reductions in dropout (equation 1)	\$116	0.87	1.66
Including reductions in dropout (equation 2)	\$95	1.05	2.02
Absolute change	-19	0.18	0.35
Relative change	-17%	21%	21%

6. Sustainability, scalability and replicability

This section of the paper utilises the estimated unit costs in Section 4 to investigate the cost-effectiveness associated with the potential of sustainability, scalability and replicability from a financial perspective. As noted, unit costs vary according to whether the intervention has initially started (and so includes start-up costs); is being sustained (excluding start-up costs); is being scaled-up (for which the fixed costs will be spread across a larger number of beneficiaries); or, once established, is passed on to other organisations, including the government (by which time, it is assumed start-up costs and fixed costs have been covered) (Figure 1).

Figure 1: Cost-effectiveness analysis of Camfed's programme - different scenarios

Type of:	Girls financially supported by Camfed	Girls in supported schools	Girls & boys in Camfed supported schools
Initial What it cost Camfed the first time	Startup Fixed Variable	Startup Fixed Variable	Startup Fixed Variable
Sustainability What it cost Camfed the next time	Startup Fixed Variable	Startup Fixed Variable	Startup Fixed Variable
Scalability What it would cost Camfed to scale up x10	Startup Fixed ÷ 10 Variable	Startup Fixed ÷ 10 Variable	Startup Fixed ÷ 10 Variable
Replicability What it would cost if passed on to another organisation	Startup Fixed Variable	Startup Fixed Variable	Startup Fixed Variable
Support	Financial support Study guides life skills Learner guides Schol-community engagement	Financial support Study guides life skills Learner guides Schol-community engagement	Financial support Study guides life skills Learner guides Schol-community engagement

If Camfed's financial support to girls (Table 6, column 1) were to be replicated, the unit cost would decrease from \$114.50 to \$99.18. This is because when replicating the programme start-up costs (which are the second largest cost across the three cost types) and fixed costs would be excluded. This in turn increases cost-effectiveness by \$15.32.

Table 6: Cost-effectiveness analysis of different cost scenarios

Scenario	Impact/cost type/CER	Girls financially supported by Camfed	Girls in Camfed supported schools	Girls & boys in Camfed supported schools	Total
Current	Impact English (SD)	0.572	0.586	0.472	
	Unit cost	\$114.50	\$15.40	\$15.40	
	CER English	\$400.58	\$52.55	\$65.31	\$116
	SD per \$100	0.25	1.90	1.53	0.87
	Years of schooling per \$100				1.66
Sustainability	Unit cost	\$101.97	\$7.88	\$7.88	
	CER English	\$356.71	\$26.89	\$33.42	\$87
	SD per \$100	0.28	3.72	2.99	1.15
	Years of schooling per \$100				2.22
Scalability	Unit cost	\$99.46	6.55	\$6.55	
	CER English	\$347.95	\$22.34	\$27.77	\$81
	SD per \$100	0.29	4.48	3.60	1.23
	Years of schooling per \$100				2.37
Replicability	Unit cost	\$99.18	\$6.40	\$6.40	
	CER English	\$346.98	\$21.83	\$27.41	\$81
	SD per \$100	0.29	4.58	3.68	1.24
	Years of schooling per \$100				2.38

Note: CER = cost-effectiveness ratio.

Referring to the final column of Table 4, which summarises the key points of the analysis, the following key messages can be highlighted:

Sustainability: Once the programme is established, and so start-up costs can be removed, there would be an improvement in cost-effectiveness equivalent to 0.56 years of schooling. Since this equates to 2.22 additional years of schooling compared with 1.66 years in the initial phase, this represents an improvement in effectiveness of 33.7%.

Scalability: Once established (and so start-up costs are no longer needed), if Camfed's programme were to be scaled up and so fixed costs were also reduced due to economies of scale, our calculations suggest that cost-effectiveness would increase further, and be equivalent to 2.37 years of schooling.

Replicability: If the programme is replicated in ways that can eliminate both start-up and fixed costs, the programme's impact could be estimated as being equivalent to 2.38 years of schooling per \$100 spent.

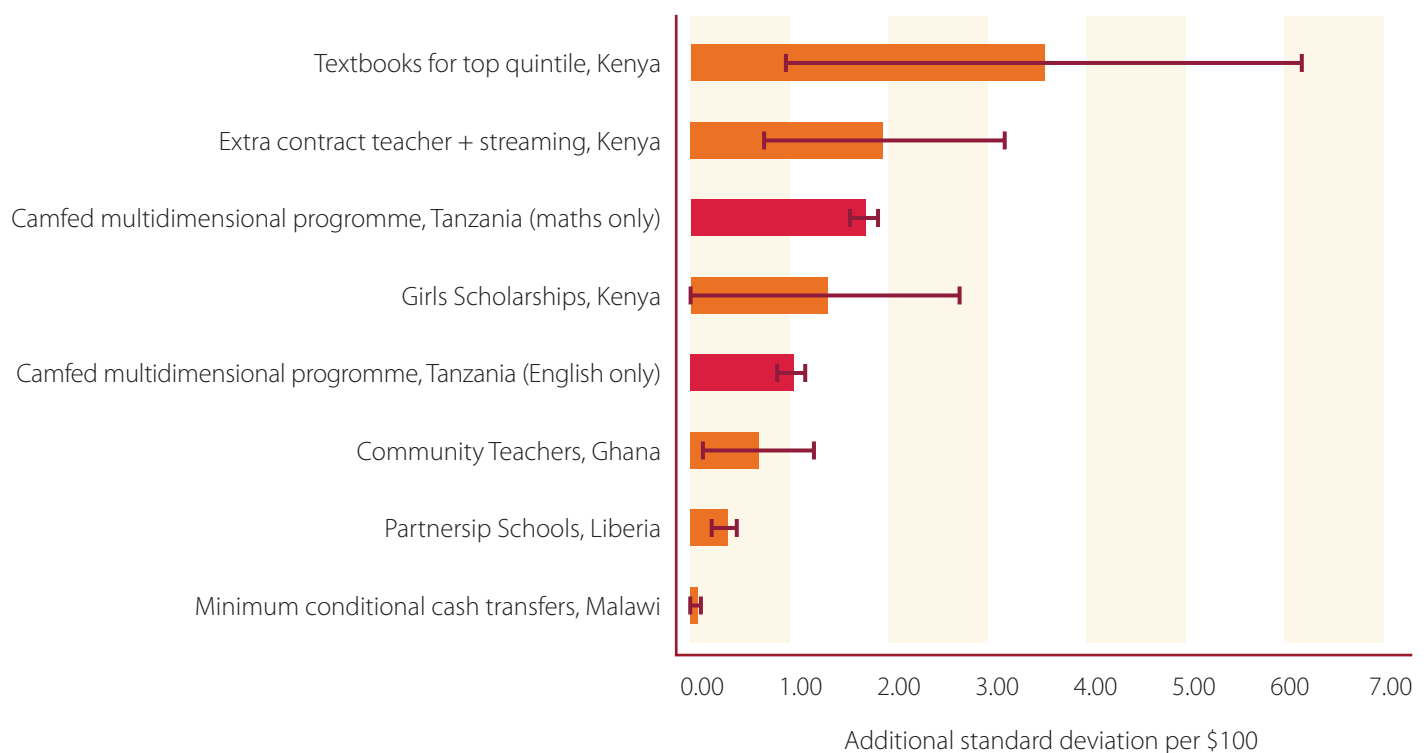
7. Comparing the cost effectiveness of Camfed with other educational interventions

The final section of this paper responds to the question: How does the cost effectiveness of Camfed’s programme compare to the cost effectiveness of other educational interventions in developing country contexts? In order to answer this question, Figure 2 plots our estimate of cost effectiveness transformed into additional standard deviation gains per \$100 cost incurred using equity adjustments for all girls and boys supported by Camfed – both those receiving bursaries and those receiving the broader support (using Formula 2). We also include in Figure 2 the 90 percent confidence intervals of the cost effectiveness ratio based on the standard errors of the impact estimates. Figure 2 illustrates that Camfed increased English scores by 1.05 standard deviation per \$100 spent, as indicated in Table 5. We also include here the increase in maths scores which, as noted previously, are higher.

Camfed’s intervention appears to position well within the range of cost-effectiveness of educational interventions within sub-Saharan Africa (see Figure 2). On average, the estimate for Camfed’s multidimensional programme is similar to the girls’ scholarship intervention in Kenya, and considerably higher than the cost-effectiveness of the Malawi conditional cash transfer programme and the Partnership Schools for Liberia programme. Averages are higher for the Kenya contract teaching and streaming programme and intervention providing textbooks for the top quintile. However, the confidence intervals for the Kenyan programmes are wide. The overlap of these confidence intervals with Camfed’s estimates suggests that **there may not be a significant difference in the cost-effectiveness across these programmes compared with Camfed’s**.

It is also worth noting that comparisons such as these are not necessarily meaningful as interventions vary so vastly in terms of type, target population, context, education level etc.. From the interventions mentioned in Figure 2, very few are closely related to Camfed’s approach. In particular, these differences are in two key focus areas namely the **level of education** (Camfed focuses on secondary education which has higher cost implications than primary level) and **target population** (Camfed targets *the most marginalised* from very remote and disadvantaged communities).

Figure 1: Comparison of the cost-effectiveness of Camfed’s programme with other related educational interventions in sub-Saharan Africa



Notes: Weighted cost effectiveness for Camfed are obtained using Formula 2. Lines present estimates of confidence intervals.

Sources: Calculations for for Malawi and Kenya: J-PAL (2014); Ghana: Kiessel and Duflo (2014)¹⁴; Liberia: Romero, Sandefur and Sandhotz (2017).

Box 1: Comparing the cost-effectiveness of Kenya's Girls' Scholarship Programme and Camfed's Multi-dimensional Intervention in Tanzania

Kenya's Girls' Scholarship Programme was carried out by International Child Support Africa in two rural Kenyan districts. Sixty-four randomly selected primary schools were invited to participate in a merit-based scholarship programme providing scholarships to 6th grade girls scoring within the top 15% in government administered tests. The amount of the scholarship was around \$17 per child.¹⁵ Therefore, this intervention targeted highly academically achieving girls in primary schools.

In comparing the Kenyan programme with the multi-dimensional intervention in Tanzania, it is worth noting that despite working in very marginalised communities and with highly disadvantaged individuals, the Camfed programme is able to provide results that are potentially as high as those witnessed through the Kenyan programme. For example, the scholarship programme in Kenya for girls produced a gain of 1.38 standard deviation per \$100 cost (Kremer et al., 2009). This is higher than the 1.05 standard deviation gain per \$100 for Camfed's intervention in English (but lower than the gain for maths). However, the scholarship programme in Kenya is not directly comparable as it differs in terms of the target population. While the scholarship programme in Kenya aimed for high achieving girls and provided scholarship based on academic merit, the Camfed programme aimed for girls in remote rural areas and targeted financial support to those in most need regardless of academic merit. This illustrates the danger of making direct comparisons without taking into account the population groups that are being reached.

It is also important to note that, for the Kenya programme, although the point estimate is higher than for Camfed's gain in English, the confidence intervals are large and potentially showing no statistical difference with respect to the Camfed programme. In addition, Camfed's gain in maths is higher.¹⁶ When comparing based on this fact, one could argue that the Camfed multidimensional programme's cost effectiveness to reach the most marginalised is similar to the scholarship programme evaluated in Kenya to reach the most academically able girls.

Source: Kremer, M., Miguel, E. & R. Thornton (2009).

Another comparison of the Camfed programme could be with the intervention providing contract teachers together with the streaming of children in classes in Kenya (Duflo et al. 2011). The programme in Kenya included a component that aimed to reduce class size by hiring local teachers. The estimated cost effectiveness of the programme in Kenya was a 1.97 standard deviation increase in test scores per \$100 cost, compared with 1.05 for Camfed's programme. Again though one has to be careful with a direct comparison of the cost effectiveness of these programmes. The programme in Kenya consisted only of class size reductions via hiring of local contract teachers, while the Camfed programme contains several activities aimed at increasing learning for the most marginalised girls.

In addition, while the cost-effectiveness of the Kenyan intervention appears higher, the estimated impact is far higher for Camfed's programme, which increased the combined learning by 0.88 standard deviations, compared to only 0.23 standard deviations in the Kenyan programme. Given the more limited scope of the Kenyan programme, including that it was not targeted on the most marginalised, the cost of the Kenyan programme was relatively low (an average cost per student of \$11 compared with \$114.50 for financially-supported girls who needed these resources to stay in school, and \$15.40 for other girls and boys for Camfed). This again highlights that comparisons of cost-effectiveness calculations need to be treated with caution.

Conclusions

This policy paper has identified the following key messages:

- In order to reach the most marginalised, programmes are likely to be faced with higher costs. These interventions are often complex in nature, as they need to be multi-dimensional to be effective. It is likely that aspects will be targeted towards the needs of the most marginalised, while other aspects will benefit all of those in the classes being supported.
- Taking into account these complexities in cost-effectiveness analysis is not straightforward. This paper attempts to do take account of equity in the analysis by paying attention both to the improvements in access for the most marginalised along with improvements in learning for all those supported.
- Camfed's programme shows that, while it may be more costly to reach the most marginalised, the impact is impressive. In taking into account both access and learning, we find that Camfed's programme results in improved learning of an equivalent of around 2 years in school for every \$100 spent.
- It is difficult to make meaningful comparisons with the cost-effectiveness interventions of other programmes given their different contexts and target groups (many of them do not aim to reach the most marginalised), different nature of the interventions (many are individual interventions, rather than Camfed's multidimensional approach), and different parts of the education system that are addressed (many are at the primary level, for which interventions may be less expensive).
- Even so, comparisons show that Camfed's multidimensional programme has been able to attain similar cost-effectiveness outcomes to ones that have not included the aim of reaching the most marginalised.
- Finally, by addressing the needs of the most marginalised, programmes such as Camfed's can be seen to be addressing the needs of *all*. System reforms need to focus on the most marginalised due to the fact that inclusive education systems will function for everyone if they function for the most marginalised.

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Endnotes

1. <https://www.gov.uk/guidance/girls-education-challenge>
2. Control schools were selected with the agreement of the evaluation manager of the Girls' Education Challenge, taking account of schools with similar education characteristics at the baseline. For example, data from pass rates in the Form 4 examination before the intervention shows that the average pass rate in Dodoma districts selected as the control group (pass rates of 39% and 27%) were comparable to the pass rates in Camfed supported districts such as Iringa (47%) and Morogoro (23%). The districts of Pwani for the control group also show similar pass rates (21% and 16%) compared to districts supported by Camfed in Pwani (with a pass rate of 21%) and Tanga (21% and 9%). For further information, see Camfed International (unpublished) Project Reference Number 5101: Tanzania and Zimbabwe Baseline: A New Equilibrium for Girls, 8th July 2014.
3. Detailed information about the comparability of treatment and control schools was obtained from Camfed International (unpublished) Project Reference Number 5101: Tanzania and Zimbabwe Baseline: A New Equilibrium for Girls, 8th July 2014.
4. For a review of cost effectiveness analysis see, for instance, Dhaliwal et al. (2011); McEwan (2012, 2015).
5. In order to impute learning outcomes in the data for children for whom data are missing because they have dropped out of school, we use information from the baseline, including initial test scores follow the imputation procedure of Rubin (1996) to impute missing data.
6. Adopting the same approach as J-PAL, we have adjusted for inflation using the average US inflation rate with the base year of 2013, and use nominal exchange rate rates to convert from US\$ to £ sterling. The costs were brought into present value using a social discount rate of 10% per year (similar rate used by J-PAL in their estimates). We also adjusted for purchasing power exchange rate for the year of analysis (2016) to adjust for the differences in relative prices between countries. Our estimates do not include opportunity costs.
7. School fees are TZS 20,000 (\$9.80), Form 2 examination fees are TZS 10,000 (\$4.90) and Form 4 are TZS 50,000 (\$24.48). Mock exams costs are for Form 2 \$ 4.90) and for Form 4 \$9.80. All these sunk costs are deducted from direct financial support due to their inapplicability.
8. The adjusted US\$ to GBP exchange rate at the time was \$1.56 per GB £.
9. Unfortunately, we only the overall score from the test that was provided by the Tanzanian Examinations Authority to Camfed. Without individual items, we are unable to generate a scale which would provide more information on competencies achieved.
10. As will be seen in the discussion on the calculation of additional years of schooling, it is not meaningful to derive an estimate for this if there is no, or almost no, learning gains in the control group.
11. To do this, the CER is standardised to \$100 and the corresponding standard deviation modified accordingly.
12. Presented differently, the cost effectiveness of increasing English learning outcomes by one standard deviation for the most marginalised girls supported financially is \$400. For boys and girls attending government secondary schools supported by Camfed, the cost effectiveness of increasing English outcomes by one standard deviation improves, at \$53. As noted previously, this is largely because of the lower unit cost due to costs being spread over a larger number of beneficiaries. The weighted cost effectiveness ratio, taking account both of the financially supported girls and other interventions supporting all young people in their schools, increases English learning outcomes by one standard deviation for all students is \$116.
13. In Romero, Sandefur and Sandholtz (2017)'s study, the effect on English test scores of being randomly assigned to the programme after one academic year of treatment was .18 of a standard deviation and the average increase in test scores for each additional year of schooling in the control group was .31 of a standard deviation. This information was used to transform the effect into equivalent to roughly 0.56 additional years of schooling for English (.18s/.31s).
14. Confidence intervals were estimated from the results presented in the working paper available at: <https://www.theigc.org/wp-content/uploads/2014/10/Duflo-Kiessel-2012-Working-Paper.pdf>.
15. The amount provided was 1.500 Kenyan shillings per girl, which we have converted here using an average exchange rate of 88 Kenyan shillings per US dollar during 2011, the year of analysis.
16. Without the data from the Kenya project we are unable to test this, but the fact that the confidence intervals overlap provide an initial evidence for the rejection of the alternative hypothesis (which indicates that the Kenya scholarship programme provides a more cost effective way to improve learning than the Camfed programme).



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