**Final report**

# Evaluating the 2013 salary reform

International Growth Centre

Oriana Bandiera
Nava Ashraf
Torsten Walter

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# Evaluating the 2013 Salary Reform

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*Final Report*

## Introduction

The original research questions of this project were the following: How did the 2013 salary reform for civil servants affect civil service productivity? Based on quantitative analysis of payroll data, what was the causal effect of the reform on worker productivity? What were the underlying channels through which the reform affected performance?

As described in this document, answering these original research questions has only been feasible to a limited extent. While our research can highlight characteristics and outcomes of the salary reform, two factors preclude a comprehensive impact analysis:

1. Data quality: The collection, cleaning, and merging of payroll data and performance data has been very challenging due to technical problems as well as data availability and data quality issues.
2. Nature of the reform: The salary reform was accompanied by other simultaneous administrative changes, which make it difficult to unambiguously attribute changes in performance to salary changes.

At the same time these difficulties have led to the discovery of important and previously unknown facts about the allocation of teachers which we plan to investigate further.

## Background

During the dissemination of the study "Recruiting and compensating civil servants: A large-scale randomized field experiment in Zambia" in 2014, the Cabinet Office, Public Service Management Division, and Ministry of Labor requested additional research on civil service productivity. This document represents one effort to respond to this request by analysing the effects of the 2013 salary increase for civil servants on service delivery.

## Policy Context

In March 2013, the Government of Zambia (GRZ), after concluding negotiations with public service unions, announced a salary reform and increase for all civil servants effective September 1, 2013.

The reform consisted of a re-grading exercise which grouped all positions into 18 grades based on experience and educational requirements. For each grade, a minimum wage was established, with the condition that employees with higher salaries than the minimum for their revised salary grade would continue to be paid these higher salaries. As a consequence of the reform, civil servants experienced an average wage increase of 45% (IMF Country Report No. 14/5 - January 2014), though the increase varied greatly across positions and even across civil servants within the same position.

There were a number of unintended consequences resulting from the reform. First, the high salary increases contributed to the national deficit. Second, there were perceptions of unfairness based on heterogeneity in the increase of salaries.

## Approach

Our analysis is focused on the effects of the salary reform in the health and education sectors. We chose to base our analysis on data from the period between September 2012 and December 2014. This way we have a sufficiently long pre-reform period to provide a baseline and a sufficiently long post-reform period to observe impacts in the short and medium run.

Understanding the causal effects of the reform and evaluating its overall impacts requires a careful analytical approach. We investigated various channels through which the reform could have affected the productivity of civil servants. This document highlights research progress to date. While some analyses have been completed successfully, others have involved challenges that prevented us from performing a full analysis. Where this was the case, we discuss the limitations we encountered.

Based on considerations that will be presented in more detail in the corresponding sections that follow, we investigated the following potential impacts of the reform:

1. The effect of the reform on civil servants' pay: How did the reform change salaries of civil servants in absolute terms? How did it affect salaries relative to the salaries of co-workers and superiors?
2. The effect of the reform on civil servants' motivation and effort: Did the salary changes brought about by the reform affect the motivation of civil servants? If so, in which way?
3. The effect of the reform on new applicants: Did the reform affect the type and quality of applicants to the civil service?
4. The effect of the reform on outcomes within the population: How did the reform affect educational and health outcomes?
5. The effect of the reform on the provision of materials and equipment: Did the tightening of the national budget due to the reform affect the provision of materials and equipment to health and education facilities?

In the following sections we describe methodology, findings, and challenges for the analyses of each of the five above impact channels. Finally, we discuss other issues that prevent a full understanding of the reform's effects.

## Effect of Reform on Pay of Civil Servants

We begin by studying the effects of the salary reform on civil servant pay. In order to determine the effects of the reform on the pay of civil servants, we first compare the salaries of civil servants before

and after the reform. Then we go on to study the heterogeneity in the salary change across civil servants and analyze the effects on wage compression in the health and education sectors. Finally, we examine how the reform affected the pay structure within organizational units.

## Data

### Summary

With the assistance of PMEC, we received de-identified payroll data for all employees in the Ministries of Health (MoH), Education (MoE), and Community Development (MCDMCH). This data was extracted for each month from September 2012 through December 2014.

For each Ministry-month, we received two reports from PMEC: personnel and wage data. The personnel data consisted of profile information such as position title, admin unit (the ministry through which the individual is paid), organizational unit, age, and gender. The wage data consisted of all monthly salary payments as well as all allowances specific to the Ministry in question. These datasets could be merged using each employee's uniquely identifying personnel number.

### Extraction and Cleaning

Data extraction and cleaning worked iteratively, with raw data extracted by PMEC and then run through our cleaning processes, which occasionally highlighted potential data issues from the original extraction. Through these iterations we eventually built a fully cleaned set of employee and salary data.

Our cleaning process was designed to perform a variety of tasks. The high-level function was to merge the personnel and wage data for each Ministry-month, and then to append each month (and MoH with MCDMCH) in order to create a single dataset for each sector under consideration.

A major goal of the cleaning was to highlight raw reports that required re-extraction. There were two main flags for re-extraction. First, certain months showed highly inconsistent employee counts from previous or subsequent months. Second, certain months had a large percent of employees appearing in the personnel but not the wage data, or in the wage data but not the personnel data. This flag required significant input and background from PMEC, as this could be caused by an issue with the extraction. However, there were some cases (for example, suspensions without pay) when employees were properly listed in one dataset but not the other.

We were also very careful in our merging of the MoH and MCDMCH datasets. In September 2013, at the same time as the salary reform, a large share of the Ministry of Health was transferred to MCDMCH. This was done over a very short period, and led to a number of irregular patterns in the data, such as staff appearing on the payroll data from one ministry, but listed as working at the other ministry within that dataset's admin unit variable because their salary was still being drawn from there (e.g. staff would be in the MoH database, but the admin unit variable would indicate them as working at MCDMCH). In merging the two datasets it was not always clear whether irregularities were due to extraction or to actual issues in the personnel transfer.

Beyond these high-level functions, our cleaning involved a variety of other tasks to facilitate analysis. The largest task was to manually examine and clean the titles of positions and organizational units so that they were both internally consistent and consistent with other data sources.

Pre-reform, a large number of position titles performed the same job functions. Post-reform, many of these were changed to more uniform job titles. In order to compare both across time and employees,

we standardized all position titles so that one title reflected the work performed by one job type. We would like to thank PMEC and TS for their input and assistance with this task.

Because the organizational unit was a primary unit of analysis, and many other datasets were maintained by organizational unit, the ability to merge different datasets at this level was crucial. Since the only organizational identifier in most datasets is the unit name, we also performed a significant degree of manual string cleaning of these names to standardize spellings and ensure that names within and between datasets all have the same format (e.g. some datasets identify Yoram Mwanje Basic School as such, while others use Yoram Mwanje Basic, or simply Yoram Mwanje).

In addition to these processes, we performed additional cleaning to ensure that the dataset was internally consistent, such as adjusting salaries after the Kwacha rebasing and GIS analysis to adjust for districts that had been created during the study period.

This cleaning process resulted in two sector-level datasets from our study period:

1. Ministry of Education
2. Ministry of Health & Ministry of Community Development and Mother and Child Health

## Results

The reform led to large salary increases among the civil servants at the three ministries studied. Figure 1 illustrates how average salaries increased sharply at the time of the reform. The median salary at the MoE before the reform amounted to 3325 ZMW, the median salary after the reform was 5250 ZMW. In the MoH and MCDMCH pre-reform salaries were on average 3737 ZMW and rose to 4426 ZMW at the median after the reform.
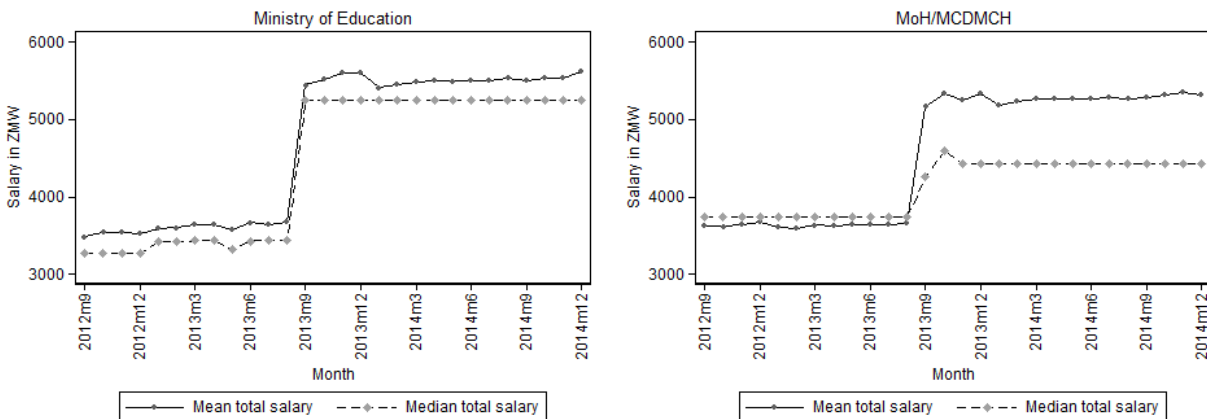


*Figure 1: Average total salary (basic salary and allowances)*

Figure 2 shows how heterogeneous the salary increase was. While some salaries barely increased, others sky-rocketed. The average increase at the MoE was 53% (or 0.53 on the left graph in Figure 2), at the other two ministries 25% (or 0.25 on the right graph in Figure 2).
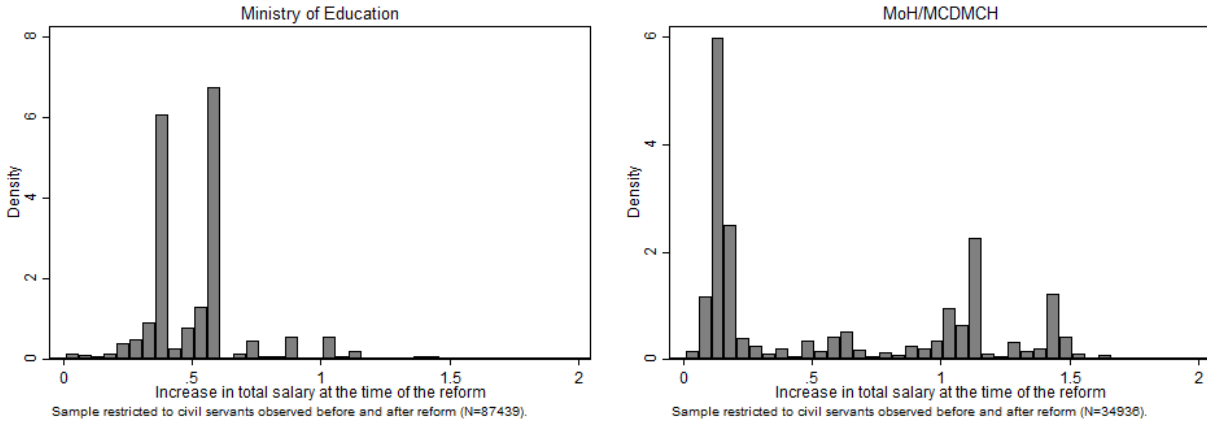
*Figure 2: Distribution of the pay increase at the reform*

In Figure 3, it can be seen how the salary increase depended on the pre-reform salary. In all ministries, the lowest paid employees received by far the largest increase in salary, with the increase generally decreasing for higher-paid employees, though the relationship is not linear. Notably, in the MoH/MCDMCH, the highest paid employees (Junior Resident Medical Officers) received one of the largest increases.
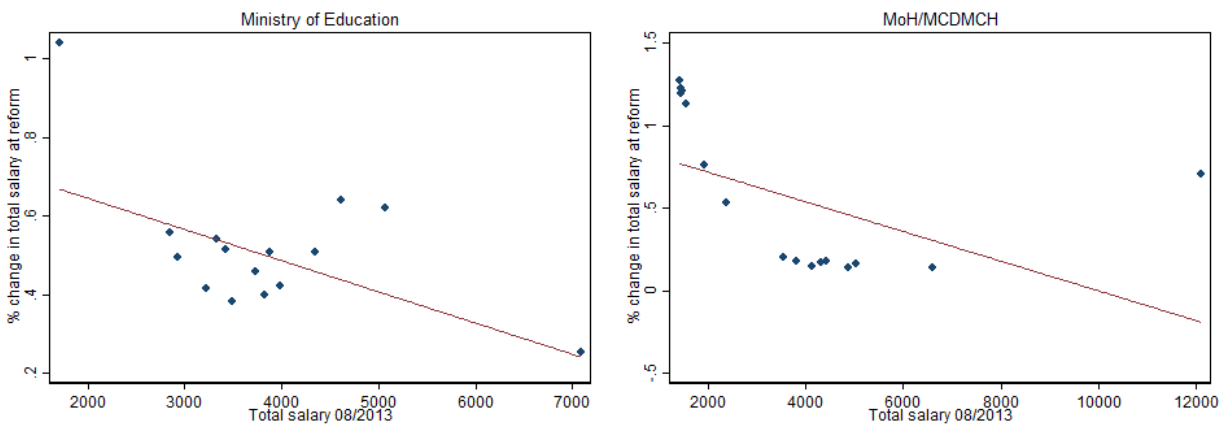


*Figure 3: Correlation between pre-reform salary and salary increase at the reform*

Figure 4 depicts how the salary reform affected the sectoral pay structure. In both sectors, salaries were largely equalized within the newly introduced pay grade. This is borne out especially by the figure for the Ministry of Education, which shows a step function after the reform. In the MoH and MCDMCH the reform largely compressed salaries. Only the very top of the pay distribution was exempted from the compression as it received large increases in some cases. Figure 4 shows the salary distribution in each ministry before and after the reform.
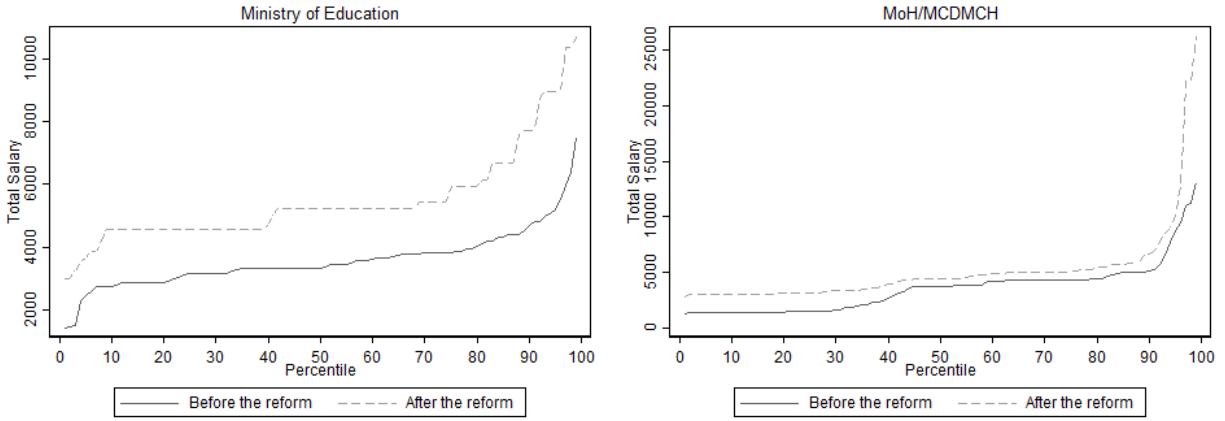
*Figure 4: Sectoral pay structure before and after the reform*

Figure 5 examines the pay structure in schools before and after the reform, by looking at the ratio between the 75th and 25th percentiles of salary within school, as well as the 90th and 10th percentiles, both common measures of inequality that illustrate how much more those with high salaries (at the 75th or 90th percentile) get paid than those with low salaries (at the 25th or 10th percentile). Before the reform, nearly all schools had a 75/25 ratio greater than 1 (i.e. the salary at the 75th percentile was greater than the salary at the 25th percentile). While this ratio varied substantially across schools before the reform, it takes roughly three values after the reform, 1, 1.5 and 2. For the 90/10 ratios we observe a similar effect of the reform, and it is evident that the reform had a significant effect on the pay composition within organizational units.[1]
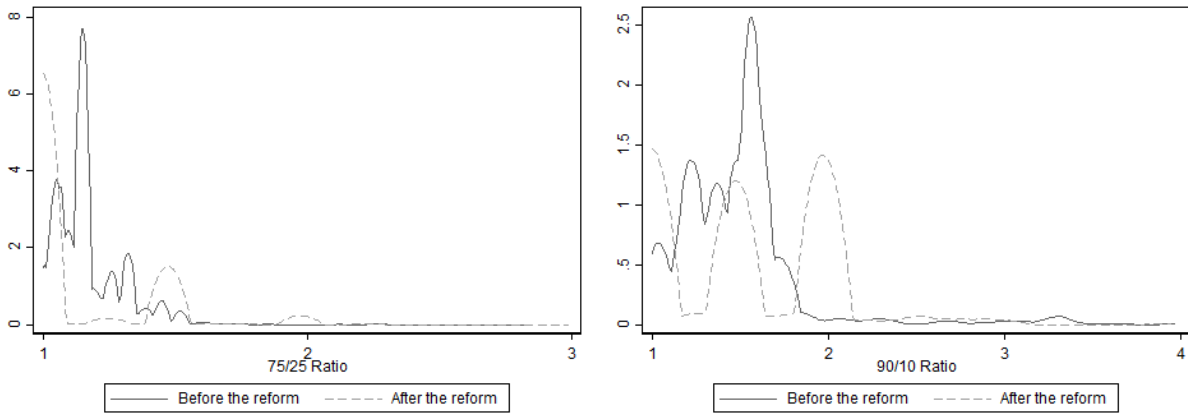


*Figure 5: Pay structure in schools before and after the reform.* The figure shows the cross-school distribution of two distinct within-school pay inequality measures, the ratio of the 90th percentile of the pay distribution to the 10th percentile of the pay distribution and the ratio of the 75th percentile to the 25th percentile.

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[1] Our conjecture is that the reform unified pay within positions and that the different values of the ratios post-reform are driven by school size. In large schools with many class teachers ratios are likely to be 1 while at small schools they are likely to be larger because essentially in the former case, the salary at the 90th (75th) percentile of the pay distribution is the salary of a class teacher, while in the latter case it is the salary of the head or deputy head teacher.

# Effect of Changes in Pay on Civil Servant Motivation

We proceed to investigate the effect of the changes in the pay structure on the motivation and effort of individual civil servants. As described in the previous section, the reform had two separate effects on individual pay:

1. The reform led to an increase in absolute pay for everyone.
2. Some civil servants' salaries also increased relative to their co-workers and superiors, while others' salaries saw relative declines.

It is a priori unclear how the combination of these two effects will affect the motivation of civil servants.

## Theoretical Background

According to existing research, there are a number of ways in which the 2013 salary reform could have impacted individual motivation of civil servants.

First, one would expect civil servants to show increased motivation in response to the increase in their wages because, as stated by the gift exchange hypothesis: "workers respond to high wage levels by increasing their effort…and to low wage levels by decreasing their effort…to the minimum required, in retaliation for the low wage" (Gneezy and List 2006). The central idea behind this hypothesis is that organizations may perform better "by treating their workforce kindly (e.g. paying fair wages) because workers reciprocate positively to `gifts´ and return favors by exerting higher effort" (Akerlof 1982). Since the 2013 increase was heterogeneous, this positive motivational effect could vary across civil servants, being stronger for those who received larger pay raises.

Second, as outlined previously, relative wages also changed with the reform and the perceived fairness of these changes is likely to be important for the impact on motivation. A few studies have shed light on the role of fairness in this context. Cohn, Fehr, and Goette (2013) demonstrated that when wages increase, only workers who perceive being underpaid increase their effort. As a matter of fact, these researchers found that the level of effort of those workers who previously felt adequately paid or overpaid doesn't change. Taken to the extreme, workers may even withhold effort if they feel they are treated unfairly (Fehr and Gächter 2000). More generally, Kube et al. (2013) found that "work morale is sensitive to the relationship between the workers' actual wage and a reference wage. Positive and negative deviations from the reference wage are interpreted as kind or unkind; employees then reciprocate by exerting higher or lower effort, respectively".  This reference wage is likely to be heavily influenced by the wage of coworkers. As Kahneman, Knetsch, and Thaler (1986) state, "making judgments about fairness, individuals compare what they (and others) get to what they think they (and others) are entitled to receive." In line with this idea, Cohn et al. (2014) showed that the effect of a wage cut on individual performance depends on the wage paid to coworkers. Anecdotal evidence, such as nurses striking in response to the reform and appeals to the reform sent by civil servants to PSMD, suggests that fairness considerations are likely to have played a major role in mediating the impact of the reform.

Third, when individuals work in teams, peer pressure and team dynamics such as free riding and positive spillovers must be considered. Mas and Moretti (2009) for instance find that workers performance increases when they are observed by other employees who work harder. For example, if the reform triggered an increased level of effort within one individual in an organizational unit, this could have generated spillover effects that positively impacted the performance of all the other individuals on that employee's team.

On the contrary, Klor et al. (2013) demonstrate that in the context of sequential team production, incentive reversal might prevail: "an increase in monetary rewards (either because bonuses increase or effort costs decrease) may induce agents that are fully rational, self-centered money maximizers to exert lower effort in the completion of a joint task. Incentive reversal happens when increasing one agent's individual rewards alters her best-response function and, as a result, removes other agents' incentives to exert effort as their contributions are no longer required to incentivize the first agent." Rather than the reform causing entire teams to improve their performance due to spillover from one individual, that individual's increased motivation may have actually decreased team motivation.

## Measuring Individual Motivation and Effort

In order to study the effects on individual motivation of the changes in pay induced by the reform, proxy measures of individual effort and motivation are needed.

Both the health and educational sectors have some mechanisms for monitoring individual motivation and performance. Formally, there are annual performance reviews through the Annual Performance Appraisal System and evaluations by departments such as MoE Standards and Evaluations. Other potential metrics of effort include attendance, commendations, and reprimands. Unfortunately, performance data for individual civil servants is extremely limited and in its current state cannot generally be connected to the data extracted from the payroll system. There are several reasons for this. The vast majority of individual-level data is exclusively paper-based, and digitizing it would be an extremely large undertaking. Additionally, the decentralized nature of these records makes them extremely difficult to tie into a nation-wide study. Most records are maintained at organizational units (schools for education, health posts for health), with varying qualities of data storage. It is also unclear how regularly these evaluations are performed. Anecdotally, teacher evaluations are often not performed each year, and Standards and Evaluation school visits face significant budget constraints. Finally, these records are generally identified by employee name or at best a sector-specific identification code. This makes it very difficult to connect performance records to the existing salary data, which is identified only by personnel number.

After an exhaustive search for potential performance measures in the MoE, we came to the conclusion that we were not able to assess the effect of the salary changes on individual motivation and effort due to the lack of data that can be used for an analysis of this nature. We are currently working with MoH and MCDMCH to uncover data on individual productivity in the health sector.

## Effect of Changes in Pay on New Applicants

Another potential effect of the pay changes brought about by the salary reform is a change in the size and composition of applicant pools to civil service. Increasing compensation for a given position may attract more job applicants. Additionally, it could attract different kinds of applicants compared to before the reform. A higher salary may attract more applicants with higher academic and professional qualifications, who would not have applied previously because their qualifications make them eligible for other jobs with higher pay. It may also attract fewer pro-social applicants, and more who are primarily motivated by compensation rather than public service.

Due to the hiring freeze proposed in October 2013 and lifted in May 2015, the three ministries studied were largely inhibited from hiring new employees except to cover turnover. Consequently, the number

of new hires we observe after the reform is small. However, there were some exceptions to the hiring freeze. According to payroll data at the end of 2013, the Ministry of Education hired about 4,000 new teachers. Moreover, some positions at the Ministry of Health were apparently exempted from the hiring freeze. While we did not investigate the effect of the reform on the composition of the newly hired teachers due to the described lack of data on individual teachers, we are currently gathering information on the exemptions from the hiring freeze at MoH to determine ways to study selection effects induced by the reform.

# Effect of the Reform on Education and Health

Ultimately, we are interested in how the reform affected education and health in the population. The central idea is that changes in pay affected education and health outcomes through changes in employee effort and motivation. In order to assess these effects, it is necessary to compare geographical units that were affected by the reform to different extents. In particular, we would like to compare outcomes at organizational units, such as schools, whose pay structures were affected differently by the reform. In a first step, we focused on the education sector and attempted to collect outcome data at the school level. We have not yet carried out this step in the health sector.

## Educational Outcome Data

### Educational Outcomes

The main indicator of service delivery within the education sector is test scores, available through the Examinations Council of Zambia (ECZ). We had previously worked with ECZ to extract nationwide test scores for grades 7, 9, and 12, and in addition to data from 2012 and 2013, we received 2014 data for this analysis.

Another important dataset in education is the Education Management Information System (EMIS, also referred to as EdAssist or EdStats). This dataset offers potential additional outcome measures, such as student dropouts and repeaters. However, EMIS faces some limitations as a source of outcome data. It is not designed as an evaluation tool either of schools or teachers, and it is unclear how much control teachers have over the potential outcome variables contained in the data set. Moreover, the quality of the EMIS data is unclear. Data comes from Annual School Censuses, filled out by Head Teachers. Irregular patterns when comparing certain variables across years raise doubts about the reliability of the data. For this reason, we decided to focus on test scores.

## Matching Educational Outcomes to Payroll Data

### *Determining Schools of Test Takers*

Theoretically, test scores provide an effective outcome measure of performance in schools. But in practice, using them presented a number of challenges. The largest of these challenges was that ECZ test scores are maintained by the school where a student took the exam. However, not all schools are also registered test centres, and a number of students sit for exams at a different school from the one they attend. Because there is no clear way to definitively tie a student to where they are enrolled, we do not only face the inability to evaluate all schools, but also risk attributing the performance of a school to students who did not actually learn there. According to informal interviews in government schools, 63% of test centres receive students from other government schools.

*Payroll Mismatch*

A key aspect of using outcome data for analysis is connecting individual employees to outcomes within organizational units. This requires the ability to know where individual employees are working. Unfortunately, given the current state of payroll data this is largely not possible due to the issue of payroll mismatch, where employees do not work at the location indicated in the payroll system. A 2014 Office of the Auditor General (OAG) report found that up to 60% of teachers do not work at the location where they are paid.

Additional evidence from our own research corroborates this finding: an analysis comparing teacher counts in the payroll and EMIS data shows largely different results between the two datasets. As seen in Figure 6, on average there are more teachers in EMIS than in the payroll data. However, there is a great deal of variation in individual schools, with some schools having far more teachers on payroll than in EMIS, and others having much fewer. This analysis could actually understate the magnitude of payroll mismatch, as even when schools have similar counts of teachers in the two data sources, there is no guarantee that these are the same teachers.
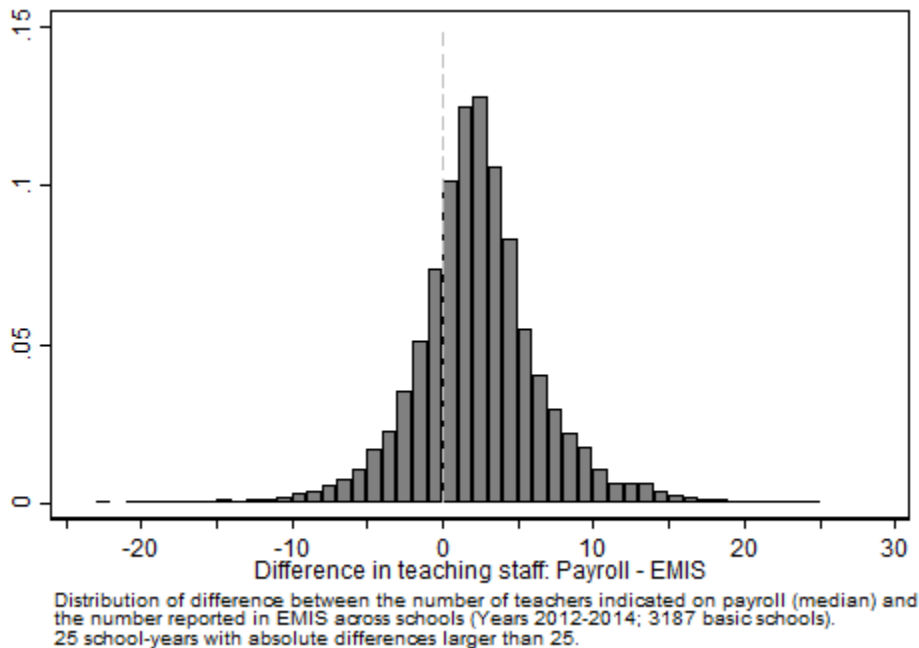


Distribution of difference between the number of teachers indicated on payroll (median) and the number reported in EMIS across schools (Years 2012-2014; 3187 basic schools). 25 school-years with absolute differences larger than 25.

*Figure 6: Distribution of difference in teacher counts*

Due to the magnitude of this issue, any thorough analysis tying individuals to organizational units in payroll is nearly impossible. Adding the problem of tying test scores to schools to this, we are not capable of analyzing the effects of the reform on educational outcomes with the data currently available.

## Effect of the reform on the provision of materials and equipment

The above analysis implicitly assumed that the salary reform would only affect individual motivation and population-level outcomes through changes in the pay of civil servants. But the reform may have affected these also through other channels, most notably through its effect on the national budget.

Anecdotally the reform had a negative impact on the budget, leading to the aforementioned hiring freeze. The tight budget may have affected the provision of materials and equipment as well. If the reform actually had negative effects on resource provision, employee motivation could also be affected through this channel. Similarly, changes in education and health outcomes could be due to changes in resource provision rather than changes in pay and motivation of civil servants. In order to assess whether the reform had an effect on materials and equipment, we are currently carrying out an auxiliary analysis on school budget and infrastructure.

## Other Issues: Simultaneous Policy Changes

There were other policy changes that happened at the same time as the reform, which must be considered. These changes could have a significant impact on employee motivation and service delivery, external to the salary increases. The simultaneity of events would make it very difficult to disentangle the effects of the salary reform from the effects of such additional policy changes.

One such simultaneous change was the transfer of a large share of MoH employees to the (previously very small) MCDMCH. In the payroll data we observe about 20,000 civil servants shifting from the MoH to the MCDMCH in 09/2013. Another roughly 4,000 follow in 01/2014. This transfer almost certainly had a number of impacts on employees and may have shifted employee motivation at the same time as the salary reform.

Additionally, the Ministry of Education introduced some significant curriculum changes in January 2014. The main changes of these were:

1. Grades 1-4 instruction was moved to local languages rather than English
2. Education from grade 8 onwards was split into two pathways: academic and vocational
3. ICT was introduced as a mandatory subject from grade 5 onwards

## Conclusion

### Difficulties

It has been extremely difficult to provide clear answers to our original research questions regarding the effects of the 2013 salary reform. This difficulty comes from several sources. Measuring employee motivation in a systematic way is difficult due to the lack of individual level data that can be connected to the payroll data. Connecting individuals to organizational unit outcomes is extremely difficult due to payroll mismatch. Finally, simultaneous policy changes make it difficult to isolate effects of the reform.

It is important to note that these challenges are not limited to this research, but exist in all impact evaluations. In any such research, it is crucial to have a concrete understanding of the connection between inputs (higher salaries), intermediate outputs (increased motivation), and long-term outcomes (improved service delivery). Moreover, it is important to have measurable indicators that allow each of these to be measured. It is equally important to isolate the program under study's effect on these indicators. Any evaluation that fails in any of the above should be viewed with suspicion. In the current situation, measurement of the input is feasible, but an effective evaluation of outputs and outcomes is much more difficult and at least for some sectors not at all feasible.

## Next Steps and Deliverables

While answering the original research questions is challenging, our research remains in progress, and there are still important questions that we hope to answer.

First, we are currently working with the Ministry of Health's Monitoring and Evaluation unit to extract health service data from their HMIS system, and exploring other useful MoH data, specifically personnel data maintained by the Human Resources Department. We believe that a closer focus on the health sector will answer several useful questions related to the salary reform. In addition to MoH potentially having more data that can be used as a proxy for individual motivation, the structure of the health sector makes it a rich research environment. The most interesting feature of the sector in this context is the heavy dependence on teamwork. Health centers require a wide variety of staff at different levels of seniority to work together to provide services. Due to the reform's uneven effect on salaries, it will be interesting to learn how this impacted team dynamics within health centers.

Second, the encountered difficulties in matching organizations across data sets in the education sector have drawn our attention to a previously neglected and seemingly important fact about the allocation of teachers. We found that pupil-teacher ratios differ widely across schools, and we intend to investigate the causes and consequences of this dispersion in future work.

Third, to date our work has yielded a number of products that we hope will be useful to policymakers. Foremost, for the creation of this report, we developed a payroll employee-month level dataset, cleaned in the previously-described manner. Second, as part of our attempts to match individual pay to outcome measures, we have performed substantial cleaning of the Education Management Information Systems (EMIS) data, which will be useful to the Ministry of Education. Finally we have linked schools between EMIS and payroll.

## Policy Recommendations

While our research is not complete, at this juncture of the project we are able to make a number of policy recommendations that will assist in future productivity research:

- Reduce payroll mismatch by investing in connectivity of the payroll system, allowing district offices to more easily access the system
- Invest in SAP Business Intelligence module and capacity within PMEC to improve in-house data extraction, analysis, and reporting capabilities
- Encourage ministries to digitize more of their personnel and performance records, and ensure that such records can be connected to the payroll system through a common identifier, such as personnel number

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