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Teacher Incentives and Attendance: Evidence from Tanzania

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Abstract

We study early grade teacher attendance in a nationally representative sample of public primary schools in Tanzania. We document high and costly levels of absence: during unannounced school visits, only 38 percent of teachers are observed to be actively teaching in the classroom. We find that an experimental incentive program that provided test-based performance rewards improved classroom attendance and teaching among eligible early grade teachers, although it did not explicitly incentivize attendance. Using panel regressions across the full sample, we find that teacher attendance is positively associated with the probability of school inspections and that classroom attendance and teaching activity is substantially higher among female teachers. Traditional incentives such as school infrastructure quality and salary level do not correlate with attendance.

JEL Classification: C93, H52, I21, M52, O15

Keywords: teacher absence, teacher incentives, monitoring, group norms, Tanzania

Teacher Incentives and Attendance: Evidence from Tanzania

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1 Introduction

Employee absence is an important obstacle to organisational effectiveness across industries and settings (Krishnaswamy, 2019; Cikes, Maskarin Ribaric, & Crnjar, 2018; Zhang, Sun, Woodcock, & Anis, 2017). Empirical studies show that incentives matter for absence behavior (Mastekaasa, 2020; Callen, Gulzar, Hasanain, & Khan, 2013; Krishnaswamy, 2019), ".. in that more protected and difficult to monitor jobs show significantly higher levels of absenteeism: employees in public sector or in large firms, with permanent contracts or with longer tenure" (Scoppa, 2010).

These conclusions are directly relevant to public schools in many low- and middle-income countries, where the effort of public employees on long term contracts is often nearly impossible to observe by their superiors. In education systems in Africa, information on teacher absence is not included in annual education monitoring statistics (Bashir, Lockheed, Ninan, & Tan, 2018). Micro data on staff attendance are often available on paper in school attendance books, but the data are rarely digitized, aggregated and analysed; and so remain practically invisible to education managers at the district-level and beyond (Mulkeen, 2010).

In the absence of administrative data, estimates of teacher attendance in low-income countries typically come from surveys. Several studies have used survey data to document teacher workplace absence rates for low- and middle-income countries. These rates vary but are high on average: Chaudhury, Hammer, Kremer, Muralidharan, and Rogers (2006) measure absence during unannounced visits to primary schools in Bangladesh, Ecuador, India, Indonesia, Peru and Uganda and found that on average about 19 percent of teachers were absent from their school. For a nationally representative sample of rural primary schools in India, Muralidharan, Das, Holla, and Mohpal (2017) report school absence rates of 24 percent for 2010, down from 26 percent in 2003. Arbache, Habyarimana, and Molini (2010) reports school absence rates of 20-27 percent for East Africa. The more recent World Bank Service Delivery Indicators (SDI) surveys report an average school absence of 23 percent across a number of African countries (Bold et al., 2017), with an average absence from classrooms of 44 percent. These absence rates are high in comparison with general absence rates reported for high income countries. Barmby, Ercolani, and Treble (2002) report sickness absence rates between two and six percent for European countries.

This paper provides new evidence on teacher attendance in primary schools in Tanzania. Tanzania's primary school system is particularly interesting for our study because

it is dominated by public schools[1] and because it employs one of the largest teacher workforces in Africa. In addition, Tanzania has at least two structural features in common with other African (and a number of non-African) countries. First, following the global calls for universal primary education in the 1990s, Tanzania experienced fast expansion of its primary school system after primary school fees were abolished in 2001: the number of primary teachers grew from 106,142 to 180,987 in 2012 (UNESCO Institute for Statistics, 2022) which was necessary to keep pace with the inflow of students. The number of public primary teachers in 2016 was 206,829 and thus represents over one quarter of the total regular public employment of 755,360 in 2015 (United Republic of Tanzania, 2016). Many African countries managed similarly large increases in their primary teacher workforce between 2000-2013, often by a factor of two or larger (Bashir et al., 2018). Second, in the late 1990s Tanzania embarked on a process of decentralization that created key implementation roles at the district level, while retaining central control over core functions such as curriculum, teacher training, management and employment, supervision and inspection, and finance. The growth of the school system necessitated this process of decentralized implementation but had several important consequences, including a longer and more bureaucratic flow of information between schools and managers.

Our study is based on data that were collected in a series of surveys in a nationally representative sample of 220 public primary schools during 2014-2016, after the decade of expansion and decentralization. Our focus is attendance of teachers in grades 1-3, who are responsible for instruction of foundational literacy and numeracy. The attendance data in these surveys are based on various reporting sources: attendance book registration, self-reports by teachers, head teacher reports, and enumerator observations during announced and unannounced survey visits. The analysis focuses on observed absence measures from unannounced school visits that took place in three survey rounds. The survey data also include a rich set of teacher and school covariates.

Our study presents four sets of results. First, we document high levels of teacher absenteeism among early grade teachers responsible for instruction in foundational skills, including early Kiswahili literacy and numeracy: absence among early grade subject teachers is large, with 28 percent of teachers absent from school and 60 percent of teachers not in class during an unannounced visit. School absence among head teachers is also substantial, at 21 percent. We find that teacher classroom absence is particularly widespread and persistent. Our results are consistent with results from other surveys in Tanzania, and with findings for other low-income countries, e.g. Bold et al. (2017).

[1] EMIS data show that 94 percent of all primary schools in 2016 were public.

Jointly, these results point to a substantive problem in teacher motivation and human resource management in public education. We also find that the report type matters for the level of absence: observed school attendance is substantially lower during unannounced visits compared with both announced visits and head teacher reports.

Second, school absence produces large fiscal costs associated with non-delivered services to the taxpayer. At the lower end, not counting teachers at school that are not teaching, we find an annual fiscal cost of 120 million USD or 11 percent of the primary education budget. If we add teachers not in class and those not teaching, the annual cost estimate amounts to 411 million USD or 19 percent of the total education budget in 2016 (39 percent of the primary education budget). This estimate does not account for the costs of lost learning and associated lifetime benefits borne by students.

Third, we find that, after two years of implementation, an experimental test-based cash-incentive program for early grade teachers results in increases of 7.5 to 10 percentage points in classroom attendance and active teaching. These effects are precise and amount to increases of 20 and 28 percent relative to mean attendance in the control group.

Fourth, in a panel data analysis we find mixed effects for a range of other incentives that are present in the system. We find that the probability of school inspections is positively associated with teacher attendance across a number of specifications. We do not find a similar association for more generic government visits that do not have an explicit inspection or external accountability component, such as the very frequent ward-level monitoring visits.

We also find that, consistently across specifications, the behavior of colleagues correlates with individual teacher behavior, which may suggest norm-setting in the workplace. We also find that female teachers are over six to seven percentage point more likely to be in the classroom and actively teaching, which is 14 percent higher than the control group mean attendance level. A few notable variables that show no or negligible correlation with teacher attendance are quality of infrastructure; salary level; the student-teacher ratio; student learning levels; and head teacher attendance.

In the next section, we provide an overview of relevant formal structures of policy implementation and teacher management in the Tanzanian education system. We discuss system features and limitations of teacher effort monitoring. We also present our analytic framework for the empirical analysis, based on discussions of teacher effort incentives found in the literature. In Section 3 we describe our survey data. We discuss the collection of the various teacher attendance reports and covariates in our analysis, and present data summaries of these measures. In Section 4 we calculate the fiscal and

policy costs of teacher absence. In Section 5 we present impact estimates of the experimental cash incentives program. In Section 6, we provide panel estimates of a wider set of incentives, including workplace conditions, regular salary and inspection visits. In Section 7 we discuss our findings and conclude.

2 Context and analytical framework

Tanzania has managed an impressive quantitative increase in its education system in the first decade of the new millennium. Over the period 2001-2012 the number of students increased from 4.9 million to 8.3 million, raising primary net enrollment from 58 to 88 percent (UNESCO Institute for Statistics, 2022). To accommodate this increase while keeping the STR in check, the number of teachers employed also increased by a factor 1.7 over this period; public expenditure on education increased from 3.5 percent to 4.5 percent of GDP between 2004 and 2010.

Tanzania has one of the largest primary teacher workforces in Africa (Bashir et al., 2018). Table 1 shows the EMIS number of teachers and students for public primary schools in 2014-2016, the years covered by our survey data. We have added the student-teacher ratios (STR), the number of schools and, in the final row, the percentage of schools with an STR lower than 50.[2]

Table 1: Public primary schools, EMIS

	2014	2015	2016
Schools	15,275	15,632	15,692
Teachers	183,790	184,093	191,219
Students	7,955,598	7,766,700	8,230,113
Student-Teacher Ratio (STR)	46.9	46.7	46.8
STR 50 or lower (fraction)	0.62	0.64	0.63

Source: Education Management Information System 2014-16, Tanzania. Note that because this table only presents public school data in mainland Tanzania (excluding Zanzibar), the number of teachers is lower than the UNESCO UIS number quoted in 1.

Table 1 shows that, despite the large increase in teachers since 2001, the number of

[2]An STR of 50 was used as the upper acceptable limit in the Education Program for Results (EP4R), in an effort designed to reduce and harmonize STR across the country.

students per teacher in public schools is high on average. More than one in three schools have an STR above 50. This is reflected in survey responses by teachers, most of whom consider large class sizes to be the main problem in their work environment. Teacher attrition is about 2 percent per year (EP4R), which implies that 4,000 new teachers need to be deployed every year just to keep the number of teachers constant. Furthermore, the 2016 cancellation of parental contributions caused a large inflow of new students, requiring a larger increase in new teachers.

2.1 Managing teachers in Tanzania[3]

The large expansion of school building and teacher deployment that followed the policy of Universal Primary Education (UPE) in 2001 was founded on two pivotal reform programs: the Local Government Reform Program (LGRP), implemented between 1999 and 2001 (Tidemand & Msami, 2010) and the 2002-06 Primary Education Development Plan (PEDP).[4]

The LGRP originally intended to 'hire and fire' all Local Government Authority (LGA) staff locally, including directors, teachers and health workers). However, the Public Service Act (2002) reversed this (UNICEF, 2018). As a result, teacher human resource and contract management in Tanzania remains centralized, with a number of functions distributed across different entities and levels in the decentralized system. According to Tidemand and Msami (2010), LGA control over local staff is limited, because of the dual authority system that provided powers over staff and management to both central and local government. Moreover, these authors argue that legislation is occasionally contradictory, with specific roles and responsibilities being assigned to different levels of government at the same time.

As an example, according to Bennell and Mukyanuzi (2005), there is "widespread confusion about who exactly is the teacher's employer". Head teachers are responsible for the day-to-day supervision of teachers but have only very indirect HR or legal authority over teachers. Teacher disciplinary cases originate from schools, but involve a long chain of communication. They involve briefings of the Ward and District Education Officers

[3]This section draws, besides the listed references, on conversations with the late Joseph S. Mmbando, who oversaw the PEDP implementation for the Ministry of Education.

[4]The LGRP aimed to strengthen the local government authorities by granting them more responsibility and autonomy, a process labeled Decentralization by Devolution. The LGRP approach viewed LGA (Local Government Authority) administrations as independent and all-round government entities, supported by central Government departments. In reality, a more top-down relation persisted, especially in the financial relationship: a large share of the typical LGA budget comes from the central Government, with detailed instructions (budget ceilings). The LGAs depend on central Government approval for their budgets and therefore carefully follow the guidelines and instructions when creating these.

(WEO and DEO, respectively). Upon their advice, the District Executive Director (DED) sends the case to the Teachers' Service Commission (TSC), the disciplinary authority.[5] The TSC sits to deliberate on disciplinary issues and makes decisions on promotions or dismissal for teachers in the District. Apart from disciplinary cases, the DED makes decisions on teacher transfers upon advice from DEO, and implements them through letters to the school heads and teachers in question.

2.2 Monitoring teachers

Data collection about schools and teachers is wide, but limited in terms of frequency and depth. Data is collected through the annual school census and digitized in the Education Management Information System, but the teacher data are limited to their qualification status. Tanzania does not have a Teacher MIS, i.e., no centralized database with all management data on teachers. Data about a teacher's career progress, are managed by the District Statistics and Logistics officer (SLO) and an Academic officer (DAO); these two are responsible and accountable to the DEO. Monitoring of schools and teachers is organized at various levels. First, day to day supervision of teachers on the job is done by the head teacher and the academic teacher. Second, Ward Education Officer (WEO) is the lowest level external representative of the education hierarchy, a role that was created to enable regular local monitoring and support. Third, there are visits from higher level external representatives such as the DEO and fourth, the inspection visits carried out by the district School Quality Assurance (which fall under the Ministry of Education) . These last two external monitoring visits are less frequent.

While this monitoring regime in principle provides a control, information and feedback tool for the local Government, the potential impact of the monitoring regime on observed individual teacher attendance and effort should not be overestimated, for several reasons. First, as indicated by the high STRs in Tanzania, in many schools, head teachers struggle to have sufficient teachers and do not want to lose them. Moreover, schools have teams of relatively well educated staff who depend on their colleagues and supervisor. Especially in rural and smaller schools, head teachers can be expected to choose their battles. Second, head teachers do not have authority about hiring and firing themselves. If they want to remove and replace a teacher from their school, they need to spend time (and political capital) to appeal, through the WEO, to the district level for sanctions and replacements. These two arguments are relevant for the WEO as well.

[5]The Teachers' Service Act (2015) states that the functions of the Commission include "to appoint, promote and discipline teachers".

Third, external inspection visits are often announced in advance, especially since recent SQA reforms. Fourth, school inspections are not frequent and take place every two to three years, on average.

Survey data suggest that this monitoring and feedback system does not exercise much performance pressure on teachers. The nationally representative Sauti za Wananchi baseline survey, fielded in 2012, included interviews with head teachers of 156 public primary schools. In only one (0.6 percent) of these a teacher had been fired in the previous three years because of "bad performance". In 63 percent of schools, teachers had been transferred in the previous three years, but in none of these cases was poor performance mentioned as a reason. This finding confirms earlier evidence on the extremely low risk of being fired in India (Chaudhury et al., 2006).

Nevertheless, teacher absenteeism continues to be a topic of political and public interest. In a speech in 2021, Tanzanian Minister for Local Government Ummy Mwalimu spoke about government plans to develop an electronic fingerprint system to monitor teacher attendance in classrooms at primary and secondary schools in all councils in the country to control absenteeism. Citizens also indicate that teacher attendance is an issue of interest, suggesting there is popular demand for the monitoring efforts. In a 2017 survey, over 70 percent of respondents (all with a child in primary school) indicated to be "interested in following more closely whether teachers are present or absent in the school" (Ipsos Tanzania, 2017).

2.3 Analytical framework: teacher incentives

The incentives that potentially determine attendance and other forms of effort come from various sources. We follow Bruns and Luque (2015) and slightly modify their classification to distinguish three broad classes of teacher incentives: (1) professional rewards, which includes working conditions and student level, as well as factors like intrinsic satisfaction, recognition and contact with colleagues; (2) material rewards, including salary (differentials), bonus rewards and (travel) costs; and (3) accountability pressure, which includes different levels of monitoring and potential sanctions, including visits by system administrators outside the school (see previous subsection), feedback from the head teacher and colleagues, and from parents and students.

For this study, teacher bonus rewards are especially relevant because our survey data were collected for the evaluation of the KiuFunza teacher incentives experiment. KiuFunza ('Thirst for learning' in Kiswahili) is a test-based teacher incentives program managed by Twaweza, an East African civil society organization. The program was

started based on evidence of low basic skills learning from large learning assessment surveys (Uwezo, 2013) and low teacher effort (Bennell and Mukyanuzi (2005), World Bank (2012)). The first set of interventions under this program were launched in 2013, lasted until 2014. A second phase of the program, with a revised bonus design, was implemented in 2015 and 2016. For detailed descriptions and impact evaluation of these program phases we refer to (Mbiti, Muralidharan, et al., 2019) and Mbiti, Romero, and Schipper (2019).

This paper presents empirical evidence on the effects of incentives in all three categories. We provide two sets of attendance estimates. The first uses the experimental design to estimate the impact of test-based cash incentives on teacher attendance measures, see Section 5. The second uses the teacher panel data to investigate associations between our attendance data and school and teacher level variables across all three incentive categories, see Section 6.

3 Data and summary statistics

3.1 Survey data

Data collection took place throughout the first two phases of the KiuFunza program, KiuFunza I (KFI) and KiuFunza II (KFII), implemented in 2013-14 and 2015-16, respectively. For our study, we focus on data that were collected in 2014-2016 in a total of nine survey rounds in a set of 220 schools that the surveys had in common throughout all years. The programmatic focus if KiuFunza is reflected in the teacher sampling, which focused on teachers responsible for teaching Kiswahili, Arithmetic and English in the first three grades of primary school. However, some teachers in practice combine early grade teaching with responsibilities in other grades.

Unannounced school visits took place during the 2014-2016 survey rounds (one per year), and our analysis focuses on attendance measures from these survey rounds. The survey data also include attendance data from other reporting sources: observations during announced visits, attendance book registration, self-reports by teachers, and head teacher reports. There is also a rich set of teacher and school covariates that were collected in the same years, including school (head teacher) surveys, teacher surveys, low-stakes student tests for students in grades 1-3, and classroom observation data.

The unannounced visits focused specifically on measuring teacher attendance and provide the most detailed attendance information, based on enumerator observations. During these visits, enumerators came to the schools with a list of teacher names and

assignments that was prepared after the baseline survey a few months earlier. At the start of the visit, the teacher lists were reviewed by the head teacher and teachers not currently working at school were removed from the exercise; this could be because they had retired, passed away, or transferred to another school after baseline. Teachers on long-term study leave were also omitted from the list. Moreover, a teacher who according to the head teacher was on duty only in the afternoon would not be considered for the attendance count if the school visit took place in the morning. In other words, the teacher lists were carefully scrutinized and cleaned so that only teachers on duty during the time of the visit were included.

Survey staff were instructed to monitor teacher attendance in the morning but after allowing 15 minutes after the start of the school day. (This may have provided some teachers with an opportunity to come to school to be counted, after hearing of the visit). During the visit, a structured attendance check took place, consisting of a few key elements for each Standard I-III teacher assigned to the particular school: in-person assessment whether the teacher was at the school compound; if yes, is she on duty; did she sign in; is she in class during class hours; if yes, is she actively teaching; if no, what is she doing outside the classroom.

During the announced visits school and teacher surveys were administered, providing head teacher reports on teacher absence, teacher self-reports on attendance "last week", and enumerator observations. The head teacher report is recorded for each teacher, without verification, during the head teacher interview. The teacher self-report is provided during the teacher interview, again without independent verification. The announced visit enumerator report is coded "present" if the teacher is at school on the first day of the survey visit.

All three "announced visit" report types were collected in six survey visits, at the start (March) and end (November) of the school year in each of the three years 2014-2016. The unannounced visits took place mid-year (August) and only recorded enumerator reports. For this paper we construct a panel data set at the teacher-year level, with at most one observation for each teacher in our dataset per year. If we have two announced visit reports for a teacher in a year, we calculate the mean of the two observations. The panel has 2585 unique teachers. 48 percent are observed in all three years, 23 percent in two of the three.

3.2 Teacher attendance measures

Table 2 summarizes our attendance data, presenting the overall mean (column 1), the rural and urban means (columns 2 and 3) over all (teacher-level) observations across the three years in our dataset. Column 4 gives the rural-urban difference, and the significance of the difference in a t-test.

The first three rows of Table 2 are from the announced visit data: row 1 presents teacher school attendance (on the last school day) according to the head teacher report; row 2 is based on enumerator observation on the first day of the survey team school visit; and row 3 is observed attendance summed over all days of the visit, which allows teachers to be counted on more days. The mean attendance rate in row 3 (all survey visit days) is higher than the first day attendance, as expected. The difference between the two measures for the full sample is 12 percentage points and driven mainly by urban schools. Head teacher reports on average provide attendance estimates that are on average somewhat higher than the observed measures for the first day, again particularly in urban schools.

Our focal school attendance measures are based on enumerator reports during unannounced visits; these are presented in rows 4-7. Here we find that mean workplace attendance in schools is at 72 percent, with hardly any difference between rural and urban schools. Rows 6-7 show that 40 percent of duty teachers are in class at the time of the visit and that 38 percent are actively teaching. These statistics are calculated over the full sample and so are not conditional on being at school. That is, the 60 percent of teachers not in class include teachers that are away from school and teachers at school. Our school and classroom attendance results are consistent with previous evidence for Tanzania.[6]

The attendance book is one of the few documented sources of attendance information in the education system. For unannounced visits, the attendance book inspection shows that the information in the book is largely consistent with the enumerator observation (equality of means cannot be rejected).

The data in Table 2 show that attendance report type is associated with reported attendance levels. First, announced visit school attendance (day 1) is higher than the unannounced visit attendance in rural schools. A regression of teacher school attendance on report type, not reported in the table, shows that the unannounced measure is

[6]For example, previous large scale surveys found classroom attendance rates of 36 (World Bank, 2012), 54 (World Bank, 2016) and 29 percent (Oxford Policy Management, 2015).

Table 2: Teacher attendance

	All mean	Rural mean	Urban mean	d(R-U) b
Announced visit				
HT report: Teacher at school yesterday	0.87	0.85	0.90	-0.05***
Observed: Teacher at school day 1	0.83	0.87	0.70	0.18***
Observed: Teacher at school day 1/2	0.95	0.95	0.92	0.04***
Unannounced visit				
Teacher signed attendance book	0.68	0.69	0.66	0.03
Teacher at school	0.72	0.72	0.73	-0.01
Teacher in class	0.40	0.38	0.48	-0.10***
Teacher actively teaching	0.38	0.36	0.45	-0.09***
Self-reported				
Teacher attended all classes last week	0.68	0.64	0.80	-0.16***
SR reason: personal admin education other	0.64	0.65	0.54	0.11*
SR reason: illness	0.35	0.31	0.55	-0.24***
SR reason: personal events (wedding)	0.29	0.29	0.28	0.00
SR reason: official duty (unrelated to education)	0.12	0.12	0.08	0.04
SR reason: official duty (related to education)	0.13	0.15	0.03	0.12***
SR reason: administrative tasks	0.15	0.16	0.07	0.09***
SR reason: other	0.00	0.00	0.01	-0.01

Source: KiuFunza surveys 2014-2016

significantly lower than the day 1 announced measure. [7]

Second, urban head teachers' reports about the attendance of their teaching staff is higher than attendance based on enumerator reports. Overall head teachers overestimate attendance by between 15 and 4 percentage points on average (for unannounced and announced visit reports, respectively).[8] Equality of mean attendance according to the head teacher and enumerator reports is rejected by a t-test (not reported in the table).

The eighth data row of Table 2 presents teacher self-reports on their class attendance and provides much higher attendance rates: overall, 68 percent of teachers report not having missed a class over the last week. Note that this variable refers to the previous full week and to class attendance. While the average is much higher than class attendance according to unannounced visit observation, it is still far below 100 percent and appears to reflect a remarkable openness and acceptance of not being in class.

The self-report questionnaire also included questions on the reasons for this absence. This is useful to obtain a sense of what share of the absenteeism can be justified. The reasons for self-reported absence provided by teachers are varied and include illness, personal reasons (eg attending a wedding), official duties, administrative work, and other. The two categories mentioned most often are illness (mentioned by 35 percent) and personal events (29 percent). These numbers imply that in a typical week, 11 percent of all teachers (0.32 times 0.35) missed classes because of illness, and 9 percent because of personal reasons.

In 2015, the 25th, 50th and 75th percentiles of (unannounced visit) mean teacher school attendance are 0.5, 0.75 and 1, respectively. For mean class attendance, the respective percentiles are 0.2, 0.33 and 0.5. These percentiles do not change much between years. The median absence rates show that the high mean levels of absence, particularly at the classroom level, are widespread in the system.

How persistent are the attendance patterns at the school level? To investigate this, we calculate a persistence measure that indicates how many years (out of the three in the data set) a school has below or above 75 percent attendance. We find that 10 percent of schools have 75 percent or lower staff attendance at school in three consecutive years. For class attendance, however, the share of schools with below 75 percent attendance across all three years is 65 percent. On these measures, a relatively high level school absence

[7] In a (linear probability) regression of school attendance status in the enumerator report on report type, with unannounced type equal to one and zero otherwise, with teacher and year fixed effects, the unannounced survey coefficient is -11 percentage points and significant. However, unannounced visits took place in the middle of the school year, whereas the announced visit attendance is the mean of baseline and endline attendance.

[8] Note that the head teacher report does not involve in-person confirmation, and is not about the day of the survey visit but about "yesterday".

is persistent in 10 percent of schools, while high classroom absence is persistent across a wide segment of the school population. 31 percent of schools have class attendance of 50 percent or lower across all three years.

3.3 Teacher incentives: summary statistics

Our data on teacher incentives are summarized in Table 3, calculated over all observations for the three years 2014-2016. Column 1 presents overall means. Columns 2 and 3 display means for rural and urban areas, column 4 the rural-urban difference. We present summary statistics by 3 categories of (potential) effort incentive in our analytical framework (see Section 2). The fourth panel summarizes background characteristics.

Professional rewards (panel 1) includes measures of work environment attractiveness. Note that only 37 percent of teachers had a one-on-one meeting with the head teacher, their local "boss", in the year of the survey, suggesting a low level of formal supervision for teachers. The third row shows that 36 percent of teachers are teaching full-time (exclusively) in grades 1-3. This type of lower-upper primary specialization is stronger in urban areas, where schools are larger. The assignment specialization is relevant as a majority of teachers prefer teaching in the upper grades. A well-known policy issue is that pupil-teacher-ratios (STRs) are high, especially in the lower grades. The mean lower grade STR is 54. Rural schools are worse off in terms of learning and infrastructure, with only 8 percent connected to electricity and 43 percent with a clean water source.

Rural teachers are more likely to live in staff housing and have lower travel time to school on average. Rural teachers are also more likely to work in the district they were born in.

The third panel (Accountability) includes variables representing both school level norms and the system of external school oversight. The behavior of peers affects individual teacher behavior by setting behavioral norms. Norms are represented by attendance variables for colleagues and the head teacher. Colleague attendance is measured at teacher level as the share of teachers (in grades 1-3) in the school who are attending, excluding the teacher herself. Head teacher attendance represents both norms and supervisory pressure, and is at 79 percent.

The system of external monitoring is intended to periodically provide information about the school results, conditions, leadership and staff to higher levels of Government (and instructions, information and recommendations from higher levels to the school). Our data include information on three types of school visits: inspection visits (SQA), generic visits by a Ministry representative, and WEO visits.

Table 3: Summary statistics

	All mean	Rural mean	Urban mean	d(R-U) b
Professional rewards				
Works in district of birth	0.25	0.27	0.20	0.07***
Meeting with HT this year	0.37	0.37	0.35	0.03
Full-time lower primary	0.34	0.29	0.47	-0.18***
STR grades 1-3	53.85	54.05	52.73	1.32
CG received per student (USD)	3.02	2.90	3.66	-0.76
S123 learning index (PCA)	-0.08	-0.63	2.99	-3.62***
School has electricity	0.16	0.08	0.60	-0.52***
School has clean water source	0.49	0.43	0.81	-0.39***
School has a library	0.20	0.18	0.35	-0.17**
Material rewards				
Salary (USD monthly)	358.38	343.76	398.63	-54.87***
Travel time to school (hrs)	0.35	0.25	0.61	-0.36***
Staff housing (half or more)	0.13	0.14	0.09	0.05
Accountability				
Colleagues at school (fraction)	0.69	0.70	0.68	0.02
Colleagues in class (fraction)	0.38	0.37	0.42	-0.06***
Head teacher is present	0.79	0.78	0.87	-0.09**
Had inspection visit this year	0.33	0.30	0.47	-0.16*
Had Gov visit this year	0.74	0.72	0.84	-0.12*
Had WEO visit last 2 months	0.82	0.81	0.88	-0.08
Background				
Is female	0.64	0.53	0.93	-0.39***
Age (years)	38.40	37.60	40.60	-3.00***
Teaching Diploma or higher	0.03	0.02	0.07	-0.05***

Source: KiuFunza surveys 2014-2016

We find that the mean probability of an inspection visit (this year) by the district School Quality Assessment officers is about one in three. In rural schools the inspection probability is 30 percent, in urban schools it is 47 percent (so urban schools are more likely to be inspected by a factor of about 1.6). These numbers reflect the difficulty of frequent high-level inspection visits in rural schools in Tanzania, and their remoteness: on average, travel time from a rural school to the district office is 90 minutes larger than for an urban school.

The second variable reflects visits by any Ministry official: this variable includes both district level administrative visits (e.g. by the District Education Officer) as well as the SQA inspection visits. The overall annual probability of a visit is higher in this case, but a similar urban-rural divide is present: 72 percent of rural schools have had one and 84 percent of urban schools. A third and common type of visit is by the Ward Education Officer (WEO): the probability of this type of visit is nearly 100 percent over the full year (not reported in table), and over 80 percent over the last two months. Finally, 64 percent of all teachers is female. Female teachers are more likely to work in urban schools, as are teachers with a teaching diploma or more advanced training (e.g. a university degree).

4 Fiscal cost of absence

The fiscal cost of absence depends on how we define what a teacher is supposed to do: for example, if we define the core of the teacher's job description as actively teaching then any teacher not actively teaching will be counted as adding to the fiscal loss. We sidestep the choice here and present a set of three different job definitions, with the following requirements: 1) when on duty, a teacher needs to be at school; 2) when on duty, a teacher needs to be at school and to be in the classroom; 3) when on duty, a teacher needs to be at school and in the classroom, and needs to be actively teaching.

We base our calculations for fiscal cost of absenteeism on these three definitions, but allow for justified school level absences based on the absence reasons reported by teachers. While it is hard to draw a definitive line for what constitutes "justified" absenteeism in terms of these reasons, we propose to use a conservative measure, that takes at face value the teacher provided reasons of official duties related to education and illness for missing classes. According to the teacher self-reports, these reasons account for about half of all school absences.

We calculate the fiscal cost as the share of salary costs paid for absent teachers, according to the various definitions (and excluding head teacher absences). These cost estimates use a number of Tanzanian education system parameters, including the fact

that the number of primary school teachers in Tanzania was in 206,829 in 2016 and the average annual teacher salary was USD 4,144. These numbers provide a total primary wage bill of USD 857,099,376, meaning that every percentage point of unjustified absence represents a fiscal cost of USD 8,570,994 per year; equally, every percentage point increase in attendance represents a fiscal value-for-money benefit to tax-payers of the same amount.

The total government expenditure on education was 2.16 USD billion, the share of the education budget on primary education was 49.2 percent, and the per student expenditure was USD 122.65. [9]

Table 3 presents our fiscal cost estimates. In column 1, we count as pure fiscal costs all unjustified school level absences; in column 2 we add to the cost all classroom absence among teachers that are at school (i.e. not caused by school absence); and in column 3, we add all teachers that are in class but not actively teaching (i.e. not caused by class absence). We acknowledge that these estimates use attendance rates and salary estimates for teachers in the early grades. However, our absence estimates do not differ much from surveys that include higher grades, while we have some evidence (not reported here) showing that teachers teaching higher grades are more, not less, likely to be absent.

Table 4 reports a large fiscal burden as a result of teacher absence, even under our most lenient of definitions ("Absent from school"). In this scenario, close to 120 million USD in education resources is lost every year due to teacher absence, representing over 5 percent of the education budget and 0.2 percent of GDP. In the lower panel we show estimates of what these amounts mean: this money represents the annual salary for almost 29,000 teachers and total per-student primary education spending for close to one million students (11 percent of the primary school student population).

In the intermediate measure in column 2 ("At school but not in classroom"), the total annual education budget lost due to absence is 18.3 percent (394 million USD). This amount represents teacher salaries for 95,000 teachers or 46 percent of the total number of primary teachers in 2016. The loss in this column further represents per-pupil expenditures for about 37 percent of students.

In the most stringent definition ("Not teaching"), the fiscal burden is 411 million USD and approaches 1 percent of GDP forgone as a result of teacher absenteeism. This is almost twice the national budget for research and development and about five times the 2016 primary education aid budget (UNESCO, 2019).

[9] We use expenditure data and number of teachers from the World Bank Open Data and UNESCO UIS, retrieved from https://data.worldbank.org/. The average annual salary is based on survey data.

Table 4: Fiscal cost estimates

	Definition of absence		
	Not at school	Add: not in classroom	Add: not teaching
Fiscal cost			
Share of teachers	14%	32%	2%
Cumulative share of teachers	14%	46%	48%
Total fiscal burden (USD)	119,993,913	394,265,713	411,407,700
Share of education budget	5.6%	18.3%	19.1%
Share of GDP	0.2%	0.8%	0.8%
Opportunities represented by cost			
Hiring additional teachers	28,956	95,141	99,278
Doubling per pupil expenditure for primary students			
Number of students	978,333	3,214,524	3,354,286
Share of students	11.3%	37.2%	38.8%

5 Experimental cash incentives

5.1 Intervention

The experimental KiuFunza teacher incentive program aims to improve foundational literacy and numeracy by offering cash incentives to teachers in grades 1-3 that are linked to foundational learning outcomes.[10] The core KiuFunza intervention is simple: at the start of the school year, program staff visit a school, communicate the bonus offer and identify and enlist eligible teachers; at the end of the school year they assess students of these teachers on their foundational literacy and numeracy skills. Then, based on test scores, payments are calculated, and the incentives are paid at the start of the next year. Schools and administrators receive a report on student performance by grade-subject. There is no teacher training, only a brief explanation of the program rules at the start of the year.

Over the 2013-2016 period, the KiuFunza incentive program has gone through two phases that we label KFI and KFII. A number of practical features of the intervention were constant across these implementations. First, the incentivized focal grades and

[10]See https://twaweza.org/learning-by-doing/kiufunza/ for a description.

subjects (FGS) were primary grades I-III, and Kiswahili, Math and English as subjects for the high-stakes tests. Second, the head teacher was included in the bonus offer, receiving 20 percent of the earnings of the teachers in her school. Third, student learning was measured at the school-grade-subject-classroom level, which is equivalent to the teacher personal level in most cases (except where teachers split teaching responsibility in one classroom). Finally, all high stakes tests were administered in person (one administrator testing one student) and all students in a focal grade were tested. Fifth, the mean teacher bonus size across these years is about 3.5 percent of the mean annual teacher salary.[11]

In this paper we focus on the impact of the KFII incentive design that was implemented in the 2015-16 school years.[12] KFII offered two different incentive arms, Levels and Pay-for-Percentile, that provide rewards even if students do not pass the full curriculum test. The idea behind incentives for such "partial curriculum success" is that many students lag far behind the full demands of the curriculum. Levels is a system with a number of curriculum-based proficiency thresholds, with a payment to the responsible teacher for each student passing a skill such as addition or reading sentences. Pay-for-Percentile is a tournament system, where teachers are paid according to the ranking of "their" students when compared with other students who had the same skill level at the start of the school year (Barlevy & Neal, 2012).

5.2 Experimental design

For the KFII experiment, 180 schools from the KFI experiment were randomly reassigned into two distinct incentive arms named Levels and Pay-for-Percentile, and a control arm. These 180 schools are used for the evaluation study in Mbiti, Romero, and Schipper (2019) (see the paper for a detailed description of the experimental design).

After the KFII randomization took place an additional 40 KFI control schools were added to serve as controls for a longer term study.[13] These schools had been randomly assigned to the control group in KFI but in phase two these had zero probability to receive treatment. With this caveat, we include these 40 added controls in our analysis;

[11]These mean reward sizes are close to those in some other teacher incentive experiments, including Muralidharan and Sundararaman, 2011 (India); and Behrman et al., 2015 (Mexico). In our experience it is sufficiently high to attract teacher attention and survey data show that the program is popular with teachers (Mbiti and Schipper, 2021).

[12]The KFI experiment consisted of three experimental arms (and a control arm): teacher incentives, school grants and the combination of these two. KFI offered a standard threshold incentive design, where a student needed to pass a single and relatively high threshold, consisting of a set of curriculum skills, before the teacher earns a reward. See Mbiti, Muralidharan, et al. (2019) for details.

[13]The survey budget for these additional control schools had not been confirmed at the time of the randomization.

see Table 5 for an overview. The full sample has 220 schools. Because the two KF II incentive treatments have a number of similarities, and because we are mainly interested in the impact of receiving any cash incentive, in our focal specification we pool the treatment arms and code a school that received any KiuFunza incentive as being in the "Incentives" treatment.

Importantly, the selection of the school sample, both in KFI and KFII, was done randomly across districts and schools within districts. Treatment randomization was stratified at the district level, so that each district replicated the experimental design proportions. This means that our findings on the effects of incentives are representative for the public school system in mainland Tanzania.

Table 5: Treatment assignment (schools)

Treatment	KFI	KFII	
	2014	2015	2016
Incentives	140	120	120
Control	80	60	60
Added control		40	40
Total	220	220	220

The KiuFunza teacher cash incentives experiment provided incentives linked to test scores (not to attendance measures), but changes in teacher effort measures are a plausible mechanism to explain improvements in learning resulting from teacher performance pay programs. However, while Mbiti, Romero, and Schipper (2019) find that the incentives caused substantial student learning improvements, they estimate only small and imprecise effects of about 2.5 percentage points for teacher school or classroom attendance.

A key challenge in the estimation of attendance effects — here and in other performance pay experiments — is that attendance measures based on infrequent enumerator observations are often noisy (Muralidharan & Sundararaman, 2011; Mbiti, Muralidharan, et al., 2019). Mbiti, Romero, and Schipper (2019) report standard error estimates of the classroom attendance coefficient estimates of 0.053 (Levels treatment) and 0.044 (Pay for Percentile). Following McKenzie and Ozier (2019), this implies minimum detectable effect sizes of 12-15 percentage points, which is sizable relative to the reported control mean of 36 percent attendance. We address this challenge by using more precise attendance measures and the larger school sample.

5.3 Empirical framework and measurement error

Our empirical framework is summarized in equation (1).

$$A_{is} = \alpha + \beta Incentives_s + X_i\gamma + X_s\delta + \epsilon_d + \epsilon_i \tag{1}$$

In this equation A_{is} is the attendance measure for teacher i in school s; it is coded one if the teacher is observed in attendance (or teaching), and zero otherwise. $Incentives_{is}$ is school level (randomized) assignment to either of two incentive treatments in each year of the KFII program. We estimate equation (1) separately for each year of the KFII experiment.

X_i and X_s are matrices of individual and school level covariates, respectively (and γ and δ are the corresponding coefficient vectors). These include pre-treatment school level outcomes and teacher level characteristics that are unlikely to be affected by the treatment such as gender and level of formal training (see table notes for details). One school level covariate is previous incentive treatment, which is coded as equal to one in 2015-16 for schools that received an incentive treatment in 2013-14. In this way, we control for differences in schools' KFI incentive treatment histories that might affect outcomes under KFII.

We extend the analysis in Mbiti, Romero, and Schipper (2019) in a number of ways, to address concerns of insufficient power. We use the same raw dependent variables based on unannounced visit observations (A_{is}) but amend the specification as follows. First, we use teacher level data and controls, which may help us to absorb error variance. Second, we group the two distinct incentive designs under one generic "Incentives" treatment, meaning that β represents the effect of being in any of the two incentive treatments. The coefficient estimate for the pooled treatment is between the Levels and Pay-for-Percentile coefficients, but pooling reduces the standard error estimate.

Third, we improve measurement by excluding teachers that are not on duty during the survey visit.[14] Importantly, we also exclude teachers that are not eligible for the bonus.[15] We therefore narrow our analysis to include only those teachers who teach KiuFunza focal grade-subject combinations and so would have been eligible to receive the incentive according to the program rules. Finally, we include the additional set of

[14]For example, an absent teacher that is assigned to teach the morning shift, would not be counted in case the enumerators visited the school after the midday break.

[15]The teacher sample in the KiuFunza surveys contains individuals who were not assigned to focal grades and subjects in every year. In 2015-16, non-eligible teachers represent some 30 percent of the sample. The reason is that the exact teacher assignment is unknown when preparing surveys. Survey teams had therefore been instructed to cast a wide net and include in the teacher sample individuals who had been assigned to focal grades and subjects in previous years.

forty control schools not used in the earlier analysis, to use the full extent of our collected data and so increase power.

5.4 Results

Table 6 presents our attendance results for the experiment. This table shows estimates of two specifications each for school attendance, classroom attendance and active teaching. The first specification uses the original sample of schools and is closest to the specification in Mbiti, Romero, and Schipper (2019). The second specification uses the expanded sample of schools.

Trust is a key factor in the incentive scheme, and in our experience this is established after the first year payments have been received by teachers. In the table and our discussion we therefore focus on the results for 2016: consistent with the learning estimates in Mbiti, Romero, and Schipper (2019), the largest effects of the program can be expected from the second year of the program.

The estimates for school attendance (columns 1 and 2) are positive but small and imprecisely estimated. We cannot reject the null hypothesis that the incentives had no effect on school level attendance in any year covered by our data. For classroom attendance and teaching activity we find positive estimates, but these are not statistically significant in 2015, the first year of the experiment (2015 results are not shown in the table). In 2016 the classroom attendance and teaching estimates are sufficiently precise to reject the null-hypothesis. These estimates are between 7.5 and 10 percentage points; or between 20 and 28 percent of the control group means, depending on the specification. The findings are consistent with the student learning effects in this experiment. As reported in Mbiti, Romero, and Schipper (2019), the overall learning effect size and significance estimates are largest and most precise in the second year of the experiment.

In appendix 7 we provide further detail on the difference between the attendance estimates in Mbiti, Romero, and Schipper (2019) and our results. The transition between different specifications shows that the improvements in measurement add up to a qualitatively different result. This analysis suggests that the difference between our findings and those in Mbiti, Romero, and Schipper (2019) are explained, within the original sample of 180 schools, by (a) the focus on teachers that are eligible for the bonus and are on duty during the attendance check, (b) the added power from using one treatment indicator and (c) individual and school level controls. In addition, the use of (pre-treatment) controls adds to the precision and provides an estimate that is sizeable and significant at the 5 percent level even in the original sample.

Table 6: Cash incentives

	At school		In class		Teaching	
	(1) 2016	(2) 2016	(3) 2016	(4) 2016	(5) 2016	(6) 2016
Incentive school	0.056	0.032	0.078**	0.100**	0.075**	0.099**
	(0.037)	(0.037)	(0.037)	(0.042)	(0.038)	(0.042)
Observations	735	838	731	833	733	836
Number of schools	179	216	179	216	179	216
District FE	Yes	Yes	Yes	Yes	Yes	Yes
KFI treatment controls	Yes	Yes	Yes	Yes	Yes	Yes
Strata score controls	Yes	Yes	Yes	Yes	Yes	Yes
Covariates included	Yes	Yes	Yes	Yes	Yes	Yes
Teachers included	Duty	Duty	Duty	Duty	Duty	Duty
Eligible only	Yes	Yes	Yes	Yes	Yes	Yes
Control mean	0.71	0.74	0.38	0.37	0.36	0.36
R-squared	0.14	0.09	0.20	0.13	0.20	0.13
Adjusted R-squared	0.08	0.06	0.14	0.10	0.14	0.10

Standard errors, clustered at the school level, are in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. All models are estimated with a full factorial of district fixed effects and an indicator for receiving incentive treatment under the previous RCT (the indicator equals 1 in 2015-16 for schools receiving incentives in KiuFunza I). In addition, the models include teacher controls (gender, age, formal training level, pre-treatment attendance) and pre-treatment school level controls (school size, student-teacher ratio in the focal grades, indicators for school electricity, water source and urban location, and minutes to the district office).

Note that when using the expanded set of schools we cannot use the complete set of variables used in the original randomization stratification. Bruhn and McKenzie (2009) show that in general estimation without stratum identifiers as fixed effects will lead to more conservative standard error estimates (less likely to reject the null hypothesis of no effect) and recommend to keep stratum identifiers in the regression. In our expanded set of schools we use (interactions of) two of the three stratum identifiers from Mbiti, Romero, and Schipper (2019), leaving out an indicator for pre-KFII above median learning that we do not have for the additional schools. Appendix table A1 shows that our main findings are not qualitatively dependent on the inclusion of the KFI learning stratum dummy. Removing this stratum indicator increases the standard errors but also the coefficient sizes in the extended sample.

Overall these results show that the KiuFunza II cash incentives program substantially improved teacher classroom attendance and activity, but it had no effect on teacher school attendance. The results also show that incentive programs do not change behavior overnight but require some time before eligible teachers adjust their effort levels upwards. However, with time the impacts are sizeable relative to effort levels in the control schools.

6 Non-experimental incentives

We now widen our analysis of teacher effort to include the effects of incentives beyond the cash bonus program. These incentives are from observational data and so we turn to panel regression results. Our empirical framework is:

$$A_{isdt} = \alpha + \mathbf{PR}_{isdt}\boldsymbol{\beta}_{PR} + \mathbf{MR}_{isdt}\boldsymbol{\beta}_{MR} + \mathbf{AC}_{isdt}\boldsymbol{\beta}_{AC} + \mathbf{X}_{isdt}\boldsymbol{\beta}_{X} + \epsilon_i + \epsilon_s + \epsilon_d + \epsilon_t \quad (2)$$

where A_{isdt} is the attendance variable for teacher i, in school s, district d at time t; PR, MR, and AC are matrices containing data on professional rewards, material rewards (benefits and costs), and accountability pressure; each matrix is multiplied with a vector of coefficients, the estimands. X_{isdt} represents a set of teacher characteristics (age, gender, and training). Some of the variables in PR and AC are measured at the teacher level, and some at the school level; for the sake of brevity we omit school level matrices. The equation includes error terms at the individual, school and district level, as well as macro shocks over time. These error terms represent unobservable factors that may be correlated with the outcomes and the covariates, and therefore may confound our estimates. The key point is that our data allow us to control for these shocks, through the use of fixed effects.

We present estimates in three tables, one for each of the three attendance measures collected during unannounced visits: school attendance in Table 7, classroom attendance in Table 8 and actively teaching (from classroom observations) in Table 9. For each measure, we present school fixed effects and teacher fixed effects estimates. The fixed effects will also absorb the first order effects of the experimental incentives program. However, it is possible that the incentives interact with covariates. We therefore present results for both the full sample and the control schools only.

The selection of covariates started from a wide set of variables in the three incentive categories discussed in section 2. We trimmed the list of covariates to leave out results for the covariates without any attendance association in a set of preliminary regressions. We discuss our findings by incentive category.

6.1 Professional rewards

Table 7 presents estimates for school level teacher attendance. We find that teachers who report having had a one-on-one meeting with the head teacher are more likely to be observed at school (row 1, columns 1-2). The coefficient is insignificant in the

teacher FE equations (columns 3-4), and the school FE estimate does not have a causal interpretation since it is likely to include teacher self-selection effects. Nevertheless, the positive estimates are plausible and in any case more intensive head teacher supervision looks like a necessary improvement, given the low levels reported in Table 3. We find positive (but smaller size) associations with head teacher meetings in the classroom attendance and actively teaching school FE regressions.

Rows 3 and 4 show that the Student-Teacher Ratio and per student Capitation Grant receipts, both indicators of workplace quality, are not associated with teacher school attendance. These variables are not associated with any of the other attendance variables (Tables 8 and 9), in any of the specifications.

Row 2 shows estimates for being a full-time lower primary teacher, defined as a teacher without any teaching assignment above grade 3. Table 7 shows that these teachers are more likely to be at school, a marginally significant positive association. The school FE columns of tables 8 and 9 show that these teachers are significantly more likely to be in the classroom and to be teaching. Although the coefficients are larger for the full sample than for the controls only sample, a separate test of the interaction with the incentive treatment (not reported in the table) shows there is no significant treatment interaction in this model. The coefficient on full-time lower primary teaching is also (marginally) significant in the controls-only sample. This points to the possibility that these lower grade teachers have a higher intrinsic motivation than their non-full time colleagues.

6.2 Material rewards

We find very little association between traditional material rewards (costs) and attendance. Salary level (row 5) has a small and imprecise association with effort across all attendance types, samples and specifications. In the classroom and teaching models, salary has a negative association, and this negative association is marginally significant in the teaching regression with school fixed effects. These results show that, in contrast to the performance linked pay incentives, increasing teacher base salaries is unlikely to improve classroom attendance or teaching effort. This result is consistent with experimental evidence for Indonesia in de Ree, Muralidharan, Pradhan, and Rogers (2017), who show that doubling teacher salaries did not lead to improved student test scores. As expected, travel time has a negative association with school attendance (row 6), which is stronger and more precise in the control sample.

Table 7: School attendance (panel estimates)

	School FE		Teacher FE	
	(1) All schools	(2) Controls only	(3) All schools	(4) Controls only
Professional rewards				
Meeting with HT this year	0.0402**	0.0555**	0.0197	0.0119
	(0.0192)	(0.0277)	(0.0259)	(0.0423)
Full-time lower primary	0.0308*	0.00514	-0.0241	0.0121
	(0.0174)	(0.0219)	(0.0382)	(0.0558)
STR grades 1-3	-0.000163	0.00140	0.000251	0.00220
	(0.000714)	(0.00147)	(0.000741)	(0.00150)
CG received per student (USD)	0.00101	0.00280	-0.000960	0.00561
	(0.000757)	(0.0129)	(0.000933)	(0.00808)
Material rewards				
Log monthly salary	0.0545	0.0388	0.0798	0.0219
	(0.0433)	(0.0526)	(0.118)	(0.183)
Travel time to school (hrs)	-0.0383	-0.0863***		
	(0.0255)	(0.0267)		
Accountability				
Colleagues at school (fraction)	0.0447	-0.216**	0.258***	0.219**
	(0.0627)	(0.109)	(0.0599)	(0.0937)
Had inspection visit this year	-0.00341	0.0358	-0.0427*	0.00295
	(0.0267)	(0.0443)	(0.0257)	(0.0343)
Background				
Is female	-0.0000782	-0.0149		
	(0.0226)	(0.0281)		
Observations	2973	1862	2973	1862
Control mean	.73	.73	.73	.73
Year FE	Yes	Yes	Yes	Yes
District FE	No	No	No	No
R-squared	0.01	0.02	0.03	0.03
Adjusted R-squared	0.00	0.01	0.02	0.02

Results from estimating Equation (1). Standard errors, clustered at the school level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Classroom attendance (panel estimates)

	School FE		Teacher FE	
	(1) All schools	(2) Controls only	(3) All schools	(4) Controls only
Professional rewards				
Meeting with HT this year	0.0311	0.00828	0.0239	-0.00447
	(0.0205)	(0.0275)	(0.0281)	(0.0436)
Full-time lower primary	0.108***	0.0655**	0.00354	0.0360
	(0.0203)	(0.0280)	(0.0404)	(0.0611)
STR grades 1-3	-0.000583	-0.000465	-0.000539	-0.000448
	(0.000786)	(0.00180)	(0.000794)	(0.00135)
CG received per student (USD)	0.000391	0.0155	-0.00137	0.00508
	(0.000922)	(0.0136)	(0.000974)	(0.00987)
Material rewards				
Log monthly salary	-0.0503	-0.0462	0.0138	-0.0603
	(0.0485)	(0.0624)	(0.117)	(0.208)
Travel time to school (hrs)	0.0153	-0.0324		
	(0.0306)	(0.0310)		
Accountability				
Colleagues in class (fraction)	0.297***	0.0108	0.533***	0.443***
	(0.0496)	(0.0904)	(0.0470)	(0.0701)
Had inspection visit this year	-0.0459*	-0.0321	-0.0607**	-0.0426
	(0.0256)	(0.0424)	(0.0240)	(0.0370)
Background				
Is female	0.0643***	0.0586*		
	(0.0232)	(0.0298)		
Observations	2966	1859	2966	1859
Control mean	.43	.44	.43	.44
Year FE	Yes	Yes	Yes	Yes
District FE	No	No	No	No
R-squared	0.05	0.02	0.11	0.09
Adjusted R-squared	0.04	0.01	0.11	0.09

Results from estimating Equation (1). Standard errors, clustered at the school level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Active teaching (panel estimates)

	School FE		Teacher FE	
	(1) All schools	(2) Controls only	(3) All schools	(4) Controls only
Professional rewards				
Meeting with HT this year	0.0335*	0.0261	0.0320	0.0300
	(0.0200)	(0.0262)	(0.0277)	(0.0410)
Full-time lower primary	0.0990***	0.0430	0.00253	-0.00131
	(0.0199)	(0.0267)	(0.0373)	(0.0567)
STR grades 1-3	-0.000240	-0.000614	-0.0000482	-0.000380
	(0.000778)	(0.00170)	(0.000822)	(0.00132)
CG received per student (USD)	0.000338	0.0185	-0.000984	0.0112
	(0.000894)	(0.0130)	(0.000896)	(0.00922)
Material rewards				
Log monthly salary	-0.0970*	-0.109*	-0.0131	-0.0708
	(0.0515)	(0.0656)	(0.118)	(0.212)
Travel time to school (hrs)	0.0227	-0.0185		
	(0.0275)	(0.0328)		
Accountability				
Colleagues teaching (fraction)	0.309***	0.0133	0.525***	0.416***
	(0.0496)	(0.0887)	(0.0470)	(0.0728)
Had inspection visit this year	-0.0458*	-0.0317	-0.0602**	-0.0462
	(0.0252)	(0.0422)	(0.0237)	(0.0372)
Background				
Is female	0.0663***	0.0580*		
	(0.0230)	(0.0295)		
Observations	2974	1863	2974	1863
Control mean	.41	.41	.41	.41
Year FE	Yes	Yes	Yes	Yes
District FE	No	No	No	No
R-squared	0.05	0.02	0.10	0.08
Adjusted R-squared	0.04	0.01	0.10	0.07

Results from estimating Equation (1). Standard errors, clustered at the school level, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.3 Accountability pressure

Tables 7-9 suggest that two accountability mechanisms may affect attendance: group norms and inspection visits. Row 7 in each of these tables presents regression coefficients on the variables measuring the fraction of colleagues in attendance. This variable represents for each dependent variable and for each teacher the fraction of her or his school colleagues that is present (or active). These group measurements exclude the observation for the teacher in question so only represent colleagues'attendance.

The colleague attendance variables have positive and highly significant coefficient estimates in most of the models in these tables, and in all the teacher FE models. We emphasise that these coefficient estimates represent correlations and do not carry a causal interpretation. Well-known challenges to the econometric identification of peer effects are presented by potential self-selection into peer networks; and by the so-called reflection problem, meaning we cannot isolate the effects of contextual effects that affect all group members from true causal peer effects (see Manski (1993); Bramoullé, Djebbari, and Fortin (2019)).

The correlations we observe are significant and the coefficient size implies that a 10 percentage point increase in colleagues' attendance is associated with a higher attendance probability of between three and five percentage points. In the median school, a lower grade teacher has six colleagues, each representing 16 percent of lower grade colleagues. The FE coefficient estimates mean that one additional colleague present correlates with an increased teacher attendance probability of about 5 to 8 percentage points. However, we cannot rule out contextual or selection effects producing these results and so cannot conclude to what extent our estimates present a true peer effect, such as norm setting and/or accountability pressure.

For school inspections, we find that coefficients alternate in sign and are imprecise in the school attendance equations. However, the school inspection coefficients are consistently negative in the classroom attendance and teaching regressions. These estimates are (marginally) significant and between minus three and minus six percentage points. The inspection estimates are slightly larger and more significant in the full sample. However, we do not find any experimental treatment interaction and, because of the similarity in coefficient sizes in the classroom attendance and teaching models, we view the controls-only estimates as essentially the same but with larger standard errors.

The negative sign we estimate across these equations is consistent with the very low probability that a school will be visited by inspectors when an inspection has taken place earlier in the year. It is also consistent with two other factors. First, inspections typically take place in the first half of the school year: the median month of the visits is May. Sec-

ond, the surprise visits that generated our attendance data took place in July and August. To investigate this further, we construct an alternative inspection variable coded 1 if the inspection took place before or in the same month as our inspection visits and find that 88 percent of all recorded school inspections in our sample fall in the "before" category. When we re-estimate equation 2 with this alternative inspection variable all absolute coefficient sizes are larger and more significant (not shown in the table). We interpret these findings as evidence of a reverse monitoring effect, i.e., observed attendance decreases after the probability of an inspection visit becomes practically zero. Nevertheless, this suggests that before it takes place, the threat of an inspection does improve attendance. Muralidharan et al. (2017) report larger (and highly significant) inspection effect sizes for village schools in India of between 6 and 8 percentage points for school attendance. Our findings are smaller but qualitatively consistent with these findings.

We do not find any significant results for a set of other variables related to monitoring (results not reported in the table), including an indicator for head teacher attendance, a generic variable indicating that "any Government visit" took place at school, and another variable indicating a recent visit by the Ward Education Officer.

Finally, our results show that female teachers are about six percentage points more likely than male teachers to be observed in the classroom. The control mean level is 0.44 and so the female-male difference equals 14 percent of the mean effort level. Similarly, female teachers are 6 to 7 percentage points more likely to be actively teaching, a difference of about 16 percentage points, relative to the mean in control schools of 41 percent.

7 Conclusion

Our study documents substantive and widespread absence of primary teachers in Tanzania, one of the largest primary school systems in Africa. Across all schools and years, 28 percent of teachers on duty is absent from the school during an unannounced visit to the school. During these visits, on average 40 percent of duty teachers are found in the classroom and 38 percent are actively teaching. Unannounced visits provide lower attendance estimates than announced visits and self-reports. According to head teachers, school absence is 13 percent. During announced visits, observed teacher absence from school is 17 percent on the first day, and 5 percent across two visit days. While the official STR was 47 in the period we study, after accounting for school level absence the average effective STR for the lower grades was 97 students per attending teacher, far above recent policy targets of 50 students per teacher.

Teacher salaries represent 80 percent of the primary education budget, which amounted to about 1 billion USD in 2014. Therefore, teacher absences present large fiscal losses to tax payers. We estimate a conservative (lower end) annual fiscal cost of 120 million USD or 11 percent of the primary education budget. This cost estimate considers only justified school absences, and excludes absence costs of teachers at school but not in class and those not teaching. Adding these categories of absence, the fiscal cost estimate rises to 411 million USD (close to 1 trillion TZS at the current exchange rate), per year. These fiscal costs exclude the costs of decreased learning and related lifetime benefits borne by students and their families.

We use panel regression analysis with school and teacher level fixed effects to investigate correlation between teacher attendance and existing system incentives and obtain a number of robust results. First, we find that quality of infrastructure; salary level; the STR; student learning levels; and head teacher attendance do not show any correlation with teacher attendance. Second, we find that female teachers are 14 percent more likely to be in the classroom. Third, we find evidence suggestive of normative cohesion among school teams, where attendance behavior of colleagues is highly correlated with individual teacher attendance. Fourth, we find that Government monitoring by the school inspectorate is associated with teacher classroom attendance and teaching: across a number of specifications, a lower inspection probability is associated with lower teacher attendance.

Finally, we find that a small-scale experimental program that provided teachers with modestly sized cash incentives linked to their students' learning outcomes improved classroom attendance and teaching activity for eligible lower primary teachers. Our most conservative estimates show an incentive effect of 8 percent in both classroom attendance and active teaching.

Based on our fiscal cost estimates, at the national level the estimated 8 percent improvement in classroom attendance presents an annual value of about 68 million USD (156 billion TZS). This program did not explicitly incentivize or monitor teacher effort, but the increase in effort is consistent with the program's estimated positive impact on foundational literacy and numeracy of students in the incentivized grades. Overall, our findings are consistent with a body of evidence showing that teacher effort is sensitive to monitoring and well-designed incentives (Duflo, Hanna, & Ryan, 2012; Gaduh, Pradhan, Priebe, & Susanti, 2020; Muralidharan et al., 2017).

Our findings suggest a few directions for teacher policy and management. First, our study shows that salary differences are not associated with attendance. Therefore, unconditional salary increases are unlikely to improve teacher effort or student learning

(see also de Ree et al. (2017)). Besides, recent evidence shows that teachers in Africa are not underpaid in terms of hourly wages, relative to other groups of employees with similar education levels (Evans, Yuan, & Filmer, 2021). The mean teacher salary in our sample of teachers is over four times GDP per capita in 2016.

Second, the finding that female teachers provide higher effort than male teachers presents one easily observable characteristic that administrators can use in their hiring decisions. Our results suggest that average teacher attendance would improve if the share of female teachers increases.

Third, an encouraging finding is that the system of school inspections and monitoring (in place at the time of the study) does send incentive signals that increase teacher attendance. Apparently, these are signals that head teachers and Ward Education Officers cannot replicate through their presence in or close to the schools. However, there are stringent budget constraints that limit the frequency of inspection visits to less than once every two years.

The current lack of external enforcement of attendance requirements is reflected in the importance of school level attendance norms. Our evidence suggests that the official nature of the inspection visits by an external team matters, possibly because it reintroduces external norms. The school attendance book represents an official verification tool and teachers' daily registration follows independently observed school attendance quite closely. This suggests that an apparently soft type of norm enforcement like the attendance book is respected by teachers.

Recent evidence shows that operational and financial constraints on monitoring can potentially be loosened through cheaper monitoring technology in combination with smart incentives. For instance, in countries like India (Duflo et al., 2012) and Indonesia (Gaduh et al., 2020), linking bonus or allowance payments to physical evidence that the teacher came to school (in the form of pictures in cameras they are provided) led to significant increases in attendance and student learning. In those cases, the interventions focused on motivating teachers to spend more time on task, effectively lowering teacher absenteeism, which resulted in improved learning.

Our findings complement these results by showing that that increased attendance and teaching was triggered by cash incentives linked to foundational learning outcomes. The program we study only assessed student learning through high-stakes assessments, but it had no camera monitoring or incentives linked explicitly to attendance.

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Appendix

Table A1: Specifications

	(1) In class	(2) In class	(3) In class	(4) In class	(5) In class	(6) In class	(7) In class
Levels	0.013	0.032					
	(0.040)	(0.041)					
P4Pctile	0.026	0.044					
	(0.036)	(0.036)					
Incentive school			0.038	0.056	0.078**	0.087**	0.100**
			(0.032)	(0.037)	(0.037)	(0.042)	(0.042)
Observations	1231	1115	1115	785	731	731	833
Number of schools	180	180	180	180	179	179	216
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KFI treatment controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Strata score controls	Yes	Yes	Yes	Yes	Yes	No	No
Covariates included	No	No	No	No	Yes	Yes	Yes
Teachers included	All	Duty	Duty	Duty	Duty	Duty	Duty
Eligible only	No	No	No	Yes	Yes	Yes	Yes
Control mean	0.37	0.38	0.38	0.38	0.38	0.38	0.37
R-squared	0.13	0.14	0.11	0.15	0.20	0.15	0.13
Adjusted R-squared	0.09	0.09	0.08	0.10	0.14	0.11	0.10

Standard errors, clustered at the school level, are in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. All models are estimated with a full factorial of district fixed effects and an indicator for receiving incentive treatment under the previous RCT (the indicator equals 1 in 2015-16 for schools receiving incentives in KiuFunza I). In addition, where the model includes controls, these are at the teacher level (gender, age, formal training level, pre-treatment attendance and salary level) and at school level, pre-treatment (school size, student-teacher ratio in the focal grades, indicators for school electricity, water source and urban location, and minutes to the district office).