WPS8253

Policy Research Working Paper 8253

Moving Teachers to Malawi's Remote Communities

A Data-Driven Approach to Teacher Deployment

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Education Global Practice Group
November 2017

Abstract

There are severe geographical disparities in pupil-teacher ratios (PTR) across Malawi, with most teachers concentrated near commercial centers and in rural schools with better amenities. Most of the variation in PTR is concentrated in small sub-district areas, suggesting a central role for micro-geographic factors in teacher distribution. Employing administrative data from several government sources, regression analysis reveals that school-level factors identified by teachers as desirable are closely associated with PTR, including access to roads, electricity, and water, and distance to the nearest trading center, suggesting a central role for teachers' interests in PTR variation. Political economy network mapping reveals that teachers leverage informal networks and political patronage to resist placement in remote schools, while administrative officials are unable to stand up to these formal and informal pressures, in part because of a lack of reliable databases and objective criteria for the allocation of teachers. This study curates a systematic database of the physical placement of all teachers in Malawi and links it with data on school facilities and geo-spatial coordinates of commercial centers. The study develops a consistent and objective measure of school remoteness, which can be applied to develop policies to create rules for equitable deployments and targeting of incentives. Growing awareness of disparities in PTRs among district education officials is already showing promising improvements in targeting of new teachers. Simulation results of planned policy applications show significant potential impacts of fiscally-neutral approaches to targeted deployments of new cohorts, as well as retention of teachers through data-calibrated incentives.

This paper is a product of the Education Global Practice Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at sasim@worldbank.org.

Moving Teachers to Malawi's Remote Communities: A Data-Driven Approach to Teacher Deployment

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JEL codes: I21, I28, D73; D78

Keywords: Malawi, Schools, Teachers, Deployments, Political Economy, Data-Driven Model

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We thank Fabiano Gwalidi, former Minister of Education, for his leadership of the project; the Ministry of Education Science and Technology, in particular Honorable Minister Bright Msaka, Deputy Director Ellen Simango, and Noel Mwango, for support in collection of data and in holding focus group discussions; Director Joyce Somanje for access to payroll database; Ken Ndala, former Principal Secretary for Education, for strategic support; all District Education Managers and District EMIS officers for supporting updates and revisions to data; the MPs, District Commissioners, and others who attended focus groups; Laura Kullenberg, Gayle Martin, Innocent Mulindwa, and other World Bank colleagues in Malawi for encouragement, support and advice; Cameron Friday, Michael Mambo, Zunaira Mughal and Xu Wang for invaluable research assistance; Education GP Management, Practice Managers Sajitha Bashir, Halil Dundar and Safaa Al Tayab El Kogali, Lead Education Specialist Toby Linden, Lead Economist Andreas Blom, and Senior Economist Samer Al-Samarrai, for useful discussions, suggestions and comments; the LSE Capstone project for valuable background work and insights; and participants in the World Bank Human Development Week Lightning Talks for comments and feedback. The findings, interpretations, and conclusions expressed herein are our own and do not necessarily represent the views of the World Bank, its Board of Directors, or any of its member countries. All remaining errors are our own.
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1. Introduction

The majority of countries in Sub-Saharan Africa have struggled to make meaningful progress in deploying and retaining teachers to, and retaining them in, schools located in impoverished and hard-to-reach communities. Majgaard and Mingat (2012) find large disparities in per-student spending in schools in countries within the region. Since most countries spend 80-90% of resources on teachers, the uneven pattern of spending reflects a weak relationship between the number of teachers and number of students in a school. Unsurprisingly, learning outcomes have stagnated in these countries, even while the amount of resources spent on education in the African continent has increased (Filmer et al., 2015). The increased spending has gone to relatively advantaged schools, leaving the large majority of children in these countries with overcrowded classrooms and too few teachers – or, in extreme cases, no teachers at all. Evidence from cross-country comparisons of learning outcomes suggests that countries which have improved their overall learning outcomes have typically done so by focusing attention on the lowest performing students and addressing inequities in school quality (Crouch and Rolleston, 2015).

These disparities in staffing may reflect the effect of teacher preferences in school choice on teacher distribution. The socioeconomic status of a school, access to amenities, and students' profiles also seem to matter in the school-choice decisions of a teacher (Barbieri et al., 2011; Hanushek et al., 2004; Ingersoll and May, 2012). In the context of Sub-Saharan Africa, where access to amenities in remote areas can be extremely limited, teachers demonstrate a strong preference for postings in or near large settlements (Mulkeen, 2010). In a fully functioning education system, teacher management policies are expected to institutionalize frameworks to manage teacher preferences for less remote postings and produce an equitable allocation of teachers nationally. The level and persistence of disparities in teacher allocation suggest an institutional failure to develop teacher management systems that can target deployments and retain teachers in hardship areas.

Leveraging advances in technology and drawing insights from teacher-level databases, governments can strategically identify schools with severe shortages of teachers, proactively manage assignment of new teachers, and provide incentives matched to the level of hardship, by computing a precise estimate using geo-spatial data. This requires investments in active management of databases, equipping district managers with the tools and guidance to assign teachers, and alignment of incentives of all system-level actors to enforce rules, objectively drawn from various data sets. Previously, governments have failed in their attempts to improve deployments for lack of credible, reliable and timely data to support teacher assignment, and inability to come up with objective metrics to fully price out the hardship in teachers' choice of schools.

Like other failures of public service management in developing countries, persistent problems in teacher management can typically be traced not only to system-level failures to develop mechanisms to target and retain teachers effectively, but also to contestation between different actors within the system with different incentives to support or resist reforms to improve services (World Bank, 2004; Booth, 2012). In the Indian state of Uttar Pradesh, politically organized teachers have taken a significant proportion of seats in the state assembly, using these positions to improve their own benefits while resisting reform (Kingdon and Muzammil, 2009).

In Indonesia, efforts to reform teacher management have faced significant resistance from political and bureaucratic elites, who have used management of the teacher profession as a tool to reward political allies, punish opponents, and distribute patronage resources (Rosser and Fahmi, 2016). Although comprehensive legal reform has taken place, the operationalization of reforms has often been distorted from its original intention in order to reduce negative impacts on senior and well-connected teachers (Chang et al., 2014).

Public officials, at the national and local levels, often occupy a position at the nexus of political contestation surrounding public services. Public officials, tasked with implementing the strategic vision of political agents, are subject to direct bureaucratic accountability to politicians. However, as non-elected officials, they are only indirectly accountable to citizens, the users of public services, meaning that the preferences of these end-users may be put aside in official decision-making in favor of the preferences of political actors (UNDP, 2016). The resulting asymmetries of power can affect not only the enforcement of existing rules and policies, but the evolution and reform of rules over time (World Bank, 2016a).

Public officials can obtain greater independence – *bureaucratic autonomy* – by developing unique organizational capacities to collect and employ information fairly and consistently, bolstering their public support and increasing the political cost of interference (Carpenter, 2001). Applying this rubric to teacher management suggests that, in a system where officials have accurate and complete data to inform decision making, with a high degree of transparency, officials would gain a degree of protection from political interference.

The question of teacher distribution is particularly acute in Malawi. In a context of rapidly rising enrollment, since the introduction of free primary education in 1994, Malawi has struggled to post primary school teachers to the schools where they are most needed[1] (Mulkeen, 2010; DeStefano, 2013). School pupil-teacher ratios (PTRs) – the ratio of the number of pupils at a school to the number of teachers – vary significantly across and within districts; between zones (sub-districts) with different levels of amenities; and, within zones, between schools with better facilities and access to trading centers. This can lead to severe local shortages of teachers in some schools alongside relative surpluses in others, in some cases within the same small geographic area. In one peri-urban sub-district area in Southern Malawi, Khombwe Zone, for example, school-level PTRs vary from 27 to 130 within an area of a few square kilometers. The Government of Malawi has attempted various reforms and policy approaches to address inequities in the distribution of teachers, including targeted deployment of new teachers and incentives for teachers to work in remote areas, with little impact on the overall level of variation in PTRs across the country.

These inequities in distribution of teachers exacerbate existing shortages of teachers. Malawi's 4.8 million primary school students are taught by 61,507 primary school teachers, a national PTR of 78, well above the government's target of 60. Nationally, 75 percent of primary schools have a school-level PTR above the target. The uneven distribution of teachers between schools, however, means that the most understaffed schools are severely deprived of teachers: the top 10 percent of schools by PTR have ratios of 137 or more, while the bottom 10 percent have ratios of 46 or less. As a result, the investment in students for primary education varies widely. A typical student at a

[1] The focus of this paper is on primary schools. Although staffing in secondary schools in Malawi is an issue, the dynamics are decidedly different owing to the use of subject-specialist teachers and the smaller number of schools.

school with bottom-decile PTR benefits from investment in teacher salaries of MWK28,620 per year of schooling, versus just MWK8,434 in schools in the highest decile.

Given other restrictions in facilities, additional teachers in these low-PTR schools offer very little benefit to learning. With the majority of Malawi's schools lacking sufficient classrooms, rather than allowing smaller classes, the additional teachers typically engage in team-based teaching, with one teaching students while others prepare lessons or simply wait on-site. Reducing the extent of this variation in PTR, by relocating teachers from relatively overstaffed to severely understaffed schools, could reduce the number of overstaffed schools considerably.

This large variation in PTR contributes to Malawi's poor outcomes in student retention and learning. The significant proportion of schools which are relatively overstaffed, even in overall conditions of teacher shortage, mean that education investment is translated only very inefficiently into student learning. Only 31 percent of primary school students graduate; statistically speaking, the primary system would require 23 years to produce one graduate, versus eight years under efficient conditions. Even those who complete primary education in Malawi lag far behind other countries in regional examinations administered to Grade 6 students for English, Mathematics, and Sciences. In the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) assessment, Malawi scored the lowest in 2013: 494 in Reading and 522 in Mathematics, against average scores among participating countries of 558 and 584 respectively.

Why have conditions of inequitable and inefficient allocation of teachers persisted? The failure of efforts to distribute teachers equitably has its roots in the low quality of administrative systems for teacher management. Surprisingly, given the high level of investment in teachers, the system has incomplete and inconsistent information on the physical whereabouts of its most expensive assets, teachers, and almost no ability to monitor their presence in school or classrooms. Significant inconsistencies exist between the various databases of teacher postings used by local and national government.

In this paper, we argue that the weakness and fragmentation of administrative data in Malawi contributes to the maintenance of staffing disparities by enabling political capture of the system by political interests, particularly teachers' interests. In an efficient system, with adequate and widely accepted data on school conditions and staffing, policies can be designed to accurately target teachers to the schools with greatest need. In the absence of accurate and up-to-date information in Malawi, policies governing teacher placement remain broad 'rules of thumb', leaving officials with a high degree of *discretion* in decision-making.

The concept of discretion in administrative and bureaucratic contexts has its roots in administrative law. Broadly defined, the term refers to the space allotted by rules and procedures for officials to make, alter, or enact policies (Koch, 1986). In a situation of high bureaucratic autonomy, allowing officials a reasonable amount of discretion can be appropriate to enable them to take proper account of individual circumstances. However, in conditions of neo-patrimonial politics, where bureaucratic autonomy is low, greater discretion can create opportunity for officials to respond to pressure and enable political capture of the system without any visible breach of agreed rules. Ferraz (2007), analyzing the approval of environmental licenses in Brazil, found evidence that local bureaucrats were subject to significant political capture leading to increases in approval of licenses in the lead-up to gubernatorial elections and in municipalities where the incumbent political leadership had core support.

Malawi's political conditions reflect an environment of clientelist politics in which bureaucratic autonomy is low. O'Neil and Cammack (2014) employ the term *competitive clientelism* to describe Malawi's political economy, in which highly personalized political parties cohere and build support through patronage and informal relationships. These conditions produce incentives for elites to establish rules and policies which result in a high degree of discretion for the targeting of resources and services to politically useful groups. In particular, agricultural subsidies are widely recognized as having been targeted for vote-buying purposes in the years leading up to recent national elections (Chingsinga, 2009; Andrews, 2015).

Our contention is that the persistence of PTR disparities in Malawi reflect the ability of well-connected teachers, often exploiting patronage relationships with political or appointed officials, to exert influence on the system to resist placement in remote schools where the need may be greatest, and obtain placement in schools with more amenities. The scarcity of accurate information on teacher placements and PTR disparities within the system makes it difficult to institute and enforce policies and guidelines on the allocation and reallocation of teachers which adequately target the neediest schools. Instead, policies remain broad, creating a large degree of discretion for officials; this limits their ability to resist pressure, leading to the maintenance of PTR disparities.

Second, we explore the proposition that improvements in the quality and transparency of administrative data, and increases in sharing and coordination of data between agencies, can strengthen the system to resist this political capture. By introducing accurate, up-to-date information, accepted by the key actors involved in decision-making, it is possible to define more precise and targeted policies on the distribution of teachers, moving the system from discretion-based to rules-based norms. With more precise rules, the space for discretion-based judgment is shrunk, increasing officials' autonomy from political pressure. In addition, by helping to stimulate greater public awareness of staffing inequities, better data can catalyze communities with understaffed schools to lobby more effectively for more teachers, providing a countervailing pressure to balance teachers' interests.

The implications of improvements in the efficiency of teacher allocation in Malawi's schools for learning outcomes are likely to be substantial. A growing body of empirical literature suggests that, within schools, teachers are central to improvements in school quality (Hanushek and Rivkin, 2006), and reduction in class sizes in certain contexts can improve students' learning outcomes (Angrist and Lavy, 1999; Woessman and West, 2006). Student test-score data for Grade 4 students collected for 12,000 children in Malawi confirms this negative association between pupil-teacher-ratio at Grade 4, a reasonable proxy of class size, and the test scores for English, Mathematics and Chichewa **[Figure 1]**. There is a difference of 0.2 standard deviation on IRT-scaled scores between a child enrolled in 10th percentile school, with 30 students to a teacher, compared with 90th percentile school which has 120 students to a teacher at Grade 4 level. Children with fewer teachers per pupil belong to schools located in the poorest and least developed areas with limited access to electricity, drinking water supply, access to roads and health facilities (World Bank, 2017). The uneven distribution of teachers is likely to amplify the existing disadvantages faced by poor and vulnerable children in Malawi.

Our analysis is based on two years of extensive work in liaison with the Ministry of Education, Science and Technology (MoEST) of Malawi, as well as other official sources, to rationalize and analyze administrative data on teacher management. First, we developed the first full and accurate database of the actual whereabouts of all Malawi's primary school teachers. The exercise revealed the level of inconsistency in related data sets from different government sources, with large proportions of teachers recorded at different schools, or even districts, between databases; and the extent of inequities in teacher distribution, with PTRs[2] within even a single district ranging from a very low 9 students to one teacher to the extremity of 1,417 students to one teacher.

In order to test our first proposition – that the persistence of PTR disparities reflects political capture of the system by teachers' interests – we first conducted focus groups and qualitative discussions to identify the key variables which inform teachers' preferred school choice in Malawi. Using multiple regression analysis, we then demonstrate that these preferences – concerning the level of facilities available at a school, the distance of a school from its nearest town center, and the level of amenities available at the center – are closely correlated with PTR variation, demonstrating the key role teacher interests play in driving their allocation to schools.

Through a network mapping exercise, we developed a model of the local-level political economy of teacher allocations. This illustrated the level of pressure district-level public officials face over teacher allocations; the central role played by politicians and other public officials, who support teachers in applying pressure; and significant asymmetries of power, with communities exercising a much weaker voice than teachers.

In order to explore our second proposition – that improvements to administrative data systems can strengthen systems to resist political capture – we develop and simulate the impacts of new data-driven reforms to policies around teacher distribution. First, employing the key variables of teacher preference, we develop a data-driven classification model of school remoteness. Our system classifies schools into three categories of remoteness, employing information on the location of schools and trading centers and the levels of amenities available. Descriptive statistics demonstrate the effectiveness of the proposed categorization in predicting PTR variation.

Using statistical simulation, we then project the potential impact on PTR disparities of two planned policy applications of this categorization – targeting of newly qualified teachers to the most remote schools, and more targeted financial incentives for teachers working in the most remote schools. We find that, if fully implemented, these policies could achieve rapid reductions in PTR disparities within a short period.

Although the potential policy applications of our work are in the early stage of implementation,[3] analysis of the 2016 deployment of new teachers suggests that the improvements in data and information sharing engendered by the process have already led to improvements in the allocation of new teachers.

[2] Although we employ the term PTR for simplicity, all figures presented are for PQTR – pupil-qualified teacher ratio, which excludes volunteer, trainee, and month-to-month teachers.
[3] The Government of Malawi has agreed to implement these policy applications for the results-based component of Malawi Education Sector Improvement Project (MESIP), funded by the Global Partnership on Education.

The remainder of this paper is organized as follows. Section 2 reviews the system of allocation of teachers in Malawi, and the recent history of attempts to reform the allocation of teachers and address inequities, and the ways in which poor administrative data have prevented meaningful reform from becoming embedded in the system. Section 3 describes the process through which data were collected and analyzed and the extent of fragmentation and inconsistency between administrative data sources. Section 4 presents the findings addressing our first proposition, demonstrating the extent of PTR variation and the relationship between these variations and teachers' preferences, as well as the results of a political economy network mapping exercise carried out to illustrate the local-level dynamics of teacher allocation. Section 5 addresses our second proposition, introducing a rules-based classification of schools by remoteness and presenting evidence and simulations of the potential impact of rules-driven policy employing this classification on PTR disparities. Section 6 discusses the results and concludes.

2. Teacher allocation in Malawi

2.1. Institutional and policy arrangements for teacher allocation

Governance in Malawi, at the local level, has been marked by institutional fragmentation and competing mandates (O'Neil and Cammack, 2014). This fragmentation and structural opacity is observable within the management of education, with a number of different government departments and agencies playing a role in the recruitment, deployment and promotion of teachers. Like many other African countries, Malawi operates a two-stage system of teacher allocation and management, where central-level officials conduct recruitment of teachers into the system and allocate them to districts, while district-level officials allocate teachers to individual schools. This requires that accurate data on teacher demand and supply, and clear rules for allocation, be in place at both the central and local levels to ensure the appropriate allocation of teachers. In the absence of complete and credible data, Malawi's system relies on broad rules, based around binary concepts of *rural versus urban* and *overstaffed versus understaffed*; as a result, officials exercise considerable discretion in the allocation of teachers to schools, while teachers possess considerable power to influence their postings.

Overall responsibility for education in Malawi, including the setting of policies, curricula, examinations and standards, rests within MoEST. Primary education is based in the Directorate of Basic Education (DBE), which has overall responsibility for management and monitoring of primary education. Other MoEST departments and agencies have a role in the management of teachers, notably the Department of Teacher Education and Development (DTED), responsible for teacher training and professional development; and Malawi Institute of Education (MIE), which carries out some training of teachers in addition to its core role of curriculum development.

Responsibility for on-the-ground provision of primary education lies with Malawi's 34 education districts. These districts are aligned with the 28 administrative districts of Malawi, with four large districts possessing more than one education district. Each district supports a small office permanent staff, including a District Education Manager (DEM), a deputy DEM, and a dedicated HR officer among others. DEMs are responsible for most day-to-day matters of education in their districts, including management of teachers. Each education district is divided into 8-15 zones, each containing around 6-10 primary schools. Zones are overseen by Primary Education Advisors (PEAs), with responsibility for supporting headteachers and teachers in their zones.

An ongoing process of decentralization in Malawi means that the structures of education management are in flux. DEMs report officially to District Commissioners, appointed executives at district level, but in practice are frequently engaged on a regular basis with DBE and other MoEST departments. MoEST manages the recruitment and training of teachers, and allocates new teachers each year to districts; however, payment of teacher salaries and payroll management was until December 2016 managed by the Department of Human Resources Management and Development (DHRMD), a sub-Ministry of the Office of the President, which maintains ultimate control of all civil service staff. Since January 2017, responsibility for payment of teachers and management of payroll has been formally decentralized to districts. However, the HR officers within DEM offices, who maintain day-to-day control of payroll, remain employees of DHRMD.

Recruitment: The recruitment of teachers provides an example of overlapping mandates within education. Malawi's teaching profession has expanded rapidly in recent years as the system strives to keep up with rapidly rising enrollment. The number of qualified primary school teachers increased by 35 percent since 2010 and 2016, from approximately 41,000 to approximately 58,000.[4] The majority of Malawi's teachers enter the profession through application to the national training program, Initial Primary Teacher Education (IPTE), established in 2005. The IPTE consists of one year's residential training and one year's in-school training at specially-selected schools in the neighborhood of a teachers' training college.

Although teachers who successfully complete IPTE are not officially guaranteed a teaching placement, in practice, the custom has been that all those graduating who seek positions will receive them; therefore, the selection process for training effectively constitutes the primary method through which applicant teachers are selected. For Malawi's eight public teacher training colleges (TTCs), this process is managed by DTED, while an additional eight private TTCs employ their own procedures. Neither DBE nor local-level education officials therefore play a decisive role in the selection of teachers into the system.

Training places are oversubscribed, with 20,000 applications in 2015 for 3186 training places (Hau & Nampota, 2016). DTED's application process shortlists applicants based on academic credentials and a fifty-question aptitude test. There is no interview for potential trainees and no formal process through which motivation for teaching, pro-social inclination, or psychological suitability for teaching is assessed. Therefore, there is no process through which teachers are selected who are particularly likely to be willing to endure some hardship to work in rural or remote areas. However, applicants are asked to confirm their willingness to work in rural *districts* for at least the first five years of deployment. There is some innovation in the private sector: several private TTCs offering the IPTE include an interview in their selection process, and one network of private TTCs, run by the NGO Development from People to People (DAPP), includes a study tour where teachers are posted in a range of rural schools as part of their training program.

Deployment: All successful IPTE and ODL graduates are customarily entitled to appointment to a position in Malawi's public primary schools. However, following delays in recruitment and a hiring freeze in 2015, graduating trainees typically wait two years before being deployed to

[4] Estimates drawn from Education Management Information System (EMIS) database. See Section 3 for details of the differing sources of information on teacher numbers.

schools. This delay means that qualified teachers may never enter teaching: around a fifth of 2014 IPTE graduates left the profession before becoming eligible for deployment to schools in 2016.

Assignment of the trained teachers to districts is carried out by DBE. New teachers are not typically allocated to the four urban education districts. The number of teachers allocated to each rural district is based primarily on the national standard for pupil-teacher ratio, of 1:60; teachers are allotted to districts in order to move districts evenly toward the target ratio.[5] Teacher candidates are provided the opportunity to select first, second and third-preference districts, with the majority typically opting to work in their home district if possible.

Once IPTE teachers are assigned to districts, DEMs have responsibility for assigning their allotted teachers to schools. Conventionally, this has followed the same principles as allocation to districts, with DEMs instructed by DBE to target schools with PTRs above the 1:60 ratio. With approximately three-quarters of schools above this ratio, and school-level PTRs varying nationwide from 7 to 1,542, this approach does not significantly limit the discretion of DEMs in allocating teachers.

DEMs are limited in their ability to enforce allocation of teachers by rules and conventions, designed to minimize teacher hardship, which mean that teachers can successfully request transfers away from challenging postings. If teachers are unhappy with their school assignment, they can request reassignment based on medical grounds on presentation of a signed letter from a medical official. Common complaints concern respiratory problems from dust in semi-arid areas, and ambulatory problems making it difficult for teachers to walk or cycle to school. In most cases, these medical dispensations require the affected teacher to be placed near a medical facility, leading to a drain of staffing from remote areas to trading centers. Second, although there is no formal rule in place, custom requires that teachers – typically, but not exclusively, female teachers – can request reassignment to a school close to the place of work of their spouse on presentation of marriage certificates. There are no formal national standards for what constitutes a valid medical or marriage certificate, and both systems are widely believed to be subject to abuse.

Outside of these specific cases, DEMs describe being subject to pressure to reassign teachers based on a range of other factors, including proximity to family, lack of housing at schools, and concerns about safety when traveling to school. Although formal responsibility for these allocations rests with DEMs, PEAs play an advisory role in the process of approving moves within and from their zones, and a range of local and national-level officials, including from MoEST, exercise formal and informal influence over reallocations. The result of these limitations is that a significant proportion of requests by teachers for change to their initial allocation to a school are accepted. Furthermore, despite having applied for positions, between 5 and 10 percent of newly recruited teachers each year simply fail to report for work at their allotted school; some successfully begin work at other public schools, obtaining positions through forged posting documents or without presenting documentation.

[5] MoEST has faced pressure to adjust the allocation formula to allocate more staff to small rural schools, which may require more than one teacher per 60 students in order to provide at least one teacher per class. In 2017 the formula was adjusted to also take account of class-teacher ratios, leading to a greater allocation to districts (predominantly rural) with a large number of small schools.

Transfers: Once serving at a school, teachers retain the right to request reallocation on medical or marriage grounds, or for other reasons, under similar rules to those which govern appeals to initial allocations. DEMs have formal decision-making power over movement of teachers within their districts; moves between districts require formal approval by MoEST, but are commonplace, typically by agreement between DEMs to swap teachers. PEAs can advise DEMs on teacher management issues, and in practice often exercise de facto decision-making power over teacher placement within their zones. As a result, movement of teachers is commonplace.

To more clearly illustrate the local-level dynamics of teacher allocation in Malawi, we carried out a case study of three schools in the area of Nathenje, in Lilongwe Rural East district. Despite being all based in one of the most understaffed districts in Malawi, the three schools vary significantly in PTR: Mwatibu school, based in the area's main trading center of Nathenje, has a PTR of just 49; Chibubu school, around 4km from Nathenje, has a PTR of 79; while remote Khuzi school, 20km from Nathenje, has a PTR of 131. At well-staffed schools in the trading center, several classes have two or three teachers employing a team-teaching approach. "Having this many teachers is not good for teaching," the headteacher of one low-PTR school commented. "It's bad for discipline and morale to have teachers sitting around doing nothing all day."

The allocation of new IPTE graduate teachers to these schools in 2016 illustrates the limitations of the current system for distribution of teachers. As stipulated by the national 1:60 target, Mwatibu school received no new teachers. Chibubu school received four new teachers, enough to lower its PTR to 65; while Khuzi, despite its significantly higher PTR, received only two, enough to lower its PTR to 98. Furthermore, neither of the teachers allocated to Khuzi ever arrived to the school. Both were able to arrange to move schools without ever reporting to work at Khuzi: one had moved to another district, while another moved to another school with a PTR of only 49, within the same district, to be close to her husband. Thus, the combination of poorly targeted rules, based around the binary 1:60 target, and norms which undermine the purpose of the rules, serves to undermine efforts to equalize PTRs through targeted allocation of new teachers. This process was entirely opaque to the headteacher of Khuzi school. "I was supposed to receive new teachers last year, but they never came," he recalls. "I asked the PEA where they went and she didn't know.'"

2.2. Previous attempted reforms to teacher allocation

The Government of Malawi has employed a range of policy measures to improve shortages in teacher staffing in remote schools. In the first instance, the emphasis of policy has been on increasing overall teacher numbers through gradual increases in the capacity of the system to train and recruit teachers. The Government's National Education Sector Plan 2008-17, which governs policy and investment priorities in the sector, acknowledges the overall shortage of teachers as a key issue in the sector. Since 2005, the annual capacity of the public TTC system has increased from fewer than 3,000 trainees to over 5,000, and the government is publicly committed to further increasing training capacity, with an additional three public TTCs are under construction. However, the persistence of delays in deployment of existing IPTE graduates suggests that the expansion of training capacity will not address the overall shortage of teachers unless combined with greater fiscal support for recruitment.

Although the official emphasis has been on overall teacher numbers, the government has also introduced a range of policies aimed at reducing imbalances in the distribution of teachers.

However, these reforms have been largely unsuccessful. Simply fitting a regression line between the number of students at a school and the number of teachers, it is possible to obtain a proxy estimate of the extent to which government has targeted the new teachers hired to schools where they are needed. The randomness coefficient (1-R^2), defined simply as unexplained variation between school size and number of teachers, has stayed about the same, moving from 34 percent in 2007 (Mulkeen, 2010) to 33 percent in 2015. This suggests that the addition of more than 20,000 teachers during this period has had no impact on inequities in PTR.

The failure of these reforms stems in large part from the limitations of administrative data, which has led to poorly or vaguely defined policies and inconsistent implementation.

Bonding to rural districts: Since the introduction of the IPTE training system in 2005, trainee teachers have signed agreements to work in rural districts for at least five years upon graduation. Thus, newly qualified IPTE teachers have been allocated exclusively to Malawi's 30 rural education districts, with the four urban districts – the towns of Lilongwe, Blantyre, Zomba and Mzuzu – typically not receiving newly recruited teachers. This appears to have had some impact on district-level PTRs, with Lilongwe Urban, the capital city, in particular having experienced increasing PTRs in recent years as it goes without new teachers.

However, the impact of this bonding is severely restricted by its focus on district-level allocation. Within-district inequities in PTR dwarf those between districts, with schools in major trading centers often having PTR well below national standards, even in districts with low levels of overall staffing. As such, DEMs can respond to pressure from teachers for allocations in schools close to trading centers while still adhering to the policy. With the four urban districts accounting for only 170 of Malawi's 5,470 primary schools, the impact of the policy on the equity of school-level PTRs has been limited.

Hardship allowance: In 2010, the government introduced a targeted hardship allowance to compensate 20 percent of teachers who were placed in remote primary and secondary schools. The policy makes intuitive sense: pecuniary incentives will encourage teachers to stay in schools located in poor and remote areas and, perhaps, even to move to these schools. Implicit in this policy is the assumption that Malawi has: (i) a functioning data infrastructure to determine relative hardship of schools; (ii) analytical capacity to compute a reasonably accurate 'price' of hardship to calibrate compensation; and (iii) institutional capacity to enforce compliance with rules when hardship is compensated. In practice, however, the absence of these factors has led to an inflation in the proportion of schools where teachers are eligible for the allowance, and a concomitant reduction in its monetary value.

This weakening of the scheme stems from a lack of centralized capacity to determine eligibility. The definition of remoteness used to underpin the list, decided in consultation with stakeholders, included all schools outside major cities, towns and larger trading centers. The identification of eligible schools was left to DEMs. While the original proposal (MoEST, 2010) envisioned 15,000 teachers at eligible schools receiving the allowance, the list prepared by DEMs identified 37,562 primary school teachers, as well as 5,369 secondary school teachers, working at schools deemed to be eligible (MoEST, 2012). An audit carried out in August 2010, following the payment of the first allowances, found that the school selection carried out by DEMs had not consistently followed the proposed rules. Schools which should have been eligible were left off the list without explanation, non-eligible schools were included, and specific teachers at eligible schools were left out. Furthermore, the list which was prepared was not consistently followed when payments were being issued. There appears to have been significant confusion over the definition adopted: an MoEST report in 2012 found that Ministry officials had inaccurately advised non-eligible schools that all schools in rural districts were included, a looser standard than even that adopted by stakeholders for the scheme.

Teachers in several districts initiated industrial action over their non-receipt of the allowance, and teachers in several districts initiated legal action, leading to further increases in the number of schools eligible. Efforts to remove non-entitled teachers from the scheme were met with considerable resistance. In June 2016, for example, 23 teachers from Balaka district won a legal challenge invalidating their removal from the scheme in 2013, having argued that a *rural* allowance scheme must include all schools in rural districts. By 2015, 87 percent of schools were eligible for the allowance, encompassing 80 percent of teachers.

Our case study of Nathenje area in Lilongwe Rural East illustrates the extent to which the allowance has become detached from the ground reality. As noted above, the PTRs of the three schools vary significantly, from 49 to 131. However, teachers at all three schools are eligible for the current allowance scheme.

While the proportion of teachers receiving the allowance has grown, the real value of the allowance has diminished. In the original proposal, it was envisioned that the allowance would reward teachers in remote schools with an amount equivalent to half the average teacher’s annual salary, around MWK12,500 per month at that time. In order to reach the larger than expected initial list of teachers, however, the allowance was introduced at just MWK5,000 per month, equivalent to around one-fifth the average teacher’s monthly pay. While the allowance is now MWK10,000 per month, rapid increases in nominal teacher wages, in response to rampant inflation, mean that the nominal value of the allowance has declined to one-seventh average monthly pay. In dollar terms, the value of the allowance has declined from $33 per month to $14.

With such a non-targeted distribution of the allowance, and a severe reduction in the real value owing to severe inflation, the effect of the allowance on staffing appears to be limited: schools eligible for the allowance have an average PTR of 91, versus 85 for schools which are not eligible. At the same time, the additional cost of the allowance, on top of Malawi’s already high proportion of spending on salaries, is substantial. Reform of the rural allowance is now considered a priority by MoEST (*The Nation*, 2017).

Open Distance Learning (ODL): Initiated in 2010, the ODL scheme was intended to provide a low-cost way to increase teacher numbers by allowing recruits to undergo in-school training combined with distance learning, without the expensive residential one-year training component of IPTE. In contrast to IPTE teachers, who undergo one year’s full-time classroom training and one year’s in-school training, ODL teachers underwent a short three-week introductory training before two-and-a-half years of in-school practice. More than 16,000 teachers completed ODL training between 2010 and 2016, and from 2012-2017 around 40 percent of the new teachers deployed each year have been ODLs.

The ODL program was envisioned as a temporary measure, originally intended to run for three intakes of 3-5,000 teachers each. The program, for which entry academic requirements were lower than for IPTE, was subject to concern regarding the quality of graduates being produced (*Malawi24*, 2015). In 2015, after five intakes, the government announced the suspension of the scheme alongside a major expansion of the IPTE scheme. The last cohort of ODLs are expected to be placed in schools in 2018.

While successful in increasing overall staffing levels in Malawi's schools, the ODL scheme does not appear to have succeeded in addressing inequities in the distribution of teachers. ODLs were intended to be recruited almost exclusively from zones experiencing shortages of teachers. However, without accurate data available at central level on local variation in PTR, in practice the scheme was implemented along the same lines as the bonding scheme, with ODL recruitment restricted only to the extent of focusing on Malawi's 30 rural education districts. Although DEMs were encouraged to recruit ODLs from and allocate them to the most understaffed zones, this guidance was not enforced, and DEMs were also subject to the same countervailing pressure from teachers as with IPTE graduates. As a result, prioritization of the neediest zones within districts was largely a failure: analysis of the 2010 recruitment of ODLs found no relationship between the number of ODL recruits in a zone and the proportion of schools in that zone with a shortage of teachers (DeStefano, 2013). Furthermore, once deployed, ODLs are eligible to apply to move to more urban areas on medical or marriage grounds, similar to IPTE graduates.

A common pattern can be identified in each case of Malawi's attempts to implement policies to address inequities in teacher allocation. The systems created, while well-intentioned, depended on the availability of accurate data on teacher supply and demand to inform the development of rules; and on the willingness of local-level officials to abide by such rules.

In practice, however, the absence of adequate data on these factors meant that a simplistic binary approach, separating rural from urban at district level, became either the official or *de facto* standard. With almost 90 percent of the teachers in Malawi working in rural districts, this approach fails to adequately target teachers and incentives. Furthermore, the absence of data meant that public officials were in practice left exercising a high degree of discretion in the implementation of rules, leaving them exposed to significant pressure from teachers and other interests.

3. Data and Methodology

The primary analysis in this paper is based on: (1) data on teacher placement, collated from various administrative sources; (2) geospatial data on the locations of public primary schools and major trading centers; (3) school-level characteristics, including student enrollment; and (4) trading center amenities. All four data sets were developed from government sources, combining and reconciling administrative sources, and validated by DEM offices.

As the result of fragmented governance structures, teacher management data in Malawi is spread across multiple sources. MoEST's central record of teacher placement is drawn from the Education Management Information System (EMIS), which also tracks enrollment, various measures of school infrastructure, and basic educational outcomes on an annual basis. EMIS data, collected annually by DEM offices and collated by MoEST, provides one record of teacher placements, enrollment, and therefore school-level PTRs. The record of teacher payroll, managed by

DHRMD,[6] provides another record of teacher placements. DEMs also maintain their own records, called staff returns, updated monthly, to obtain a more up-to-date picture of where teachers are in the system.

We obtained EMIS and payroll databases directly from MoEST and DHRMD. To obtain staff returns, DEMs were asked to provide details of all qualified teachers in their districts, their school, seniority grade, gender, and other basic identifiers. Schools could be linked to the EMIS data for comparison using a unique school identifier code. Teachers could be linked to the payroll database using a unique ID number.

Comparison of these multiple databases confirmed the existence of severe problems of fragmentation and inconsistency in teacher management adminstrative data in Malawi. Sixteen percent of teachers in EMIS 2016 are missing the personal ID to connect them to the payroll database, while a further 8 percent of teachers are listed with an ID that is attached to more than one record. More than 10 percent of teachers in the initial collated staff returns database were listed in different schools or districts than in EMIS. A significant number of teachers are listed by the payroll database as being based in different districts to their actual location as reflected in the staff returns; this reflects a tendency for teachers to be added to or maintained on the payroll database according to the availability of grade-appropriate positions, even if their actual posting is in another district.

The district staff returns, updated monthly, provide the most accurate and up-to-date record of teacher postings. Employing these records as a starting point, it took the authors two years to validate the whereabouts of every teacher in Malawi with the DEMs to create a curated list of teacher IDs and School IDs that could be linked back to the EMIS and payroll databases. First, lists received from different districts were compared and duplicate teachers identified; over 600 teachers were found to be listed more than once, either in multiple different districts or in some cases at different schools within the same district. Queries were sent back to DEM offices for verification, with DEMIS officers in some cases contacting teachers by phone to confirm their actual work posting.

Within the EMIS database, more than 4,000 duplicate teachers were removed. Finally, more than 1,900 teachers in the staff returns database were matched to more than one record in the payroll database owing to a miscoded ID in the staff returns data. These were addressed through manual matching of records by name and school.

Per the finalized database, there are a total of 61,507 teachers in primary schools in May 2017.[7] In the HR employee database there are 61,833 teachers; by contrast, the EMIS database includes 57,850 teachers with the same exclusions. In part, this reflects a time lag, as the EMIS, last updated in 2016, does not reflect the addition of around 8,000 new IPTE and ODL graduate teachers to the system last year.

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[6] Since January 2017, teacher payroll has been in the process of being decentralized and managed by DEM offices; however, a central record of teacher payroll is still maintained to govern releases of finance to districts for teacher salary payments.

[7] This excludes temporary, volunteer and trainee teachers.

Having developed an accurate database of teachers, we then combined this with school-level enrollment data, derived from EMIS, to develop an up-to-date database of school-level PTRs. This enabled the first systematic analysis of PTR variation using reliable and complete data. The findings are presented in Section 4.

We then turned to the potential determinants of school-level PTR variation. Focus group discussion with key stakeholders, including teachers and headteachers, suggested a wide range of potential variables which affect the willingness of teachers to work at a school. The most common factors identified by discussants were availability of electricity at the school; accessibility of school by road during rainy seasons; availability of housing; the distance from the school to the nearest trading center; and the availability of amenities – medical facilities, banking facilities, and water/electricity – at the nearest trading center.

Information on these variables was collected from administrative databases. First, information on school-level characteristics – availability of electricity, housing, and year-round road access – was obtained from EMIS and matched to the staffing database using a unique identifier.

MoEST maintains a database of the geospatial coordinates of all public schools in Malawi, while the National Statistical Office (NSO) maintains a database of larger villages and towns, commonly known as trading centers, which includes geospatial coordinates. We obtained these data and validated them through comparison with Malawi Spatial Data Platform (MASDAP), a public platform for geospatial data, by confirming the government coordinates for each school coincided with the district boundaries drawn from MASDAP. DEMs' offices were also given the opporutnity to propose additional trading centers; the final database included 503 centers across Malawi.

Combining these records, we were able to identify the closest trading centers to each school and calculate the Euclidean distance to the center from the school.

Responding to feedback from qualitative discussions, we added an additional element of data in the form of the level of amenities available at trading centers. With the help of DEMs, the authors gathered data on the amenities available near trading centers. DEMs' offices were asked to assign each trading centers a score from 0 to 3 based on how many major types of amenity – banking, medical facilities, and piped water or electricity – were available within 3 km of the center.[8]

Combining these data sources, it was possible to construct a full picture of the remoteness of Malawi's schools, in terms of both geographical distance and levels of facilities; the variation in PTRs between Malawi's schools; and the relationship between the two. Descriptive and analytical findings are presented in the following section.

[8] DEMs classified trading centers according to the following formula:
0 = None of the following available: bank, hospital, or piped water/electricity;
1 = One of the following available: bank, hospital, or piped water/electricity;
2 = Two of the following available: bank, hospital, or piped water/electricity;
3 = All of the following available: bank, hospital, and piped water/electricity
68 out of the 507 trading centers (13 percent) were identified as in category 0, with no amenities. 184 (36 percent) were classed as category 1, 190 (37 percent) as category 2, and 61 (12 percent) as category 3, including all district capitals or government centers. On average, each district had three centers in category 0, seven in category 1, seven in category 2, and two in category 3.

4. Findings: PTR variation and correlates

In this section we present descriptive statistics of the extent of variation in PTR, and decompose the incidence of variation at district, zone, and school level. In order to test the proposition that the persistence of inequities in PTR reflects political capture of the teacher allocation system, we assess the impact of key teacher preferences in school choice on PTR variation, as compared with other relevant factors. Finally, we present the results of a political economy network mapping exercise in order to more clearly illustrate the local-level dynamics of teacher allocation.

4.1. Extent and patterns of PTR variation

The finalized database revealed considerable disparities in PTR, not only along traditionally understood demarcations of rural and urban or across district boundaries, but between schools within the same small geographical area.

PTR varies significantly between districts, consistent with findings from Mulkeen et al. (2010). The district with the best-staffed schools, the town of Zomba, has an average school-level PTR of 52, while the most understaffed rural district, Machinga, has an average school PTR of 117. Twelve districts have a median school PTR of 80 or more.

In addition to between-district PTR disparities, the finalized database revealed large inequities within districts [**Figure 2**]. Within districts, the interquartile range (IQR) is quite high for a large majority of districts, with the highest spread in Lilongwe Rural West and Dedza district. This shows that variation in PTRs between sub-district units is substantial.

Malawi's education districts are divided into 427 zones, with an average of 12 zones per district and 13 schools per zone. Per-zone average PTRs vary substantially within a single district: in Machinga district, for example, the lowest zonal PTR is 64, in peri-urban St. Therese zone, and the highest is 264, in remote Nampeya zone.

Furthermore, even within one zone, equivalent to an area of a few square kilometers, PTRs tend to vary significantly. For example, within the Khombwe Zone of Blantyre Rural, between 3-6 km West of Blantyre city, the zone-level PTR is 80, but due to the uneven distribution of teachers it spans from 27 to 130.[9] The largest schools, Chimembe and Khombwe, with over 2,800 students between them, have only 22 teachers in total, while a smaller school 3 km closer to the city, Maliya, with 853 students, has 12 teachers to itself.

We employ variance component analysis to examine how much of the total variation in school-level PTRs is attributable to the variability in PTRs (1) between districts; and (2) between zones within districts; and (3) between schools within zones. If teacher preferences for school choice are a key driver of PTR variation, we would expect to see most PTR variation to exist at school level, rather than between larger administrative units such as districts.

[9] See **Table 12**, in Annex 1 (available online: see page 40).

We fit two-level and three-level variance components models to the school-level PTR. The two-level variance components model is specified as

$$y_{sz} = \beta + \alpha_z + \varepsilon_{sz}, s = 1, \ldots, S, z = 1, \ldots, Z,$$

where *s* indexes the school and *z* the zone, and y_{sz} denotes Pupil-teacher ratio for school *s* in zone *z*. Schools are nested within zones. Thus, school-level PTRs within zones are likely to be correlated. Since the error components (α_z and ε_{sz}) are assumed to be independently distributed, the total variance in the pupil-teacher-rations Var (y_{sz}) is equal to the sum of the between-zone variance ($\sigma^2_{\alpha_z}$) and the within-zone, between-school variance ($\sigma^2_{\varepsilon_{sz}}$).

Similarly, the three-level variance components model is specified as

$$y_{szd} = \beta + \alpha_d + \alpha_{zd} + \varepsilon_{szd}, s = 1, \ldots, S, z = 1, \ldots, Z, d = 1, d = 1, \ldots, D,$$

where *s* indexes the school, *z* the zone, and *d* the district, and y_{szd} denotes pupil-teacher ratio for school *s* in zone *z* in district *d*. Schools are nested within zones, and zones within districts. These factors are treated as additive random effects in the model, where α_d and α_{zd} denote the random effects varying over district *d* and zone *z*, respectively. As with the two-level model, given that the error components (α_d, α_{zd} and ε_{szd}) are assumed to be independently distributed, total variance in PTRs is equal to the sum of the variances of the error components. **Table 2** presents the results of the school-level pupil-teacher ratio variance decomposition. The estimated variance shares attributable to between districts and within districts are presented in the upper panel. Further decomposing variations within districts to sub-districts and schools are presented in the lower panel.

The evidence suggests most of the variation, 84 percent, is attributable to school-level heterogeneity within sub-districts. Furthermore, the share attributable to inter-zone differences is almost four times higher than between districts. The results illustrate the extent to which local-level school-specific characteristics influence PTR variation.

4.2. Influence of teacher school choice preferences on PTR

In this section, we employ a multiple regression framework to identify the impact of teacher preferences on PTR. Our first proposition is that, given the high degree of discretion that exists within the Malawi system, teachers can exercise preferences in their choice of school and that therefore, the correlates of teacher preference for schools will coincide with the correlates of low PTR. For example, if teachers prefer schools with electricity, given the considerable influence teachers appear to have over school allocations, we would expect schools with electricity to have proportionally more teachers and therefore, lower PTRs.

As noted above, our database included a range of indicators identified in focus groups as key drivers of teacher preferences in school selection. Combining these various school-level indicators, we fitted simple ordinary least squares regressions to explain variations in PTRs at the school-level. In addition, in order to test for potential clientelist dimensions to the allocation of teachers, we included an indicator of the party of a schools' constituency MP. The resulting estimation is:

$$P_i = \alpha + \beta_1 E_i + +\beta_2 R_i + \beta_3 D_i + \beta_4 F_i + \beta_5 H_i + +\beta_6 V_i + \beta_7 X_i + \varepsilon_i$$

where i indexes the school, and P_i denotes pupil-teacher ratio for a school i. E_i is a dummy variable of availability of electricity at school i, it turns 1 if a school i has electricity, and 0 if not. Similarly, R_i is a dummy variable for school i accessibility by road during rainy seasons. Di is a variable of Euclidean distance in km from school i to its nearest trading center and Fi denotes the number of facilities available there. H_i is another dummy that turns 1 if a school i has housing available for majority of its teachers, and 0 if not. V_i is a dummy variable that turns 1 if DPP, the ruling party, won the most recent elections in constituency of school i and X_i *includes* all other controls such as school size, share of permanent/temporary classrooms and number of toilets available in school i.

The results are presented in **Table 3**. The first specification is a simple OLS regression, while specifications 2 and 3 control for territory fixed effects, at district and zone level respectively.

Results of the regression analysis are consistent with the proposition that PTR variation reflects teacher preferences. Lower PTRs at the school level are associated with the availability of all included amenities in schools. The coefficients of the variables for availability of electricity and school accessibility by road during rainy seasons are negative and statistically significant and robust across specifications. The distance to the nearest trading center also turns out to be a strong determinant of school-level PTR: on average, a 10 kilometer increase in remoteness of school is correlated with an increase in PTR of 13 pupils per teacher.

However, availability of teacher housing, one of the variables most commonly cited by senior officials as a driving factor in teacher movement, comes out to be positively associated with higher PTRs. The results suggest that teachers prefer to stay closer to town centers or school with basic amenities, but not necessarily in remote rural schools that have staff housing.

Whether a schools' local MP was from the ruling DPP was negatively associated with higher PTR at district level, suggesting that the political linkages of DEMs play some role in the allocation and re-allocation of teachers between districts. However, within the district and zone, the dummy is no longer significant, suggesting that MP affiliation does not drive PTR variation within a single geographic area.[10]

Our case study of three schools in Nathenje, in Lilongwe Rural East district, further illustrates the role of these variables in PTR variation.[11] As noted above, the PTRs of these schools vary widely despite these schools sharing a small rural geographic area. This variation reflects the same characteristics identified by the regression analysis as key correlates of PTR variation. The school with the lowest PTR, Mwatibu, is based within Nathenje trading center and has year-round road access, electricity, water, and access to banking and medical services. Chibubu school, with a PTR of 79, is only 3.6 km from the nearest trading center; however, the center, Chadza, lacks both banking and medical facilities, while the school lacks electricity. Khuzi school, similarly, lacks electricity, and its nearest trading center lacks banking and medical facilities; however, the center, and nearest tarmac road, are about 9 km away. At 131, Khuzi's PTR is among the highest in the district.

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[10] Malawi's districts are divided into an average 3-4 constituencies each.

[11] **Table 12**, in Annex 1 (available online: see page 40).

4.3. Political economy network mapping of local-level teacher allocation

In order to more clearly identify the local-level dynamics of teacher distribution in Malawi, and the potential mechanisms through which teachers influence allocations to exercise their preferences, we conducted a series of network mapping focus groups with headteachers, education officials, and non-education officials. In total, over 100 respondents participated in the exercise, with all regions of Malawi and 33 out of 34 education districts represented.[12] The participants were organized into panels of eight-ten people by their role and geographic origin[13]. Working in groups of two to three, participants carried out a stakeholder mapping exercise. Imagining the scenario of a teacher seeking to move from a remote school to a less remote school, the groups identified the major actors, both education officials and others, who the teacher might try to use to exercise influence over the outcome. They then identified linkages of influence between the actors and assigned each linkage a score out of 10 for overall influence.

The results of the mapping exercise and discussion are summarized in **Figure 4**. The network map of influence which emerges has several striking characteristics.

Central role of DEMs as nexus of influence: In formal terms, DEMs exercise the most influence over local-level teacher allocations. Reflecting the findings of UNDP (2016), the mapping exercise revealed DEMs to also be subject to a large degree of influence, both "from above" – for example, from MoEST – and "from below", from PEAs and community-level actors. DEMs were scored by participants as being subject to by far the most formal and informal influence, and DEMs themselves describe facing a constant stream of pressure through formal and informal channels from MoEST, community-level actors, and non-education and elected officials, as well as directly from teachers themselves. "The pressure comes from all over – friends, politicians, chiefs, the Ministry, PEAs," said one DEM. "People want their friends to be at a school they feel is not remote. You have to be strong and be prepared to create enemies." The result is that despite their substantial official or *de jure* power within the system, DEMs' *de facto* power is limited by their willingness and ability to resist this pressure.

*Significant influence of teachers through informal networks***:** The situation with teachers is the inverse of that with DEMs: teachers lack formal power in the system, but exercise considerable *de facto* influence through informal networks. The overall influence of teachers within local-level networks was rated as higher than that of any other single actor, including both MoEST and DEMs. PEAs estimated that in their zones, as few as 10 percent of teachers allocated to a remote zone may actually be successfully posted and maintained in that zone, suggesting teachers have effectively captured the system to prevent allocation to remote schools.

In particular, the context of overall and district-level teacher shortages means that teachers have considerable leverage. "Better to place all the teachers around the periphery of the town than to have them leave the district, or even teaching, altogether," said one DEM.

Strikingly, the primary route of teacher influence does not appear to be through the Teacher's Union of Malawi (TUM). Participants, including TUM district representatives, said that though

[12] The remaining district, Likoma, is a small island off the coast of Mozambique with limited access to the mainland.
[13] See **Table 13**, in Annex 1 (available online: see page 40).

TUM may take up the case of a teacher seeking to avoid a remote posting under certain circumstances, this official channel is unlikely to significantly impact allocations. “Teachers come to TUM to seek help to move schools, and we do sometimes act on their behalf. But we can only advise, ultimately the decision is up to the DEM,” said one TUM representative.

Informal influence of non-education and elected officials: Instead of acting primarily through TUM, teachers primarily apply influence in the system through informal channels. Non-education officials such as District Commissioners, and elected officials such as MPs and Ward Councilors, have little official role over the allocation of teachers. This is in contrast to other developing countries, such as India, where in several states MPs have a formal say in, or veto over, teacher moves (Ramachandran et al., forthcoming). Informally, however, these actors were identified as exercising significant influence, primarily on behalf of teachers. These officials may apply pressure directly to DEMs or, in the case of MPs, through MoEST.

During case study discussions, teachers emphasized the crucial role of personal connections in obtaining transfers to desirable schools. “It is not people like us who get those positions in the trading center,” said one teacher at a remote school in Nathenje. “You have to have a connection in the Ministry, or relatives who are government officials. We have nobody above us who can help us.”

Respondents cited nepotistic or cronyism relationships, rather than political patronage or clientelist vote-buying, as the key driver of involvement by these non-education actors. “MPs, District Commissioners, and similar figures only get involved where they have a personal connection to a teacher,” said one PEA. “But where they do get involved they are usually successful.” Respondents acknowledged that MPs who are aligned with the ruling party are much more likely to successfully intervene on a teacher’s behalf.

Weakness of community-level influence: Schools, including school management committees, parent-teacher associations, mother groups, and headteachers, provide a potential source of countervailing pressure in the system to oppose DEMs allowing teachers to leave schools which are already understaffed. At present, however, the influence of schools within the system is weak. Schools exercise influence primarily through PEAs, the level of official education management closest to the school. However, PEAs possess only advisory authority over DEMs, meaning the effectiveness of this channel is easily overwhelmed by informal pressure from more powerful actors such as MoEST and non-education and elected officials.

Traditional Authorities (TAs) and Ward Councilors represent the forms of political authority closest to school level. Although these actors have no official role in teacher allocations, the informal influence of these actors over DEMs is considered to be substantial, meaning that they potentially provide a useful avenue through which schools and communities can provide countervailing pressure against the reallocation of teachers from understaffed schools. However, at present the influence of communities over these actors is considered to be weak. Despite the fact that both Ward Councilors and TAs are closely connected to communities, they do not appear to currently exercise significant influence on behalf of these communities. Teachers, for example, were deemed to have greater influence over Ward Councilors, through personal relationships, than schools.

How can this lack of democratic influence be explained? Respondents said that the primary reason is that communities lack awareness of the extent of PTR inequities, and subsequently are unlikely to organize or advocate forcefully for additional teachers or to resist the loss of teachers to less remote schools. TAs said they were more likely to be approached by communities seeking to expel a bad teacher than to protest the departure of a well-regarded teacher. Institutions for community influence over these actors are informal or underdeveloped.

Overall, the findings of the political economy analysis support the proposition of political capture of the teacher management system by teachers. Employing informal networks, particularly through personal relationships, teachers apply pressure to officials to obtain allocations to schools close to trading centers and amenities. DEMs, as the primary local decision-making official, bear the majority of the pressure. By contrast, community-level actors have a weak and fragmented voice in the system, meaning that there is little effective countervailing pressure on DEMs to resist teacher demands.

5. Findings: Data-driven categorization of schools and associated policies

In this section, we set out to develop and simulate the impact on PTR of policies based on a more accurate picture of teacher distribution and its correlates. We present the method of classification, descriptive statistics, and simulations of the impact of various policy applications of this classification on teacher distributions; as well as analysis of the 2016 allocation of new teachers to schools, which reflects the impact of a partial improvement in the quality of administrative data.

5.1. Classification of schools by remoteness

We developed a single system of classification which captured the various aspects of remoteness identified as of most relevance by the preceding analysis. The resulting classification defines school remoteness according to the types and quantity of amenities schools have access to in their nearby area. Three types of amenities are considered: (i) the availability of amenities at the school, specifically availability of electricity and accessibility by road all year round, including during rainy seasons;[14] (ii) Euclidean distance from a school to the nearest trading center[15]; and (iii) the level of amenities available at the trading center.

In the first instance, employing a simple analytical approach, we assigned schools to one of three categories based on these factors of remoteness.[16] Category A schools, the most remote, are far away (more than 14km, equivalent to more than one hour's journey by bicycle) from the nearest trading center; or are a moderate distance (7-14km)[17] from a trading center but lack both electricity

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[14] There is very little variation in access to drinking water supply and hence is highly collinear with other factors, like access to road. With 95% of schools having this access, and the vast majority of those lacking it also lacking year-round road access, this indicator was excluded from the categorization.

[15] Given the significant variation in terrain and road quality in Malawi, an ideal approach might include road distance. In order to employ the most reliable geographic information available, existing geospatial data sets, it was necessary to use Euclidean distance.

[16] **Table 14**, in Annex 1 (available online: see page 40).

[17] PTR analysis revealed 07-km, 7-14km and above 14km to be the distance categories most connected to PTR variation [**Figure 3**].

and year-round road access at the school. Category B schools, considered moderately remote, may be far from a well-developed trading center, with full facilities at the school; or less than 14km from a trading center lacking in amenities. Category C schools, which are not remote, are 7-14km from a well-developed trading center and have full facilities at the school, or are less than 7km from a well-developed trading center. **Table 4** summarizes the category criteria.[18]

Table 5 shows the distribution of schools, teachers and students between the categories. The largest category is Category C, with 39 percent of schools, while Categories A and B have 30 and 31 percent of schools respectively. Predominantly more developed centers of districts and zones have the majority of their schools in Category C, while schools further from trading centers typically have large numbers in Categories A and B.

As expected, PTRs rose steadily at each level of remoteness. Well-connected Category C schools had an overall category ratio 70.2 – below the national PTR of 1:78 – while the most remote Category A schools have an overall ratio of 92.0. Taking the more relevant measure of the average school-level PTR, the difference is similar, with Category C schools presenting an average PTR of 80.7 and Category A an average of 100.6.

The categorization can be illustrated through our case study schools in Nathenje, Lilongwe Rural East.[19] Remote Khuzi school, at 8.6km from a trading center lacking basic facilities, is classified as Category A, the most remote. Chibubu school, 3.6km from a center lacking basic facilities, is classified as Category B. Mwatibu school, based within the Nathenje trading center, is classified as Category C, not remote.

5.2. Targeting of new teachers according to classification of schools

Malawi is expecting to hire about 5,000 IPTE-qualified teachers in 2017. This will improve the national PTR from 78 to 73, moving Malawi closer to its goal of a national PTR of 60. However, if the 2017 intake were distributed in line with the current distribution of teachers, this would have the effect of allocating 2,634 teachers to Category C schools which are already typically overstaffed, and only 1,013 teachers to the Category A schools which are most understaffed, maintaining and deepening existing inequities [**Table 6**]. More extensive targeting of new teachers, informed by the new classification, is required to achieve rapid improvements in PTR disparities.

Under a more targeted approach, DEMs would be provided with guidelines to allocate teachers to schools in two stages – first, as now, by excluding schools which already have PTRs below the target of 60; then, by prioritizing Category A and B schools with a view to minimizing the disparity in PTRs between categories. Under this approach, all new teachers being deployed in 2017 would be allocated to Category A and B schools.

Table 7 shows the potential impact of such an approach. The impact is striking: under this approach, it is possible to almost equalize the difference in category-level PTR between categories

[18] **Table 15**, in Annex 1, provides full descriptions of categories (available online: see page 40).
[19] Table 12, in Annex 1 (available online: see page 40).

A-C with just one year's allocation of new teachers.[20] MoEST has instructed DEMs to follow this approach in the allocation of the 2017 deployment of new teachers; it is expected that significant reductions in the variation between per-category PTRs will be observed once the deployment is complete.[21]

5.3. Revised incentives for teachers in hardship schools

As noted above, even if teachers were allocated more equitably to schools at qualification, teachers tend to move away from remote areas over time through transfers to less remote schools. Projections based on the 2016 deployment of new teachers suggest that any elimination of category disparities in PTR achieved by targeted allocation of new teachers could be undermined by this movement within two years.[22] To reduce this 'leakage' and pressure on DEMs to reallocate teachers away from remote areas, we developed a data-driven model to revamp hardship allowances.

As described in Section 2, Malawi has a scheme in place to pay incentives to teachers serving in remote areas. The current scheme is diluted, with around 80 percent of teachers eligible, and of limited value, at around one-seventh of average teacher salaries.

When initially introduced in 2010, the allowance scheme paid an amount worth around one-fifth of average teacher salaries, with three-quarters of teachers eligible. Even this weak scheme appears to have had some impact. The proportion of teachers working in schools eligible for the scheme increased from 77 percent in 2010 to 80 percent in 2017, suggesting that at least some teachers responded to the scheme by requesting transfers to eligible schools.[23]

Evidence from other countries suggests that a scheme in line with the original proposal – targeting around 20 percent of teachers with an incentive worth around 30-40 percent of the average teachers' salary – would be highly effective in encouraging teachers to remain in or move to eligible schools. Gambia introduced an allowance in 2006 which paid an amount equivalent to 30-40 percent of salary to teachers in hardship schools, defined by distance from the nearest main road. In the first year of implementation, 24 percent of the teachers in the regions of the country where the allowance was available had requested transfers to hardship positions (Mulkeen, 2010).

For Malawi, we devised an updated remote allowance scheme, employing the A-C categorization as a basis for increasing additional remuneration. The scheme was designed to be revenue-neutral, employing the level of funding currently distributed to 80 percent of teachers under the current scheme and targeting it more effectively at teachers in remote areas. Within this framework, it is possible to design a scheme which increased the allowance for teachers in the most remote schools

[20] Around 3,500 ODL graduates are also expected to be deployed to schools in 2017; this represents the final year of ODL deployment, so our analysis focuses on IPTE deployment which is ongoing.

[21] The World Bank will monitor the 2017 allocation, subsequent movement of these teachers through the system, and future allocations of new teachers, as part of ongoing activities to evaluate the impact of the classification of teachers.

[22] Table 17, in Annex 1 (available online: see page 40)

[23] The total number of teachers operating in Malawi increased by more than 50% during this period. Precise estimation of the number of teachers who responded to the allowance scheme is not possible, owing to the difficulty of separating new teacher from the incentive effect when measuring increased staffing in eligible schools.

from MWK10,000 (US$14) to MWK25,000 ($US35), equivalent to about 35 percent of the average teacher's salary in Malawi [**Table 8**].[24] Furthermore, because the categorization is based on an objective formula for remoteness, employing data on school and trading center facilities from established sources, it is expected that the revised allowance can be appropriately targeted without the large incidence of dispute observed under the original scheme, where DEMs exercised considerable discretion in the identification of eligible schools.

Table 9 shows a simulation of the impact of the revised rural allowance scheme on PTR inequities. The simulation employs an assumption that the scheme would incentivize eight percent of teachers from Category C schools, net of 'leakage', to move to Category A and B schools, in equal proportion. This is a conservative estimate intended to reflect the impact of the allowance in preventing 'leakage' from remote schools as well as encouraging movement to remote schools. Applying the impact of the allowance following the influx of 5,000 new teachers, but distributing these teachers across categories according to the current distribution and allowing for attrition (as in **Table 6**), this movement of existing teachers further reduces the PTR in Category A from 86.3 to 78.2, and the difference in category-level PTR between Category A and Category C from 22 pupils-per-teacher to just seven.

Table 10 presents simulations of the impact of the allowance with a smaller proportion of teachers responding to the allowance by moving to more remote schools. With only four percent of teachers moving to more remote schools, the category-level PTR in Category A is reduced from 86.3 to 82.0.

In practice, the MoEST expects to implement both policies – with the 2017 targeting of new teachers prioritizing Category A and B schools, and the revised allowance expected to be introduced during the 2017/18 school year. **Table 11** shows the combined impact of both policies – allocating 5,000 new teachers with a view to equalizing PTR, coupled with a three percent reallocation of Category C teachers to Category A and B schools from the revised allowances. The results are notable – according to this simulation, it is possible that per-category PTRs could be substantially equalized within one year, with Categories A-C having an overall PTR of between 72.3 and 73.4.

5.4. Impact of improved data on 2016 allocation of IPTE graduates

The process of consultation, collection of data, validation and reconciliation of inconsistencies through which the data underpinning this analysis was prepared began in 2015 and involved all Malawi's DEMs as well as MoEST, DHRMD, and non-education officials such as District Commissioners. The process required discrepancies between data sets, and within data sets between district records, to be identified and addressed for the first time. Therefore, if our proposition is true that improvements to the quality and sharing of data can enable improvements in teacher allocation decisions, we would expect to see such impact as a result of the process of engagement as early as 2016.

[24] Under this framework ("Option 3"), only teachers in Category A and B schools would receive allowance. Other options include some allowance for teachers at Category C schools in addition.

MoEST deployed approximately 9,000 new teachers in 2016, of which 4,653 were graduates of the IPTE training scheme.[25] The deployment followed a two-year period without deployment of new teachers, increasing the need for the new deployment to be allocated to schools according to the greatest need. Allocation decisions were made by MoEST and DEMs between May and August 2016. Analysis of the allocation of these teachers therefore provides a snapshot of the state of decision-making around teacher allocation one year into the process of data collaboration.

The results suggest a notable improvement in decision-making in the allocation of teachers compared to the preceding situation. MoEST appears to have broadly succeeded in allocating teachers to districts in accordance with PTR disparities: 83 percent of new IPTE graduate teachers were allocated to one of the 18 districts with an average school-level PTR of 1:85 or more.[26]

Furthermore, DEMs appear to have improved the targeting of new teachers to schools with the greatest need. Of the 4,653 IPTE graduates recruited, 55 percent were deployed to Category A and B schools with PTRs above 60, or 80 in urban areas. This represents a significant improvement over the current distribution of existing teachers, in which only 38 percent of teachers are based at Category A and B schools. In consultations, DEMs said they had already made significant changes to practices in response to the growing awareness of the extent of PTR disparities, including introducing more strict requirements for medical and marriage certificates.

However, the 2016 deployment also demonstrates the need to deepen and institutionalize improved data management, and introduce reformed data-driven policies, to further improve allocation decisions. For example, while the deployment of new teachers to Category A and B schools represents an improvement on the current distribution, a fair distribution which aimed to minimize PTR disparities would see 84 percent of teachers allocated to these schools.[27] Furthermore, *leakage* to less remote schools appears to remain a problem in the absence of a reformed allowance scheme. Fourteen percent of teachers moved to a different school within the same district within the first year after deployment; of these, 69 percent moved to a school in a less remote category.

6. Discussion

Our findings provide support for both our main propositions. First, low-quality administrative data leave officials with a high degree of discretion in teacher allocation, creating space for political capture of the system by teacher interests and the maintenance of PTR disparities. Second, simulations suggest that improved data can mitigate the situation by enabling the development of more specific and precise policies, empowering officials to resist pressure to bend the rules, and enabling communities to create countervailing pressure for officials to consistently enforce agreed policies.

Throughout the system of teacher management, data are fragmented, inconsistent, and low in transparency. Sources of data from different government agencies differ in the number, location, and seniority of teachers. In the absence of accurate, up-to-date, and widely accepted data, policies

[25] The remainder were ODL graduates; given the cancellation of the ODL scheme, our analysis here focuses on IPTE graduates.
[26] Although we employ the term PTR for simplicity, all figures presented are for PQTR – pupil-qualified teacher ratio, which excludes volunteer, trainee, and month-to-month teachers.
[27] Table 18, in Annex 1 (available online: see page 40).

designed to target teachers are ad hoc and imprecise, leaving DEMs with significant discretion over teacher allocation. New teachers are targeted only at district level, while within districts, DEMs are only required to target schools only with PTR above 1:60, in practice making approximately three-quarters of schools eligible to receive teachers each year.

The result is that PTR disparities largely follow the pattern of teacher preferences. The factors identified by teachers as making a school attractive as a place of work – availability of amenities at school, proximity to a trading center, and availability of amenities at the trading center – are significantly associated with lower PTRs, demonstrating that teachers are able to exercise influence to get to the school they prefer, and not necessarily to the school where they are most needed.

Political economy analysis demonstrated the informal networks through which teachers exercise influence in the system. DEMs are subject to considerable pressure from education and non-education officials alike to game the system in favor of teachers with whom these officials have a personal relationship. At the same time, with low public awareness of the extent of PTR disparities, communities and community-level actors do not assert their power fully to retain teachers in understaffed schools. As was the case in our case study area, teachers allocated to remote schools are often able to obtain an alteration to their allocation before ever reporting to work.

Although the implementation of data-driven reforms is at an early stage, our findings and projections provide tentative support for our second proposition: that improved data, on teacher distribution and school remoteness, can contribute to the establishment of more appropriate and enforceable rules-based procedures for allocation and retention of teachers.

Our proposed categorization of schools by remoteness captures a significant degree of PTR variation, with the less remote Category C schools possessing an average PTR well below the national average and the most remote Category A schools well above average. Analysis of the 2016 allocation of new teachers in Malawi suggests that the process of consultation and discussion carried out as part of our research has already driven an observable improvement in the allocation of new teachers to schools with the greatest need.

Simulation of the potential policy applications of the categorization, through targeting of new teacher allocations and hardship allowances to the most remote schools, suggest that if fully implemented, these policies could significantly reduce PTR disparities in a short period of time. The combination of better targeting of new teachers, with the planned introduction of financial incentives for teachers working in Category A and B schools, has the potential to eliminate disparities in average category-level PTR.

Furthermore, evidence from our political economy analysis suggests that, if the categorization can be used to drive greater community awareness of PTR disparities, there is the potential for community-level actors to counteract pressure on DEMs so that DEMs are better able to resist demands to move teachers away from remote schools. Although communities and community-level actors appear individually as weaker voices within the network mapping, the *combined* influence of schools, local religious leaders, TAs and Ward Councilors over DEMs was measured as on a par with that of any single more powerful actor **[Figure 5]**. This suggests that if the interests of these community-level actors are aligned, they have the potential to act as a significant voice in contestation around teacher allocation.

There appears, therefore, strong potential to utilize these actors as a channel of influence for communities to strengthen the voice of citizens in the system and provide a balance to the informal influence of teachers through nepotism and cronyism relationships. To achieve this is likely to require greater public awareness of the extent of PTR disparities at the local level: communities at present may see their schools' high PTRs as symptomatic of the national shortage, not fully realizing the extent to which the overall shortage is exacerbated by relative overstaffing of schools in trading centers. Basic information on school-level PTRs for all schools in a zone, for example, would inform communities of their own school's relative status in a simple and explicable format.

Efforts to inform and strengthen the voice of community-level actors are likely to increase the influence of communities with well-staffed schools, who could organize to prevent reallocation of teachers away from their schools. However, respondents in discussions did not cite pressure from communities in trading centers as a driver of teacher concentration, identifying teachers' own preferences as the key factor. Furthermore, given limited availability of classrooms and other constraints, communities may perceive additional teachers beyond a certain point as of little benefit to learning.

The last two decades have seen a proliferation of schemes intended to increase public awareness of public service delivery in areas including health and education, with School Report Cards introduced in countries including the Philippines, Brazil and Ghana. The evidence is mixed of the ability of such interventions to alter outcomes, particularly in political conditions of clientelism or patronage (for a review, see World Bank, 2016b).

However, information which draws particular attention to inequities in input distribution may be more likely to have impact than those which more generally address service quality. Analysis of impact evaluations relating to transparency and citizen engagement in education found that providing information to parents on inputs at school level, along with information on parents' rights and responsibilities, was more impactful than providing information on school outcomes (Read and Atinc, 2017).

Evidence from other developing countries suggests that increasing awareness of PTR disparities can improve distributions: in the Philippines, for example, PTR disparities were reduced between 2002 and 2004 using a simple, highly public categorization of schools by PTR, with schools with a PTR of below 24 labeled 'blue' and those with a PTR over 50 labeled 'red'. This publicly-available categorization proved highly effective at driving better targeting of teacher allocations by giving "marginal schools a voice they previously lacked" (Genito, Roces and Somerset, 2005).

Policy makers and officials within the Government of Malawi and at local level are now aware of the extent of PTR inequities and of the potential for these and other policy innovations to reduce inefficient distribution of teachers. The revised remote school allowance scheme is also expected to move towards implementation in 2018. In addition, the government has recently entered into an agreement with the Global Partnership for Education, a collection of donors, to implement a US$45 million Education Sector Improvement Project. This includes results-based financing incentives for improvement in PTR in eight disadvantaged districts, a measure which is expected to drive improvements in teacher allocations in these districts. The project also includes trials of real-time data collection in schools, which should provide a more up-to-date and accurate central record of on-the-ground PTR disparities; as well as new systems for community dialogue around school quality, which may provide a platform for greater community engagement on issues of staffing.

The institutionalization of the proposed categorization, and the implementation of the proposed policies, is now underway. It is expected that the A-C categorization will become the basis of guidance issued to DEMs by the central Ministry of Education on the allocation of teachers to schools this year. Future papers will present evidence of the progress of implementation and their actual impact on PTR inequities through quasi-experimental design.

Our findings are broadly reflective of those from other developing countries. However, there are some unique elements both to Malawi's challenge and to our proposed solution. A striking finding from political economy discussions was that nepotism and cronyism relationships, rather than more sophisticated networks of party patronage or clientelist vote-buying, appear to drive the involvement of elected and non-education officials in teacher allocations. This is somewhat surprising in the context of Malawi's *competitive clientelism* and evidence of politically motivated targeting of resources in other sectors, notably agriculture. This finding also contrasts with Roser and Fahmi's (2016) analysis of teacher management in Indonesia, where MPs primarily become involved in the management of teachers primarily in order to achieve political ends, rewarding supporters and punishing opponents. A potential explanation is that Malawi's patronage networks, which are highly personalized and informal, may appear indistinguishable from cronyism to local-level observers. Further, detailed research is required to more fully illustrate the balance of 'the personal and the political' in driving elected officials to intervene in teacher allocations.

In terms of our proposed policy response, in contrast to other similar efforts which have categorized schools based on PTR, we propose a categorization based on the *determinants* of PTR – remoteness and amenities – the micro-geographic factors that drive teacher choices to move to a given school. Strong empirics provide legitimacy to the categorization of schools, and empower DEMs to reason with the teacher on where they are assigned and how they will be compensated for the relative hardship. It is the general acceptance of the framework of targeting teachers to the right schools, coupled with incentives to compensate them, for relative hardship that is likely to drive improvements in PTRs in Malawi.

Not all Malawi's policy problems around teacher management can be solved through better data. Nevertheless, the signs are that the provision of better data has already begun to shift the system toward rules-based decision-making and in so doing, begun the move towards a fairer distribution of Malawi's teachers. The implementation of these policies over the next few years will provide a valuable opportunity for further research to assess the extent to which improved data enable a transition towards more rules-based decision-making. Creating data to support decision-making is the easy part; creating a culture that values data and uses it at all levels to enforce these rules is a more challenging task.

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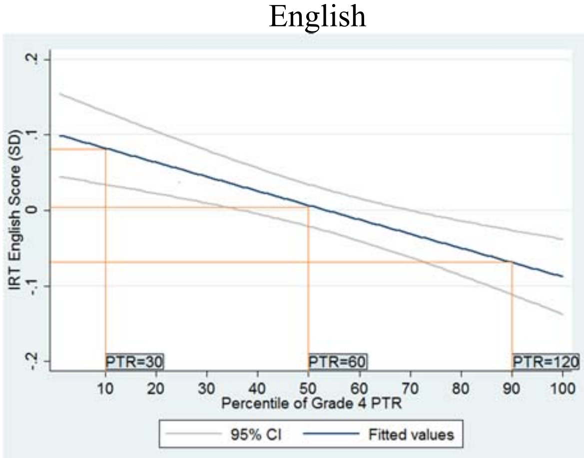
Table 1: Summary Statistics: Status of Primary Education in Malawi

Variable	2010	2011	2012	2013	2014	2015	2016
Total Schools	5,193	5,225	5,252	5,359	5,390	5,415	5,470
Total Students	3,819,168	3,996,831	4,149,364	4,441,907	4,603,589	4,724,186	4,810,561
Total Teachers	46,380	51,529	55,121	63,143	64,298	68,250	62,125[1]
Teachers on Established Posts (Qualified[2])	40,953	42,983	44,256	51,866	51,707	57,913	57,850
Pupils-Teacher-Ratio	82.33	77.56	75.28	70.35	71.60	69.22	77.43
Rural area	85.04	78.71	75.80	69.95	71.15	68.73	77.69
Urban area	63.30	67.76	70.61	74.58	76.55	74.99	74.83
Pupils-Teacher-Ratio (Qualified)	93.24	92.99	93.76	85.64	89.03	81.57	83.15

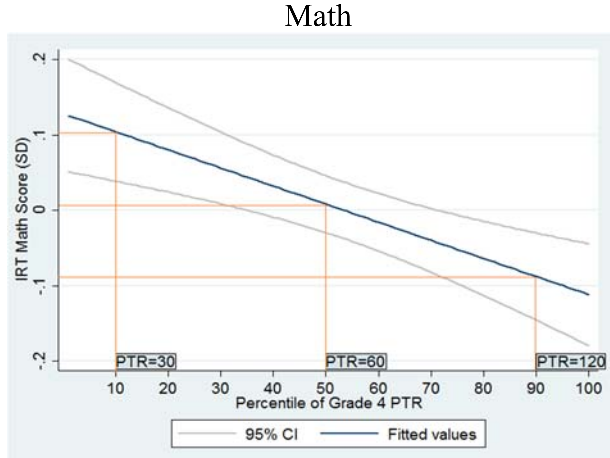
Notes: [1]In 2015, recruitment of new teachers was frozen for one year. Surplus graduates from training colleges are hired two years after graduation. [2]In Malawi, all teachers that have successfully graduated from training colleges and are assigned a permanent grade-level post are considered qualified. Subsequent analysis is limited to qualified teachers.

Figure 1: Percentile of Pupil-Teacher-Ratio and IRT Scores for Grade 4, by Subject

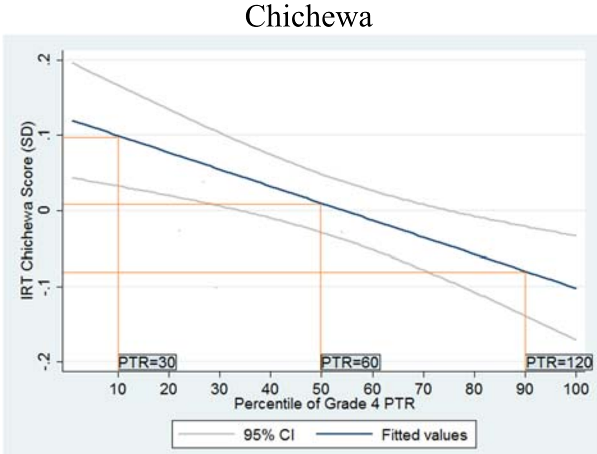
English



Math

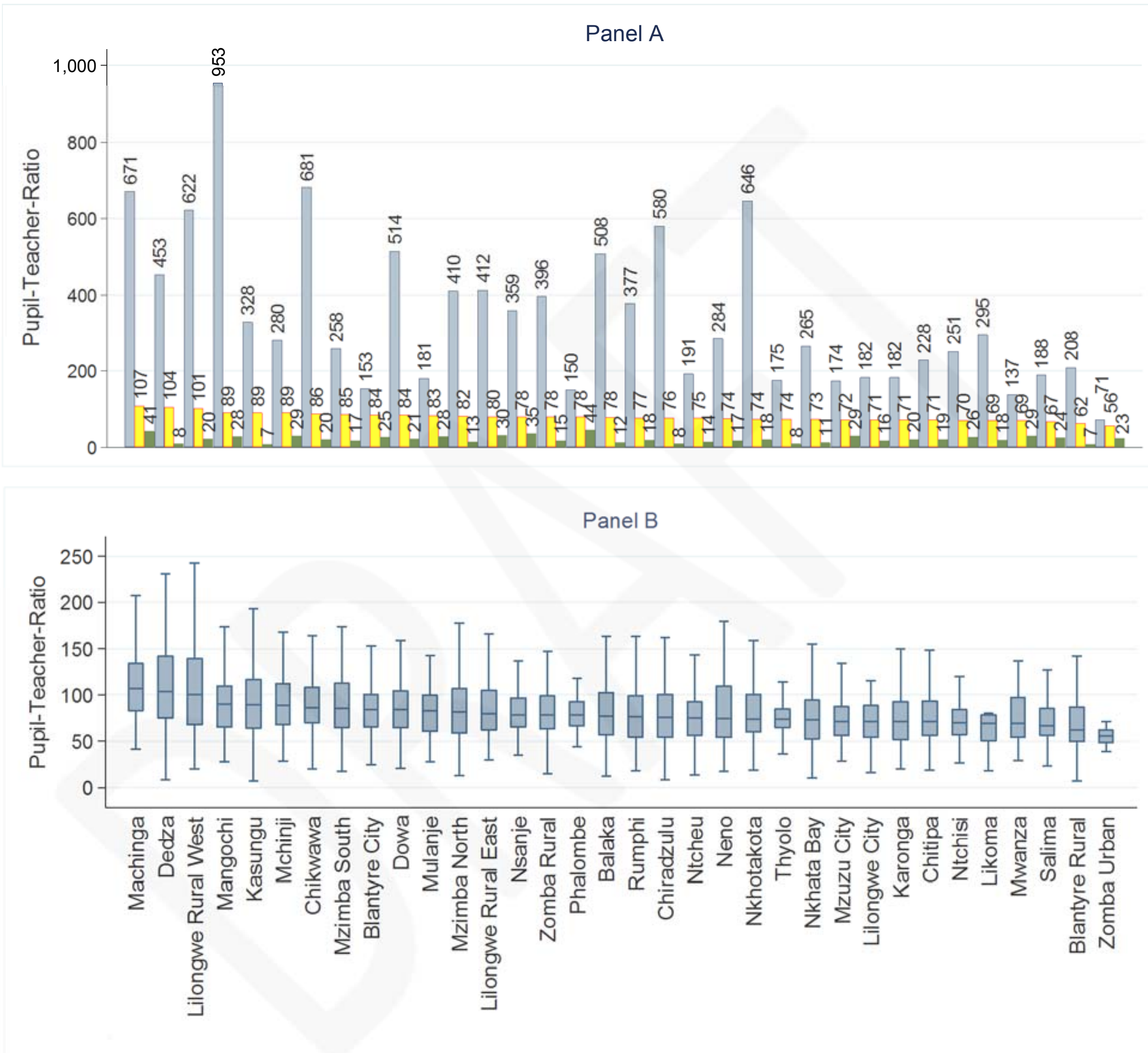


Chichewa



Notes: Source: World Bank, 2017

Figure 2: Pupil-Teacher-Ratio (PTR) by District



Notes: Panel A: Grey, green and yellow bars refer, respectively, to the maximum, minimum and median PTRs for districts shown in the horizontal axis. Panel B: Modified box plot with upper and lower limits estimated as: Q1 - 1.5 (Q3 - Q1) (lower), Q3 + 1.5 (Q3 - Q1) (upper)—these correspond to the min-max of the whiskers in the box plot and differ from actual min-max as they exclude outliers.

Table 2: Decomposition of School-Level Pupil-Teacher Ratios

Decomposition Dimension	Proportion of total variance	
2–Level Variance Components Model		
Between zones	489.5	16.1%
Within zones, between schools	2543.1	83.9%
Total Variation	3032.7	100.0%
3–Level Variance Components Model		
Between districts	104.6	3.5%
Within districts, between zones	380.9	12.6%
Within zones, between schools	2542.9	84.0%
Total Variation	3028.5	100.0%

Table 3: Determinants of Pupil-Teacher-Ratios at School-Level

	(1) OLS	(2) Fixed Territory Effects (Districts)	(3) Fixed Territory Effects (Zones)
Access to Electricity (Yes=1)	-8.60***	-6.98***	-5.56***
	(1.62)	(1.64)	(1.64)
Access to Road (Yes=1)	-5.82***	-5.52***	-3.68**
	(1.39)	(1.42)	(1.47)
Distance to TC (km x 10)	14.47***	13.74***	11.25***
	(1.39)	(1.42)	(1.74)
Number of TC Amenities	-7.12***	-6.06***	-3.08***
	(0.72)	(0.75)	(0.98)
Availability of Teacher Houses	20.46***	22.87***	17.15***
	(1.32)	(1.43)	(1.47)
Political Party (DPP=1)	-7.60***	1.07	0.36
	(1.49)	(1.75)	(2.90)
Adj R-squared	0.13	0.17	0.17
N	5,420	5,420	5,420

Notes: Standard deviations reported in parentheses. Parameter estimates statistically different than zero at 99% (***), 95% (**) & 90% (*) confidence. Availability of teacher houses is equal to 1 if teacher housing available for majority of teacher teachers and 0 otherwise. We also control for school size (number of students), share of open air classrooms in schools, number of toilets in use (not displayed).

Figure 3: PTR by Distance to Trading Centers

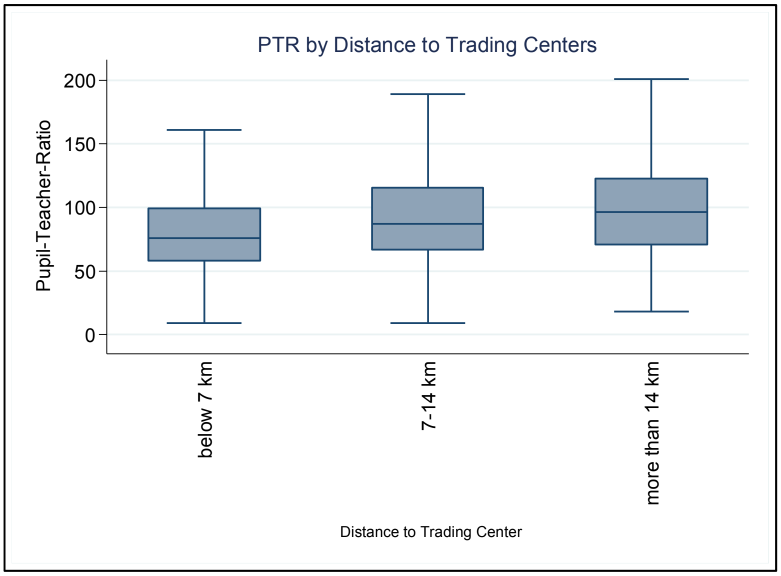
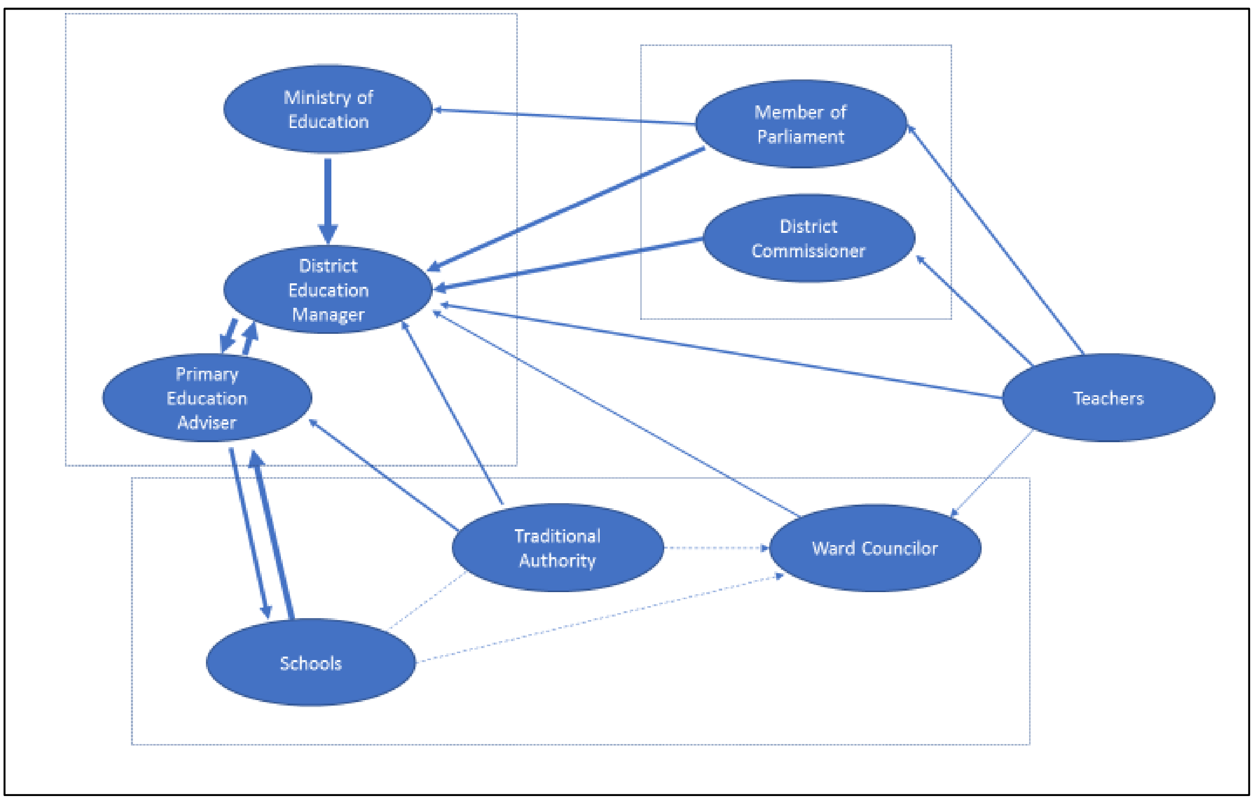


Figure 4: Network Map of Influence in Teacher Distribution



Notes: Reflects focus group data from meetings convened to identify the key actors and the strength of their influence in a scenario of where a teacher seeks to relocate from a remote school. Arrowed lines reflect direction of influence; thickness of lines represents strength of influence, averaged across the panels in focus groups. The actors in the top-left box represent the official education management structure; those in the top-right box represent district-level non-education-specific actors; and those in the bottom box represent community-level actors.

Table 4: Classification of Schools: Remoteness and Access to Amenities

Category	Subcategory	Distance to Trading Centers	Road & Electricity is Available	Trading Center's Amenities
Category A	A1	> 14 km	No	All (2 or more)
	A2	> 14 km	No	Partial (1 or less)
	A3	> 14 km	Yes	Partial (1 or less)
	A4	7-14 km	No	All (2 or more)
	A5	7-14 km	No	Partial (1 or less)
Category B	B1	> 14 km	Yes	All (2 or more)
	B2	7-14 km	Yes	Partial (1 or less)
	B3	< 7 km	No	Partial (1 or less)
	B4	< 7 km	Yes	Partial (1 or less)
Category C	C1	7-14 km	Yes	All (2 or more)
	C2	< 7 km	No	All (2 or more)
	C3	< 7 km	Yes	All (2 or more)

Table 5: Distribution of Schools, Teachers and Students by Category

Category	Number of schools	Number of qualified teachers	Number of students	Average PTR at school level
Category A	1,657	12,461	1,145,998	100.6
Category B	1,696	16,638	1,388,291	91.9
Category C	2,117	32,408	2,274,601	80.7
Total	5,470	61,507	4,808,890	90.2

Notes: Shows the categorization of schools into three categories based on facilities and distance to trading center. Category A schools are more than 7km from a trading center and lack facilities at the school level. Category B schools are more than 14km from a well-developed trading center with all facilities available at school, or are less than 14km from a trading center which lacks facilities. Category C schools are 7-14km from a well-developed trading center and have all facilities at school, or are less than 7km from a well-developed trading center.

Table 6: Distribution of New Teachers According to the Current Distribution

	Original Distribution of Teachers		% Schools with PTR<60	Non-Targeted Allocation of New Teachers		Distribution of Teachers after Non-Targeted Allocation of New Teachers and Attrition		
	# of Qualified Teachers	as % of Total		# of New Teachers	as % of Total	# of Qualified Teachers	as % of Total	PTR
Category A	12,461	20.3%	17.2%	1,013	20.3%	13,279	20.3%	86.3
Category B	16,638	27.1%	19.9%	1,353	27.1%	17,730	27.0%	78.3
Category C	32,408	52.7%	33.1%	2,634	52.7%	34,539	52.7%	65.9
Total	61,507[1]	100.0%	24.2%	5,000	100.0%	65,547	100.0%	73.4

Notes: Simulates impact on category-level PTRs of allocating 5000 additional teachers according to category-level distribution of existing teachers, minus one year's attrition.[1] Total teachers from district-level curated database as on April 2017. [2] Models category-level attrition based on average over last three years from EMIS. Average attrition is total 960 teachers per year.

Table 7: Distribution of New Teachers to Minimize PTR Disparities

	Original Distribution of Teachers		% Schools with PTR<60	Targeted Allocation of New Teachers		Distribution of Teachers after Targeted Allocation of New Teachers and Attrition		
	# of Qualified Teachers	as % of Total		# of New Teachers	as % of Total	# of Qualified Teachers	as % of Total	PTR
Category A	12,461	20.3%	17.2%	2,951	59.0%	15,217	23.2%	75.3
Category B	16,638	27.1%	19.9%	2,049	41.0%	18,426	28.1%	75.3
Category C	32,408	52.7%	33.1%	0	0.0%	31,904	48.7%	71.3
Total	61,507	100.0%	24.2%	5,000	100.0%	65,547	100.0%	73.4

Notes: simulates impact on category-level PTRs of allocating 5000 additional teachers in in order to minimize differences in category-level PTR, minus one year's attrition. [1,2] as Table 6.

Table 8: Proposed Remote Posting Allowance Scheme

	Option 0 (Current)	**Option 1 (Proposed)**	**Option 2 (Proposed)**
Category A, Kwacha	10,000	25,000	25,000
Category B, Kwacha	10,000	10,000	10,000
Category C, Kwacha	10,000	5,000	0
Immediate Monthly Cost to the Government, Million Kwacha			
Without targeting of new teachers[1]	525.5	682.0	509.3
With targeting of new teachers[2]	525.5[3]	724.2	564.7

Notes: [1] Models immediate cost of allowance based on teacher distribution as in Table 6; [2] Models immediate cost of allowance based on teacher distribution as in Table 7; [3] Estimate based on 80% of teachers claiming allowance.

Table 9: Teachers Responding to Allowance Scheme, New Teachers Distributed according to Current Distribution

	Original Distribution of Teachers		% Schools with PTR<60	Distribution of Teachers after Non-Targeted Allocation of New Teachers and Attrition		Distribution of Teachers after Reallocation between Categories Owing to Allowance		
	# of Qualified Teachers	as % of Total		# of New Teachers	as % of Total	# of Qualified Teachers	as % of Total	PTR
Category A	12,461	20.3%	17.2%	13,279	20.3%	14,660	22.4%	78.2
Category B	16,638	27.1%	19.9%	17,730	27.0%	19,111	29.2%	72.6
Category C	32,408	52.7%	33.1%	34,539	52.7%	31,776	48.5%	71.6
Total	61,507	100.0%	24.2%	65,547	100.0%	65,547	100.0%	73.4

Notes: simulates impact on category-level PTRs of allocating 5000 additional teachers according to category-level distribution of existing teachers, minus one year's attrition; as well as impact of allowance as (i) reducing net movement of teachers from more remote category schools to less remote category schools to zero; (ii) driving 8% of category C teachers to move to Category A and B schools, in equal proportion.

Table 10: Allowance Scheme Sensitivity Analysis

	8% Teachers Move	4% Teachers Move	0% Teachers Move
Category A	78.2	82.0	86.3
Category B	72.6	75.4	78.3
Category C	71.6	68.6	65.9
Total	73.4	73.4	73.4

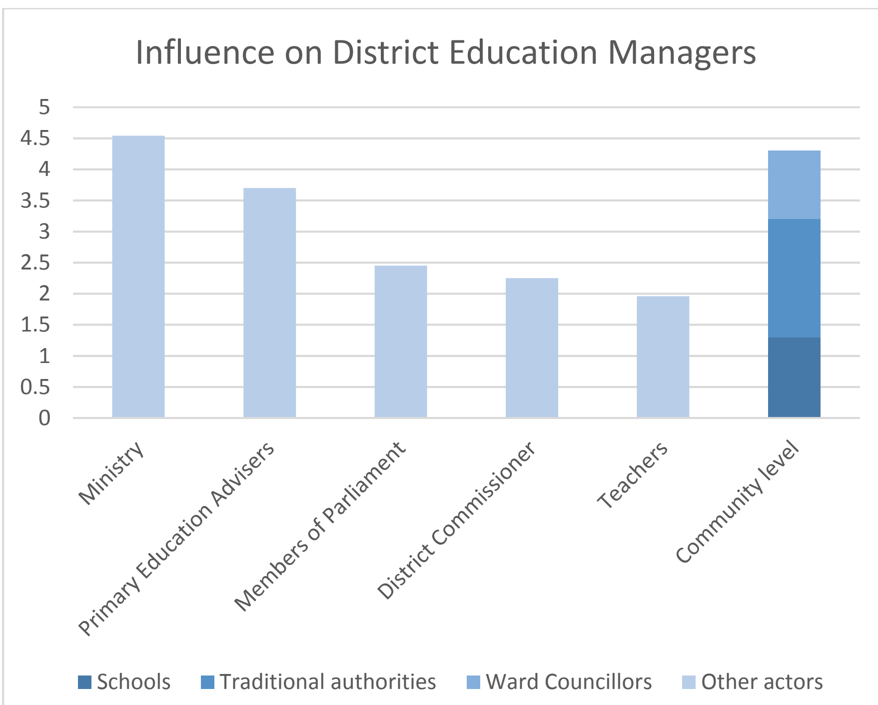
Notes: We simulate impact in one year of allowance as (i) reducing net movement of teachers from more remote category schools to less remote category schools to zero; (ii) driving either 8%, 4% or 0% of Category C teachers to move to Category A, B and C schools, in equal proportion. Assumes same scenario of targeting of new teachers as Table 9.

Table 11: Teachers Responding to Allowance Scheme, New Teachers Distributed to Minimize PTR Disparities

	Original Distribution of Teachers		% Schools with PTR<60	Distribution of Teachers after Targeted Allocation of New Teachers and Attrition		Distribution of Teachers after Reallocation between Categories Owing to Allowance		
	# of Qualified Teachers	as % of Total		# of New Teachers	as % of Total	# of Qualified Teachers	as % of Total	PTR
Category A	12,461	20.3%	17.2%	15,217	23.2%	15,855	24.2%	72.3
Category B	16,638	27.1%	19.9%	18,426	28.1%	19,064	29.1%	72.8
Category C	32,408	52.7%	33.1%	31,904	48.7%	30,628	46.7%	74.3
Total	61,507	100.0%	24.2%	65,547	100.0%	65,547	100.0%	73.4

Notes: We simulate impact of deploying 5000 new teachers in order to minimize differences in category-level PTR; and of allowance as (i) reducing net movement of teachers from more remote category schools to less remote category schools to zero; (ii) driving 4% of category C teachers to move to Category A and B schools, in equal proportion.

Figure 5: Influence on District Education Managers by Actor



Notes: The chart reflects focus group data from meetings convened to identify the key actors and the strength of their influence over District Education Managers in a scenario where a teacher seeks to relocate from a remote school. Panels scored influence of each actor over DEMs out of ten. Figures show score for each actor's influence over DEM, averaged across all panels which addressed this scenario.

Annex contents

Annexes available at: http://tiny.cc/AsimChimomboChugunovGera

Annex 1: Additional Tables and Figures

Annex 2: Implementation and Sustainability