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The Political Economy of Bad Data: Evidence from African Survey & Administrative Statistics

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Abstract

Administrative data across multiple African countries on health, education, agriculture, and poverty systematically exaggerate progress relative to independent surveys. We find evidence for two explanations for these discrepancies: political interference and weak state capacity. Evidence of political interference arises when aid donors pay for results (e.g., immunization rates across 41 countries) or statistics are politically salient (e.g., inflation in Cameroon). In contrast, central governments are themselves misled when civil servants reporting data are responsible for measured progress (e.g., agricultural production in Tanzania) or data determines funding allocations (e.g., school enrollment across 21 countries). These two phenomena suggest distinct policy agendas.

Keywords: Africa, national statistics systems, household surveys, administrative data, immunization, school enrollment, EMIS, HMIS

JEL Classification Numbers: C83, E31, I15, I25, I32

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1 Introduction

There is a growing consensus among international observers that official statistics in Sub-Saharan Africa are woefully inadequate and unreliable, what Devarajan (2013) calls a "statistical tragedy". In response to this tragedy, the U.N. High Level Panel on post-2015 development goals has called for a "data revolution" to improve tracking of economic and social indicators in Africa and the rest of the developing world (United Nations, 2013). The agenda emerging around these discussions has tended to assume that more money and better technology will solve the problem, focusing on an expansion of survey data collection efforts, and a push for national governments to disseminate information under open data protocols (Caeyers, Chalmers, and De Weerdt, 2012; Demombynes, 2012).

Do these solutions address the underlying causes of bad statistics? Relatively less attention has been paid to understanding why national statistics systems became so badly broken in the first place, or to analyzing the perverse incentives which any data revolution in Sub-Saharan Africa must overcome. We attempt to fill this gap by documenting systematic discrepancies between data sources on key development indicators across a large sample of countries. By necessity, we focus on cases where multiple independent sources report statistics on ostensibly comparable development indicators. For this we draw on cross-national data within Africa on primary school enrollment and vaccination rates taken from the Demographic and Health Surveys (DHS), and contrast it with data from education and health management information systems maintained by line ministries. We complement this analysis with case studies on agricultural statistics in Tanzania and Cameroon's consumer price index and poverty figures.

The paper is organized around three interlinked principal-agent problems. In the first case, an international aid donor (the principal) seeks to allocate resources between and evaluate the performance of a national government (the agent). The principal requires data to monitor agents' performance. Recognizing the risks inherent in "self-reported" official statistics, international donors invest heavily in the collection of survey data on households, farms, and enterprises. Notably, these surveys involve considerable foreign technical assistance paid for directly by donors. In the extreme case of the DHS data sponsored by the U.S. Agency for International Development (USAID) and other partners – on which much of the analysis below relies – the donors insists on a standardized questionnaire format in all countries, donor consultants train the data collectors and oversee fieldwork, and all or most raw data is sent back to the donor country for analysis and report writing.

Donors can't always rely on such carefully controlled data products like the DHS though, and Section 3 shows the predictable results when donors link explicit performance incentives to administrative data series managed by national governments. In 2000, the Global Alliance for Vaccines and Immunization (GAVI) offered eligible African countries a fixed payment per additional child immunized against DTP3, based on national administrative data systems. Building on earlier analysis by (Lim, Stein, Charrow, and Murray, 2008), we show evidence that this policy induced upward bias in the reported level of DTP3 coverage amounting to a 5% overestimate of coverage rates across 41 African countries.

In short, pay-for-performance incentives by a donor directly undermined the integrity of administrative data systems. To invert the common concern with incentive schemes, "what gets measured gets managed," in the case of statistics it appears that what gets managed gets systematically mis-measured, particularly where few checks and balances are in place.

A second, closely-related dimension of the accountability problem underlying national statistics relates national governments to citizens. Statistical literacy in the region is low, and the role of economic data in public discourse is limited, but there are exceptions to this rule, particularly for the highly visible phenomenon of rising consumer prices. Section 3.2 illustrates the potential pitfalls of politically salient data series with a case study of the measurement of inflation in consumer prices in Cameroon in the 1990s, which also has direct implications for the measurement of poverty reduction. We show that survey data provides an alternative means of deflating consumer prices. The evidence for Cameroon in the 1990s, as well as several other cases discussed in Sandefur (2013), suggests official CPI series understate inflation and, thus, that official figures published by, e.g., the World Bank are therefore overoptimistic about the pace of poverty reduction.

In the cases of immunization and prices statistics, national governments mislead international donors and their citizens, whether by accident or design. But in other cases national governments themselves are systematically misled, creating an important obstacle to domestic evidence-based policymaking.

In this third accountability relationship discussed in Section 4, national governments and line ministries (the principal) seek to allocate resources between and evaluate the performance of public servants such as nurses and teachers (the agents). By and large, the information the principal relies on in such settings comes from administrative data systems based on self-reports by the very agents being managed. The result is systematic misreporting, undermining the state's ability to manage public services, particularly in remote rural areas.

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Section 4.1 illustrates this problem in primary school enrollment statistics. Comparing administrative and survey data across 46 surveys in 21 African countries, we find a bias toward over-reporting enrollment growth in administrative data. The average change in enrollment between surveys is roughly one-third higher (3.1 percentage points) in administrative data – an optimistic bias which is completely absent in data outside Africa. Delving into the data from two of the worst offenders – Kenya and Rwanda – shows that the divergence of administrative and survey data series was concomitant with the shift from bottom-up finance of education via user fees to top-down finance through *per pupil* central government grants. This highlights the interdependence of public finance systems and the integrity of administrative data systems. Difference-in-differences regressions on the full sample confirm that the gap between administrative and survey of just 2.4 percentage points before countries abolished user fees grew significantly by roughly 10 percentage points afterward.

Section 4.2 demonstrates that this problem is not unique to education with a case study of agricultural statistics in Tanzania from 2003 to 2008. Tanzania's Agricultural Routine Data System (ARDS) produces annual crop production statistics for each of 169 districts in the country. However, these numbers are produced by agricultural extension agents whose primary responsibility is to disseminate new farming techniques and increase yields, and the data is passed up through district and regional officials with similar incentives. The result, as we show, is reported increases in maize output that are roughly 50% higher than the best available survey estimates for the same period.

This three-part framework relating the reliability of statistics to the accountability relationships between donors, national governments and citizens clearly abstracts from certain nuances, as does any useful model. Household survey data are not *only* used by international donors as a tool to monitor aid recipients. Donor agencies also use survey data for research purposes, and recipient governments frequently cite survey reports in planning documents and incorporate survey data into the construction of macroeconomic aggregates like GDP which are key indicators in domestic policymaking. Conversely, international donors are not completely apathetic about administrative data systems, and indeed invest heavily in education and health management information systems in the region. Nevertheless, we believe the political economy dynamics suggested by this framework, however simplistic, help make some sense of the seemingly chaotic data discrepancies documented in the paper.

Seen through the lens of this framework, the agenda for a data revolution in African economic and social statistics clearly must extend beyond simply conducting more household

Figure 1: Primary school enrollment

(a) Net enrollment by country   (b) School-level enrollment in Kenya
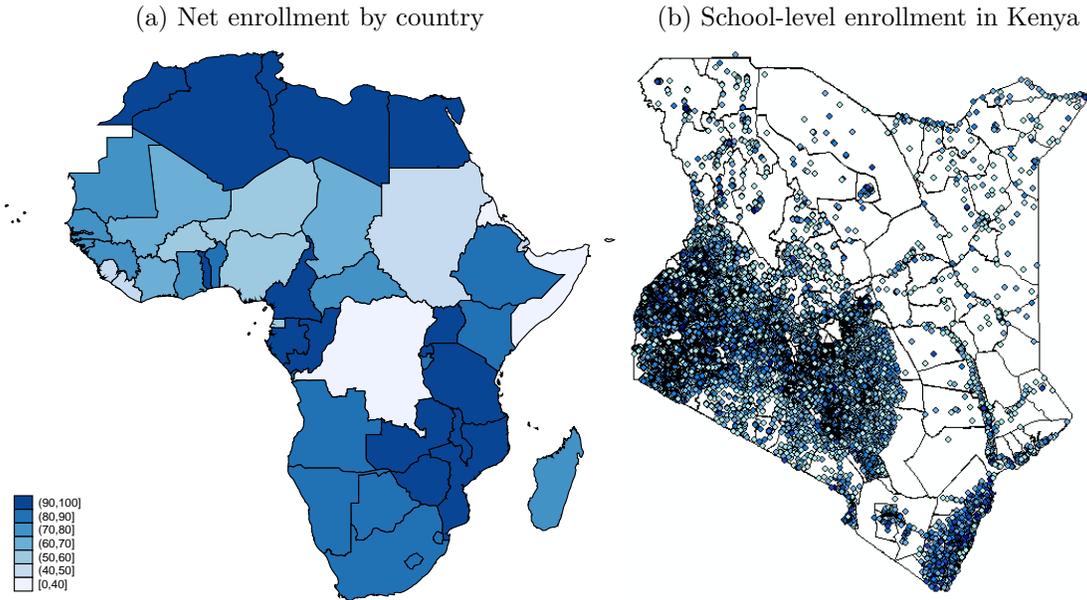
surveys to help donors circumvent inaccurate official statistics – to avoid, as we label it, being fooled by the state. If donors are genuinely interested in promoting an evidence-based policymaking process, they must assist government to avoid being systematically fooled itself by administrative data systems built on perverse incentives. Aid resources must be directed in a way that is complementary to, rather than a substitute for, statistical systems that serve governments' needs.

2   Seeing like a donor versus seeing like a state

The different needs of donors and government present trade-offs between the size, scope, and frequency of data collection activities. In stylized form, this creates a choice between (i) small-sample, technically sophisticated, possibly multi-sector, infrequent surveys designed to facilitate sophisticated research and comparisons with other countries, and (ii) large sample surveys or administrative data sets providing regional or district level statistics on relatively fewer key indicators at higher frequency, designed for comparisons across time and space within a single country.

Table 1: Trade-offs in agricultural survey design: Tanzania

	Sample of Villages	Frequency	Questionnaire Pages
Agricultural Routine Data System	≈10,000	1 year	0
National Sample Census of Agriculture	≈2,500	5 years	≈25
National Panel Survey	≈250	2 years	≈100

2.1 Harmonization across time and space

International aid donors must make allocation decisions across countries, and in many cases they are bound to working solely with national governments as their clients. This shapes their demand for data in two ways.

First, because of their concern with international allocations, donors' preferences skew toward statistics based on standardized international methodologies and homogenized questionnaire formats. At times this desire for international comparability is directly at odds with comparability over time within a single country. Tanzania's national poverty estimates are a prime example of this tension. Starting in 2008, the World Bank and the Bill & Melinda Gates Foundation put financial resources and technical support behind a new integrated household survey known as the Tanzania National Panel Survey as a tool for measuring poverty rates using a standardized questionnaire module employed by the World Bank's Living Standards Measurement Surveys (LSMS) in many parts of the world. World Bank economists simultaneously discouraged the government and other donors from continuing to conduct Tanzania's Household Budget Survey (HBS). The HBS uses a different and arguably superior methodology for poverty measurement as compared to the new panel survey (Beegle, De Weerdt, Friedman, and Gibson, 2012), and had maintained a comparable time-series on poverty measurement from 1991 to 2007. But this methodology differed from World Bank practice in Uganda and Kenya. A full switch from the HBS to the NPS poverty series, and thus a loss of any ability to measure the progression of living standards over time in Tanzania, was averted only after strong resistance from the Tanzanian government.

2.2 Geographic disaggregation and link to political accountability

The second key implication of donors' concern with international comparisons is that it renders them relatively less concerned with internal, sub-national comparisons. Household survey data sets reflect this preference. Consider the case of primary education in Kenya. The

Demographic and Health Surveys which provide comparable information across countries and time on both health and schooling outcomes are designed to provide only provincial level estimates in Kenya, with most analysis focusing on a single set of national or rural and urban statistics.[1]

This household survey design yields fully-populated regional maps like the one on in Figure 1a, which shows net primary enrollment rates for 52 African countries from the World Bank's 2010 World Development Indicators. In stylized form, this map reflects the needs of a donor sitting in Washington, allowing them to evaluate, say, Kenyan and Tanzania performance in primary schooling (by one very crude metric) on a comparable basis.

But national governments need to make sub-national resource allocation decisions. To be useful, data is often required at relatively low levels of disaggregation that coincide with units of political accountability. Ministries of Health require up-to-date information on clinics' stocks to manage their supply chain; Ministries of Education require school-level enrollment statistics to make efficient staffing decisions. In Kenya, the education ministry obtains this information from the country's Education Management Information System (EMIS), three times a year, for all twenty-thousand government schools in the country, as shown in Figure 1b.

Arguably, citizens' interests are better-aligned with the preferences of their own governments as opposed to national governments in this case. In order for citizens to exert bottom-up accountability of public service providers they require data in an extremely disaggregated form. Kenya's national trends in literacy rates are likely of limited interest to citizens of rural Wajir, but the local primary school's performance on national exams relative to neighboring villages may be of acute interest. Thus, appropriately, the Kenyan government's "open data portal" provides access to the disaggregated administrative data shown in the detailed map Figure 1b. (Unfortunately, as we show in Section 4.1, the reliability of this data is questionable.)

2.3 Breadth and frequency

International aid donors wield enormous analytical capacity to utilize statistical data. Meanwhile, government line ministries in most low-income African countries lack staff with advanced training in statistical analysis, and often even the software necessary to attempt it.

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[1]At the time of the last DHS, Kenya had eight provinces. This allowed at least limited correspondence between survey estimates and units of political accountability. In neighboring Tanzania, the mainland was at the time of the last survey divided into twenty-one regions, but the survey reported results for just seven aggregate zones corresponding to no known political division.

At the level of civil society, statistical numeracy among newspaper readers or even NGO staff is likely to be extremely low.

Donor agencies with higher analytical capacity demand different statistical products. First, donors' high human resource capacity in technical matters allows them to track and analyze a wide range of quantitative indicators and sub-indicators. Thus the breadth of topical coverage demanded from surveys is high. Questionnaires are long and in-depth, rather than short and quick. This demand for breadth and depth in topic coverage presents a direct budgetary trade-off with breadth of sample coverage. Bigger surveys, that might provide disaggregate data at the regional or district level, give way to longer surveys with smaller samples that track a wide-range of indicators but only at the national level.

For example, Table 1 shows basic meta-data for the three primary data sources available on agricultural production in Tanzania during the 2000s, which we return to in Section 4.2. The administrative data system maintained by the Ministry of Agriculture, Food Security and Cooperatives (known as the Agricultural Routine Data System, or ARDS) aims to cover the entire country via agricultural extension agents located in (roughly) all ten-thousand villages of the country, producing crop estimates for every season. Until quite recently, however, the ARDS used no fixed questionnaire; extension agents were simply asked to file a written report summarizing their estimates of crop output – raising obvious questions about the basis for these estimates and comparability across villages. The Ministry also actively participates in a sample survey led by the National Bureau of Statistics known as the National Sample Census of Agriculture (NSCA). The NSCA uses a fairly extensive 25-page questionnaire, and samples a very large number of villages (roughly 2,500) enabling it to produce district-level estimates, but is only collected every five years. Finally, the Ministry also provides token support to a separate survey described earlier, the National Panel Survey (NPS), which includes an agriculture module funded by the Bill and Melinda Gates Foundation. Relative to many donor-funded integrated household surveys, the NPS is quite frequent, conducted every two years. But the sample includes only 250 rural villages preventing the computation of district or even regional estimates of crop production.

In addition to the trade-off (for a given budget) between sample size and frequency, the Tanzanian agriculture example also illustrates another related feature of donor demand that reinforces the tendency toward longer, smaller surveys: the desire for integrated household surveys. Instead of expanding the scope or frequency of the survey, Table 1 shows that resources in the donor-funded NPS are devoted instead to an extensive questionnaire exceeding one-hundred pages in length and requiring a three- to four-hour interview per household.

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Technical experts in donor agencies are frequently (and laudably) eager for data to conduct multivariate regression analysis on important development topics. What factors determine farm yields for smallholders? How much less likely are poor people to seek professional medical attention, conditional on suffering a given ailment? These analyses can be important for the design and evaluation of policies, and they clearly require measuring multiple variables for the same household. That implies the need for integrated household surveys that collect data on, for example, maize yields, household labor supply, land ownership, consumption poverty, self-reported morbidity, and health care utilization all in the same questionnaire. The complexity of the resulting data sets rises quickly with the length of the questionnaire, requiring advanced knowledge of statistical software packages to merge and transpose data files from various survey modules.

<p style="text-align:center">* * *</p>

In summary, viewed from the perspective of national governments' data needs for policy planning and management purposes, household surveys perform poorly in terms of geographic representativeness and frequency. Many surveys provide only national estimates, offering little guidance to domestic policymakers allocating resources and attention between sub-national units. Few surveys are able to provide statistics at the district or equivalent level, and many are unable to provide even regional or provincial estimates. Furthermore, surveys of household income, health outcomes, agricultural production, and other key indicators typically occur only once every several years, often with long lags between data collection and the publication of statistics.

The overwhelming strength of household surveys in Sub-Saharan Africa, however, is that they provide information that is likely to be much more reliable in that it is better documented and collected with much higher levels of international technical assistance and oversight. While this section has focused on outlining the theoretical advantages of administrative data sources, the following two sections turn to the core task of the paper, documenting the deep flaws with administrative data systems in practice and diagnosing the causes of these ills.

3 Fooled by the state: Political interference and weak analytical capacity

In this section we turn to role of national statistics in holding national governments accountable to international donors, as well as their own citizens. Relative to other government functions, the production of national statistics in sub-Saharan Africa is highly dependent on foreign aid. [2] Donors demand statistics for a variety of purposes including, but not limited to, the allocation of aid resources across countries, and the evaluation of specific programs as well as recipient governments' overall economic management. We study these dynamics in Section 3.1 in the case of an explicit donor incentive scheme to promote vaccinations, and subsequently in Section 3.2 we turn to the issue of domestic political accountability in a case study of poverty and inflation figures from Cameroon.

## 3.1 Immunization rates across 41 countries

The health sector provides an important case study of the tension between more reliable, smaller sample, less frequent survey data and high-frequency administrative data with limited quality controls which purports to cover the entirety of the population. Like EMIS databases in education examined below, many countries' health management information systems (HMIS) databases rely on self-reported info from clinic and hospital staff, which aggregated up by district and regional health officers, each with potentially perverse incentives.

There are a number of reasons why HMIS and survey sources may disagree. Numerators in administrative data can be inaccurate due to incomplete reporting, reporting on doses distributed rather than administered, repeat vaccination or omission of the private sector and non-governmental organizations. Denominators can be inaccurate due to migration, inaccurate or outdated census estimates or projections, inaccurate or incomplete vital registration systems, among others. Indeed, Brown (2012) notes that denominators are frequently estimated by program managers in each country for the WHO's Expanded Program on Immunization, based on counts or estimates by local program staff or health workers. Finally,

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[2]McQueston (2013) shows that in Ethiopia (2007-2008) and Malawi (2007-2011) over 80% of funding for the national statistics office came from direct donor support, while national statistics offices in Tanzania (2008-2014) and Kenya (2008-2009) received 36% and 54% from aid donors, respectively.

Figure 2: Vaccination rates: WHO vs DHS
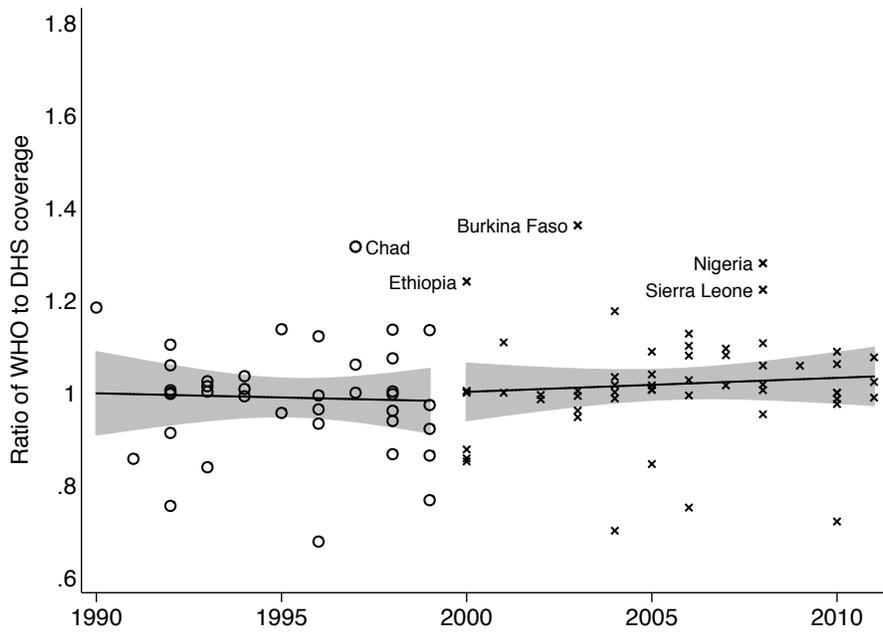
(a) DTP
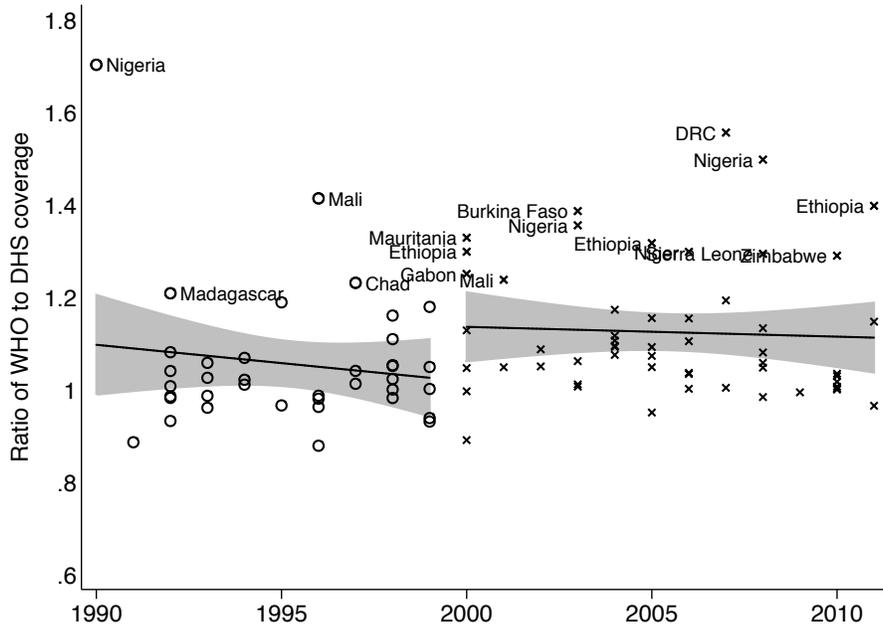
(b) Measles

Table 2: Immunization rates: Regression results

	DTP3			Measles			Pooled		
	Level		Change	Level		Change	Level		Change
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Year ≥ 2000	13.00	5.49	4.59	9.91	2.10	1.88	9.91	2.41	.79
	(3.95)***	(1.10)***	(2.49)*	(3.34)***	(1.45)	(2.85)	(3.35)***	(1.45)*	(2.73)
DHS rate		.87	.93		.94	.63		.90	.79
		(.03)***	(.09)***		(.04)***	(.22)***		(.03)***	(.15)***
DTP3							-.24	2.34	-2.33
							(2.21)	(.85)***	(1.88)
(Year ≥ 2000) × DTP3							3.09	2.86	4.50
							(1.87)*	(1.26)**	(2.68)*
Const.	61.11	9.38	-2.25	61.34	3.20	.22	61.34	5.50	.29
	(4.06)***	(2.07)***	(2.30)	(3.87)***	(2.65)	(2.27)	(3.88)***	(2.02)***	(2.25)
Observations	93	93	56	93	93	56	186	186	112
Countries	41	41	26	41	41	26	41	41	26

The sample is restricted to African countries. Each column shows a separate regression. The dependent variable is the immunization rate reported in administrative data via the WHO. The unit of observation is a country-year for a given disease. Each regression in columns 1-6 includes one observation per country-year, while the pooled regressions in columns 7-9 include two observations per country-year: one for DTP3 and one for measles. "Year ≥ 2000" is a dummy variable for the years 2000 and beyond; DTP3 is a dummy variable that takes the value of one for DTP3 rates and zero for measles rates. For the first two columns under each disease, both the dependent variable and the DHS rate are measured in levels; in the third column under each disease both of these variables are measured in changes (i.e., first differences between survey rounds). All standard errors are clustered at the country level. Asterisks (*, **, ***) denote coefficients that are significantly different from zero at the 10, 5 and 1% levels, respectively.

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in countries where immunization card distribution, retention and utilization are suboptimal and mothers report vaccination coverage from memory to enumerators, survey-based coverage estimates can be biased, particularly for multi-dose vaccines that can be under-reported (WHO and UNICEF, 2012).

One additional layer of perverse incentives for accurate reporting in the health context is the policy of aid donors to link payments to progress on HMIS indicators. Starting in 2000, the Global Alliance on Vaccines and Immunizations (GAVI) offered low-income countries cash incentives for every additional child immunized with the third dose of the vaccine against diphtheria, tetanus, and pertussis (abbreviated as DTP3) based on HMIS reports. Lim, Stein, Charrow, and Murray (2008) compare survey-based DTP3 immunization rates and their growth over time with HMIS or administrative rates reported to the WHO and UNICEF, finding that survey-based coverage has increased more slowly or not at all when compared to administrative reports.

We extend this analysis along several dimensions to attempt to isolate the causal role of the GAVI performance incentives on misreporting in a sample of African countries. We focus on two childhood vaccinations – DTP3, which was the target of the incentive scheme, and the vaccine against measles, which was not included in the scheme – comparing official administrative statistics reported to the WHO and vaccination coverage measured using the Demographic and Health Survey (DHS) instrument, widely considered a more accurate source of population-level data. Our estimation strategy amounts to a quadruple-difference estimate of the effect of this policy, comparing (i) changes over time (ii) in survey versus administrative data, (iii) before and after 2000 (iv) for DTP3 versus measles.

Let c index countries, d diseases (DTP3 or measles), and t years. We regress changes over time within the same country in vaccination rates as measured in administrative data, ΔV_{cdt}^{WHO}, on the equivalent change in survey data, ΔV_{cdt}^{DHS}.

$$
\begin{aligned}
\Delta V_{cdt}^{WHO} = {} & \beta_0 + \beta_1 \Delta V_{cdt}^{DHS} + \beta_2 I[t \geq 2000] + \beta_3 I[d = DTP3] \\
& + \beta_4 I[t \geq 2000] \times I[d = DTP3] + \varepsilon_{cdt}
\end{aligned} \tag{1}
$$

We alternate between estimating equation (1) in levels rather than differences, and running separate regressions for DTP3 and measles. Here the coefficient of interest is β_2, which measures whether discrepancies increased after the GAVI scheme was introduced (i.e., when $I[t \geq 2000]$ takes a value of one). We then pool the data so that each country-year reports two observations. In the pooled specification, the parameter of primary interest is β_4, the

coefficient on the interaction between a dummy variable for observations in 2000 or later and a dummy variable for observations of DTP3 rather than measles vaccination ($I[t \geq 2000] \times I[d = DTP3]$). Our estimate of $\hat{\beta}_4 > 0$ measures the degree to which the discrepancy between administrative and survey data grew more rapidly over time for DTP3 vaccinations relative to measles vaccinations after the onset of the GAVI scheme in 2000.

Starting with the simplest single-difference comparison, Table 2 reports regression estimates of DTP3 and measles immunization coverage before and after the onset of GAVI incentive scheme (essentially, estimating β_2 in isolation). The dependent variable in each case is the immunization rate from the administrative HMIS reported to the WHO. Without controlling for other variables, average DTP3 rates in our sample of 93 observations spanning 41 countries increased by 13 percentage points from 2000 onward (column 1), while measles coverage increased by roughly 10 percentage points (column 4). Column 7 pools the data from both diseases to compute the difference-in-differences (the shift after 2000 in administrative data for DTP3 relative to measles) and shows that this divergence in immunization rates of 13 versus 10 points is statistically significant at the 10% level.

Controlling for the coverage rate reported by the DHS puts the focus directly on discrepancies between administrative and survey data. When including this control, DTP3 coverage rates in the administrative data rose by 5.5 percentage points after 2000 (column 2, statistically significant at the 1% level) while measles coverage rose by only 2.1 points (column 4, insignificant). Column 8 shows that this triple-difference is again significant (now at the 5% level). Finally, we look at changes over time immunization rates before and after 2000 to produce a quadruple-difference comparison. As see in column 9, discrepancies in administrative data on DTP3 coverage accelerated significantly (4.5 percentage points, significant at the 10% level) relative to measles rates.

To summarize, in the case of both DTP3 and measles, we find over- and under-reporting of vaccination coverage by administrative sources [CITE FIGURES], with some countries such as X consistently over-reporting vaccination coverage data. However, when comparing trends in discrepancies over time using the ratio of WHO to DHS coverage, DTP3 shows a clear shift in the extent of over-reporting when GAVI introduces its ISS incentives in the early 2000s, while measles over-reporting remains consistent over time. This analysis confirms and updates the findings of Lim, Stein, Charrow, and Murray (2008); without greater verification of self-reported administrative data, financial incentives from donors may affect the accuracy of data used by the vaccination program.

While over-procuring inexpensive vaccines such as measles (at 3 cents a dose) does not imply large additional costs or major trade-offs with other health system priorities, newer vaccines donated by the GAVI Alliance cost about US$3.50 per dose, and require several doses. As a result, every vaccine purchased that is not used due to inaccurate numerators or denominators in vaccination coverage implies significant expense and opportunity cost, both in lives and money.

Not all, or perhaps even most, of the discrepancies in HMIS data are the result of the incentives to misreport provided by the GAVI ISS program. The issue of weak state capacity to monitor front-line service providers discussed in Section 4 is likely crucial here as well. We note this to caution against interpreting the analysis here to imply that health systems suffer from one type of malaise, while education systems suffer from another. We do not believe this is the case: rather the health data provides the opportunity to identify one specific problem, and the education data another.

Note also that vaccination coverage is only one of many essential indicators of health system performance that are affected by weak institutional capacity to collect and analyze data. For example, even in countries where vital registration systems are almost complete in terms of coverage, the quality of reporting remains an important problem. In South Africa, where 89% of adult deaths are reported via the vital registration system, a death certificate audit found errors in 45% of all records (Yudkin, Burger, Bradshaw, Groenewald, Ward, and Volmink, 2009; Nojilana, Groenewald, Bradshaw, and Reagon, 2009; Bradshaw, Groenewald, Bourne, Mahomed, Nojilana, Daniels, and Nixon, 2006; Burger, Van der Merwe, and Volmink, 2007). A 2009 study found that 43 out of 46 countries in the WHO/AFRO region had no population-level data on cause of death (Mathers, Boerma, and Fat, 2009).

3.2   Consumer price inflation in Cameroon, 1996-2001

While economic journalists in many OECD countries pore over quarterly GDP reports or monthly unemployment statistics, in many low-income countries in Sub-Saharan Africa there is a paucity of economic data available to the general public on a timely and frequent basis. GDP is typically produced annually, for instance, and unemployment figures only every several years, and released with considerable delay. An important exception is inflation in the consumer price index (CPI), which is collected monthly and usually in the public domain. As a result, the CPI frequently becomes a highly politicized focal point for debate about the

Figure 3: Inflation and poverty reduction in Cameroon

(a) Inflation
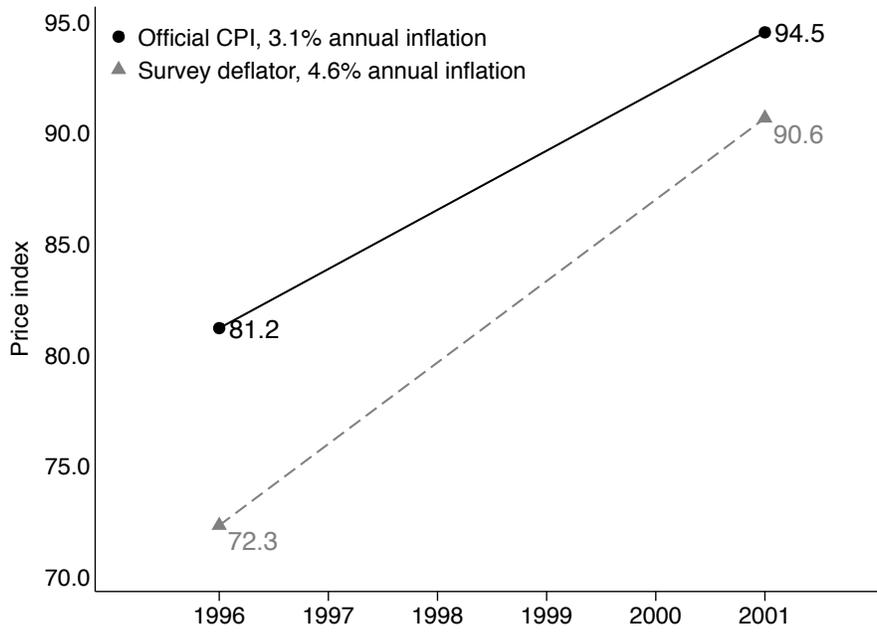
(b) Poverty
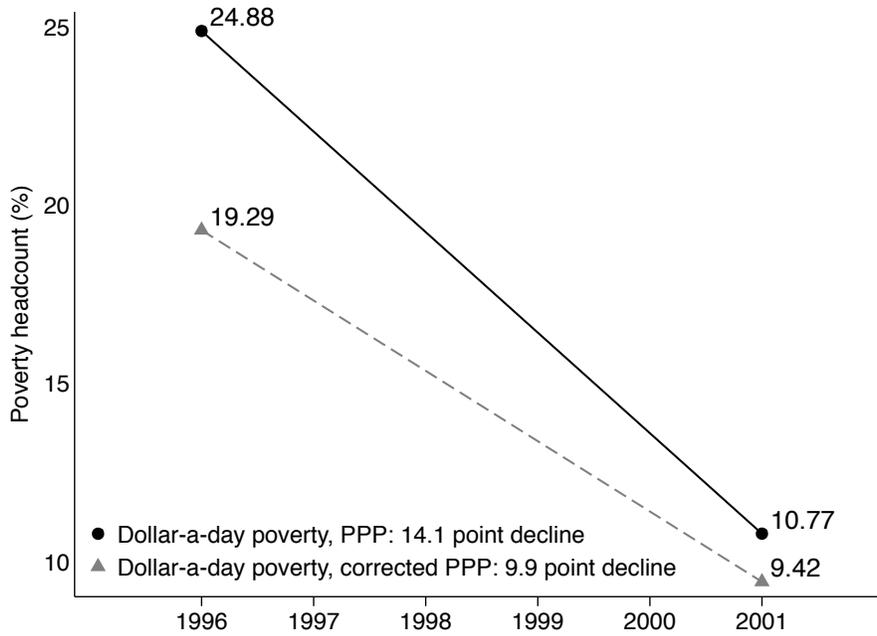
state of the economy. The political salience of consumer prices is perhaps best underscored by the large literature on the role of food price rises on social unrest (for a recent empirical analysis, see Bellemare, 2011).

The concerns about the accuracy of inflation series are typically very different from the concerns regarding, say, school enrollment data discussed in Section 4. Unlike head teachers reporting enrollment numbers that will determine how much funding their school receives, NSO employees conducting price surveys in regional markets have little incentive to misreport. Instead, typical concerns are twofold. First, and most obviously, governments may suppress the reporting of high inflation when this indicator becomes politically sensitive. Second, computation of a CPI is a relatively complex task which African NSOs with low technical capacity must perform under tight time pressure, and for which they receive rather little technical assistance relative to the large international presence in household surveys. For instance, major economies in East Africa delayed for several years in moving from the use of arithmetic to geometric means to compute average prices in their CPI series as recommended by the ILO, leading to possible biases in the series due to outdated methodologies (Keeler, 2009).

Sandefur (2013) demonstrates how household survey data can be used to check and/or replace CPI series when calculating deflators for poverty estimates or GDP growth rates. Consumption surveys underlying most poverty measures in Africa collect data on unit values, i.e., the price paid by the household per unit. Unit values are used in the construction of cost of basic needs (CBN) poverty lines which measure the cost in local prices of consuming a basic food basket plus some allowance for non-food expenditure (Ravallion, 2008). CBN lines thus provide an alternative, independent measure of consumer prices, collected at the same time and for the same households as used in poverty analysis.

We present the case of Cameroon, where two comparable, nationally representative household consumption surveys were conducted in 1996 and 2001, the ECAM I and II respectively. In each case, a national poverty line was calculated using the CBN approach based on the cost of consuming 2,900 calories per day following the consumption patterns of a representative consumer. This yielded a poverty line of CFA 185,490 in 1996 and CFA 232,547 in 2001 (International Monetary Fund, 2003).[3]

In contrast, Cameroon's official CPI is based on monthly surveys of market prices in twelve urban locations. Differences in rural and urban prices (and, more importantly, their

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[3]Relative to these lines, the national poverty headcount rate fell from 53.3% to 40.2% from 1996 to 2001 (*op. cit.*).

changes over time) are ignored. From 1996 to 2008 the weights applied to these sites were based on 1996 population data without update (National Institute of Statistics of Cameroon, 2008).

Figure 3a shows the evolution of these two alternative price deflators from 1996 to 2001. We have rebased both series using a benchmark year of 2005, the base year for international PPP calculations. The official CPI series began in 1996 at a base of 81.2 and rose to 94.5 in 2001, representing a trend annual inflation rate of 3.1%. Meanwhile, the deflators based on the household survey data underlying the national poverty lines began at 72.3 in 1996 and rose to 90.6 in 2001 yielding an annual inflation rate of 4.6% over the same period.

This discrepancy in reported inflation rates has direct implications for measured poverty reduction. It is not obvious why this is the case. National poverty lines are frequently deflated survey data precisely for the purpose of avoiding the need to rely on questionable CPI series. However, international poverty lines – such as the PPP$1.25 per-person per-day absolute poverty line computed by the World Bank, a.k.a., the dollar-a-day line – do not rely on these survey deflators. Even when using household survey data to compute poverty rates (i.e., to count the number of people below the line), international poverty estimates rely on lines which are deflated using CPI data to calculate PPP exchange rates for the relevant year.

The results of recalculating international dollar-a-day poverty rates using survey-based deflators for Cameroon over this period is depicted in Figure 3b. Official dollar-a-day poverty for Cameroon in 1996 as reported by the World Bank's PovcalNet database was 24.9%, and fell quite rapidly to 10.8% by 2001. Applying the survey deflators to recalculate PPP values, absolute poverty began in 1996 at just 19.3% and fell somewhat more slowly to 9.4% by 2001. Thus while official deflators yield poverty reduction of 14 percentage points in five years, survey estimates show a decline of just under 10 percentage points.

What can we conclude from this discrepancy? There is nothing in the data nor the documentary record that we are aware of to suggest deliberate manipulation of the CPI series by the Cameroonian government. More charitable hypotheses would attribute discrepancies to (a) innocent calculation mistakes, or (b) differences in the methodology underlying the calculation of the CPI and the CBN poverty lines. The latter explanation is perhaps not entirely exculpatory given the questionable choices in CPI methods, e.g., ignoring rural areas and population shifts over time. But in either case, the politically convenient outcome from the government's point of view of the CPI calculations during this recent historical episode

suggest the need for either greater technical capacity or protection from political interference within the National Institute of Statistics.

4 Fooling the state: Incentive compatibility in data collection

Having focused in the previous section on the role of national governments as suppliers of statistics, we return to the challenges facing national governments as users of statistics for evidence-based policymaking.

We discuss the pitfalls of the principal-agent relationship between central governments and front-line service providers scattered across the country. Rather than managing a single agent, line ministries require data on thousands of schools, clinics, police stations, water points, and road maintenance activities across the country. Given African states' weakness in terms of their ability to exert control over or provide government services to remote populations, it is perhaps unsurprising that they struggle to collect reliable data on these same activities.

We draw parallel lessons from two sectors: education and agriculture. Notably, in both cases administrative data systems are commonly based on self-reports by low-level public servants. The resulting biases are disproportionately in the direction one might expect given the inherent conflicts of interest in data collection, and they help point to lessons about (a) how public finance systems and administrative data systems must be designed in tandem to avoid compromising the integrity of the evidence base for policymaking, and (b) how surveys could be designed to complement and correct rather than substitute for administrative data sets.

4.1 School enrollment across 21 countries

We compare two independent sources of information on primary school enrollment: administrative records and household surveys. Administrative records are drawn primarily from the Education Monitoring and Information System (EMIS) databases sponsored by UNESCO and maintained by Ministries of Education throughout the region. EMIS data is typically compiled from reports submitted by school officials and aggregated up. We compare these

records to survey-based estimates of school enrollment, focusing both on levels at a point in time and trends over time.

The full sample of the 21 country-year periods for which comparable administrative and survey data are available is listed in Table 3. Fifteen of the 21 spells show discrepancies in the direction of greater optimism in the administrative data relative to household surveys. This tendency appears to be particularly pronounced in sub-Saharan Africa: the average gap between enrollment growth in administrative versus survey data (i.e., the degree of over-optimism in administrative data) was 3.1 percentage points in the African sample, but was slightly in the pessimistic direction at -0.8 for the 15 observations available from non-African countries.

There are multiple reasons why EMIS records may exhibit systematic biases. The first is underreporting of private schools. There is evidence from household surveys of a rapid increase in private schooling in at least some countries (Bold, Kimenyi, Mwabu, and Sandefur, 2011a), and even where theoretically required to report to EMIS, unregistered schools may have little incentive to do so. The second, potentially more damaging bias stems from the incentives for public school officials to report accurately. The abolition of school fees for primary education in much of the region has brought a shift, in many cases, to a system of central government grants linked to the head-count of pupils. In Tanzania, for instance, enrollment rates in the EMIS database suggest the country is on the verge of reaching the Millennium Development Goal of universal primary enrollment. Yet household survey estimates show that 1 in 6 children between ages 7 and 13 are not in school (Morisset and Wane, 2012).

We explore the second hypothesis by examining two cases from Table 3 which exhibit large discrepancies and where survey data spans the abolition of user fees in primary education: Kenya and Rwanda.

Kenya abolished user fees in government primary schools beginning with the 2003 school year. Figure 4a shows the trend in net primary education spanning this reform as reported by the Ministry of Education's (MOE) administrative data, as well as two independent household survey data sources: two rounds of the DHS conducted in 2003 and 2008, and two successive surveys conducted by the Kenyan National Bureau of Statistics (KNBS) in 1997 and 2006.[4] The striking feature 4a is the steady upward trend in enrollment, including

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[4]These are the 1997 Welfare Monitoring Survey and the 2006 Kenyan Integrated Household Budget Survey, which measured comparable indicators of primary school enrollment. For further discussion of these surveys and the effect of Kenya's free primary education policy on enrollment, see (Bold, Kimenyi, Mwabu, and Sandefur, 2011b).

Table 3: Changes in primary school enrollment

Country	Years		Admin. data			Survey data			Gap	FPE
	Start	End	Start	End	Δ	Start	End	Δ		
Kenya	1998	2003	56.4	74.2	17.8	82.3	78.7	-3.6	21.4	2003
Rwanda	2005	2010	81.9	98.7	16.9	85.4	87.3	1.9	15	2003
Ethiopia	2000	2005	40.3	61.9	21.6	30.2	42.2	12	9.6	2002
Cameroon	1991	2011	70	93.8	23.7	63.7	78.3	14.6	9.1	1999
Burkina Faso	1993	1999	26.9	33.3	6.4	26.6	25	-1.6	8	2007
Kenya	2003	2008	74.2	82	7.8	78.7	78.7	0	7.8	2003
Benin	1996	2006	62	87.1	25.1	41.8	60.1	18.3	6.8	2006
Burkina Faso	2003	2010	36.5	58.1	21.5	28	44.4	16.4	5.1	2007
Eritrea	1995	2002	26.5	43.2	16.7	36.6	50.3	13.7	3	2005
Niger	1992	2006	22.3	43.2	20.9	13.6	32.1	18.5	2.4	2009
Ethiopia	2005	2011	61.9	86.5	24.6	42.2	64.5	22.3	2.3	2002
Guinea	1999	2005	43.2	68.3	25.1	21.6	45	23.4	1.7	
Senegal	2005	2010	72.2	75.5	3.3	52	54.3	2.3	1	2001
Namibia	1992	2000	82.6	88.1	5.5	76.5	81.3	4.8	0.7	2013
Burkina Faso	1999	2003	33.3	36.5	3.2	25	28	3	0.2	2007
Tanzania	1999	2004	49.3	86.2	36.9	35	73.1	38.1	-1.2	2001
Tanzania	1992	1996	50.6	48.7	-1.9	26.2	27.3	1.1	-3	2001
Nigeria	1999	2003	61.3	65.6	4.3	56.7	64.2	7.5	-3.2	1999
Nigeria	2003	2008	65.6	58.8	-6.8	64.2	62	-2.2	-4.6	1999
Tanzania	1996	1999	48.7	49.3	0.6	27.3	35	7.7	-7.1	2001
Lesotho	2004	2009	73.9	71.9	-2	80.9	88.8	7.9	-9.9	2000
Ave.: Africa					12.9			9.8	3.1	
Ave.: Other					3.8			4.5	-0.8	

Table reports the starting and ending rates (%) of net primary enrollment in the administrative data reported in the WDI data base and the DHS survey data, and their respective changes over time. The "gap" measures the difference between the rise in the admin data and the rise in the survey data. The FPE column lists the date that the country removed user fees for public primary education.

a sharp jump with the introduction of free primary education, juxtaposed with absolutely no change in enrollment measured by either household survey.

Rwanda, which also abolished user fees for primary education in 2003, presents a similar, if slightly less stark picture in Figure 4b. Administrative data from the Ministry of Education (MINEDUC) shows steady enrollment growth spanning the abolition of fees. The DHS rounds from 2000 to 2005 confirm this general growth trend, but the 2005 to 2010 rounds of the DHS show a very modest increase from 85 to 87% net enrollment, while the administrative data shows a huge leap over the same period from 82 to 99%.

To test whether the patterns observed in Kenya and Rwanda represent a systematic pattern in the data, we draw on the full sample of African countries for which comparable administrative and survey data is available. This includes 46 spells spanning 21 countries,

Figure 4: Trends in net primary enrollment: various sources
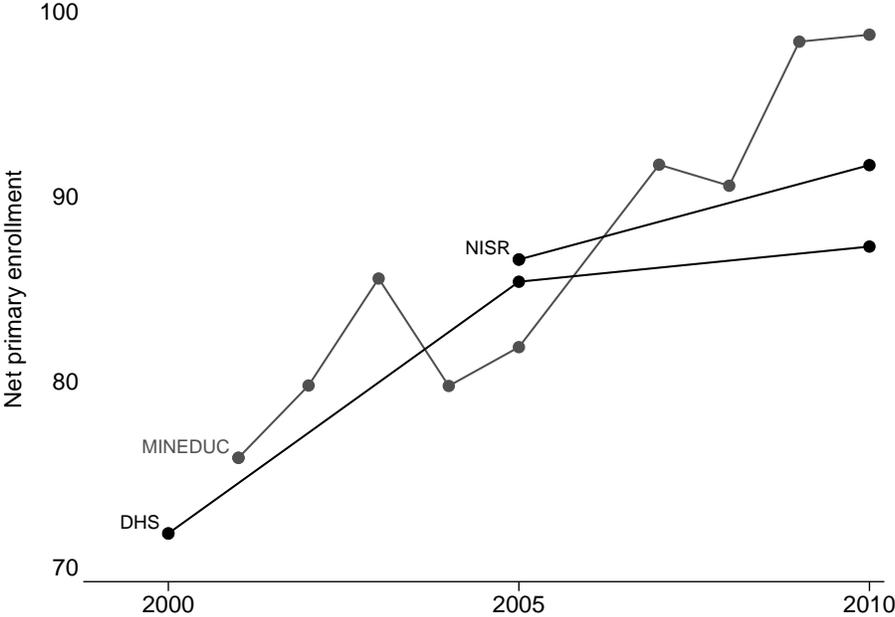
(a) Kenya
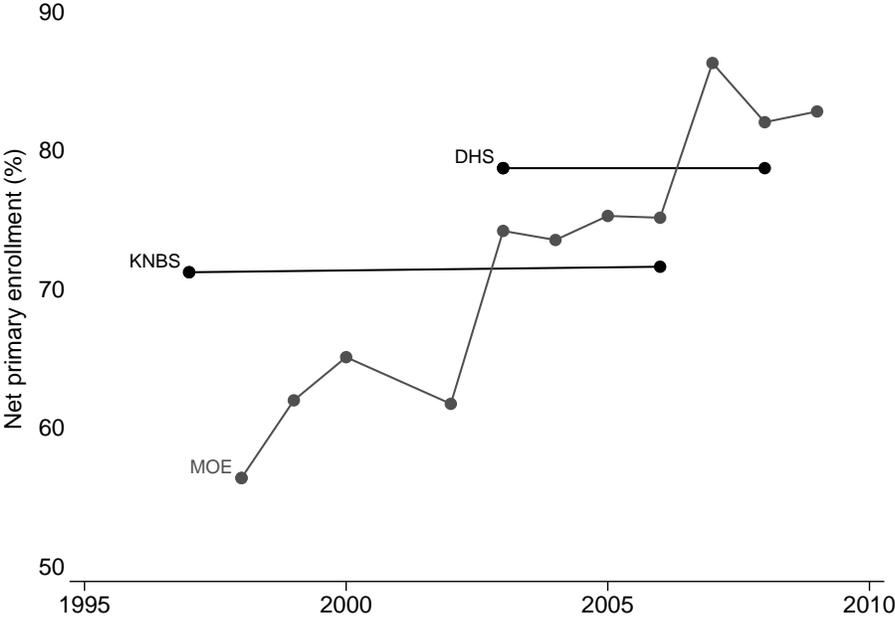
(b) Rwanda

Table 4: Primary school enrollment rates: Regression results

	DHS		WDI			
	Level (1)	Change (2)	Level (3)	Change (4)	Level (5)	Change (6)
Free primary educ (dummy)	15.81 (7.48)**	6.46 (5.66)	15.30 (6.79)**	14.89 (4.90)***	4.93 (4.82)	10.25 (3.59)***
Time trend	1.38 (.66)**	.34 (.43)	.96 (.53)*	.49 (.43)	.06 (.45)	.25 (.42)
DHS enrollment (%)					.66 (.12)***	.72 (.18)***
Const.	42.40 (7.71)***	4.79 (2.25)**	56.81 (7.79)***	5.84 (2.75)**	29.00 (7.14)***	2.40 (2.77)
Obs.	46	21	46	21	46	21
Countries	21	14	21	14	21	14

The sample is restricted to African countries. Each column shows a separate regression. The dependent variable is the primary school enrollment rate as measured by either the WDI (primarily administrative data) or DHS (survey data). The unit of observation is a country-year. In columns labeled 'Change', the dependent variable as well as both the FPE dummy and the DHS enrollment variable are measured in first-differences, as shown in equation (2). The time trend is a year variable set to zero in 2000. All standard errors are clustered at the country level. Asterisks (*,**,***) denote coefficients that are significantly different from zero at the 10, 5 and 1% levels, respectively.

of which 35 spells are drawn from the 14 countries in Table 3 with more than one data point over time. Using a methodology similar to the vaccination regressions in Section 3.1, we regress changes in primary school enrollment from administrative data (ΔE_{ct}^{WDI}, as reported in the World Bank's World Development Indicators) on changes in enrollment in survey data (ΔE_{ct}^{DHS}).

$$\Delta E_{ct}^{WDI} = \gamma_0 + \gamma_1 \Delta E_{ct}^{DHS} + \gamma_2 \Delta FPE_{ct} + \gamma_3 t + \upsilon_{cdt} \tag{2}$$

We estimate equation (2) both in levels and in changes. In both cases, the parameter of interest is γ_2, which measures the extent to which the gap between administrative and survey-based enrollment rates diverged after the introduction of free primary education.

As a preliminary step, columns 1 and 2 of Table 4 use the DHS enrollment rates as the dependent variable, showing that enrollment rates were nearly 16 percentage points higher for observations in our sample after fees were abolished, though when comparing like with like (i.e., in the first-difference specification in column 2), this change falls to just 6 percentage points and is statistically insignificant. Columns 3 and 4 repeat this exercise for the WDI administrative data, which rose by 15% on average and remained at 15% when comparing changes within the same country, significant at the 1% level in both cases. Finally, columns 5 and 6 estimate the full specification shown in equation (2), with the administrative data as

the dependent variable and the survey data as a control. Our estimate of $\hat{\gamma}_2$ is 4 percentage points (statistically insignificant) in the levels specification in column 5, but rises to 10.3% (significant at the 1% level) when comparing changes within the same country in column 6. In all cases, standard errors are clustered at the country level.

To summarize, we find that administrative data sources claim enrollment increases that are more than twice as fast after FPE than comparable survey sources – a differential of roughly ten percentage points.

While the patterns in Kenya and Rwanda, and even from the econometric results for the broader sample of countries, are far from definitive proof of a causal chain from top-down funding for education to the production of unreliable enrollment statistics, they are suggestive of an important link between funding systems and data systems. EMIS in much of the region appear to have been designed with little regard for the incentives faced by teachers and education officials to report accurately. With the onset of free primary education, these incentives changed radically, and the data systems have failed to keep up. The resolution to overcoming these perverse incentives is not immediately obvious, but in Section 5 we discuss possible ideas for how survey and administrative data collection efforts could be better integrated so that the former could act as a check on misreporting in the latter.

## 4.2 Agricultural output in Tanzania, 2002/03 - 2007/08

In 2005, Tanzanian President Jakaya Kikwete campaigned on a platform of promoting agriculture (Ngaiza, 2012), and international donors have made grand pledges to renew their focus on increasing agricultural productivity in Tanzania, especially among smallholders (Group of Eight, 2012). Yet various official reports on simple statistics like total output of Tanzania's staple crop, maize, are highly contradictory, indicating either rapid growth or virtual stagnation in production in recent years.

The challenges facing agricultural statistics in Tanzania illustrate two of the general themes of this paper: (i) data quality concerns arising when individuals collecting and collating data have a vested interested in the values they report - a problem we refer to as incentive compatibility – and (ii) a failure to coordinate disparate and duplicative data collection efforts.
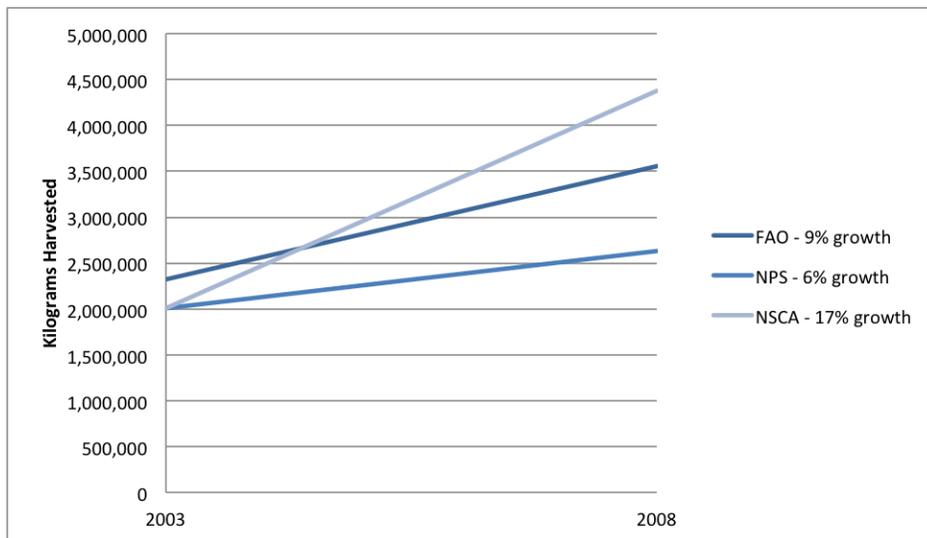
The striking point from Table 1 from the previous section is that in years like 2008, the Tanzanian National Bureau of Statistics conducts three separate surveys to collect the

Figure 5: Trends in agricultural output in Tanzania

(a) FAO provides annual data for several crops
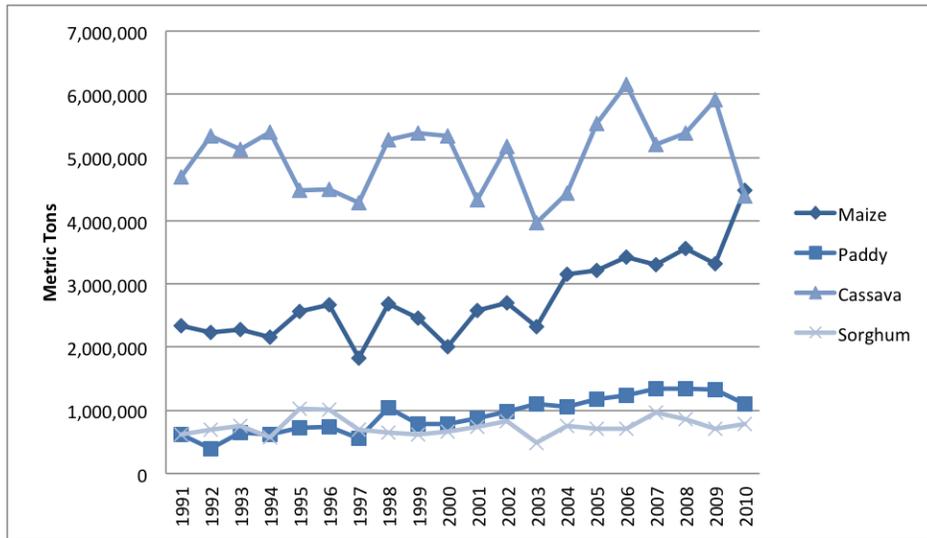
(b) Nationally representative surveys contradict FAO data, and each other

same information (e.g., maize output) from the exact same villages (the samples overlap) for the same season. Indeed, the duplication is actually even worse: in addition to the three sources outlined in Table 1, donors continue to invest in new duplicative surveys to fit specific programming needs – including a USAID survey tailored to its "Feed the Future Initiative" and an enormous baseline survey for the World Bank's evaluation of the National Agricultural Input Voucher Scheme.

The three contradictory maize output series in Table 1 are not random variants. Their credibility is tied up with the trade-offs between sample size and subnational representativeness on the one hand, and survey supervision and data quality on the other.

To be blunt, the credibility of the administrative data series, ARDS, as reported by FAO is highly suspect. The ARDS challenges illustrate the danger of ignoring the incentives to truthful reporting faced by data collectors. The ARDS data is collected by village extension agents. These agents' primary responsibility is to promote new farm technologies, and assist farmers in meeting production goals. Until recently, agents were not provided with any fixed questionnaire or clear methodology to measure output. They were simply requested to report various metrics to the district office. The incentives for truthful reporting faced by an extension agent who has previously been asked by the district commissioner to improve maize yields, and who is now asked to report on the scale of the maize harvest are fairly clear.

At the other extreme, the NPS data is collected by a team of full-time enumerators, all of whom are required to be fully numerate and computer literature. The data collectors travel in teams, under direct supervision of an NBS employee, and enter data in real time which is relayed back to NBS headquarters for verification. (The NSCA is, roughly, a mid-way point between the capital- and skill-intensive NPS model and the low-skill, low-monitoring technology of the ARDS.)

The ARDS provides data that feed into the UN Food and Agriculture Organization's global database, FAO Stat,that is cited in most international policy debates of agricultural production. Figure 5a shows the FAO Stat series for four main staple crops: maize, paddy, cassava, and sorghum. Perhaps the most notable feature of the graph is its completeness: FAO reports national output levels for each crop in each and every year from 1991 to 2010. Within this period, the overall trends are modest, though maize output growth does accelerate in the last decade.

Independent data from household surveys, the NSCA and NPS, portray a very different – but utterly contradictory – picture of agricultural growth. Looking at maize output from the 2002/2003 to the 2007/2008 seasons in Figure 5b allows us to compare three independent, nationally representative, official government statistical sources ostensibly measuring the same thing over the same period. While FAO reports an average annual growth rate in maize production of 9% for this period, the NSCA reports an astronomical growth rate of 17% per annum (National Bureau of Statistics, 2010b). At the other extreme, the NPS reports growth of just 6% per annum (National Bureau of Statistics, 2010a).

These discrepancies are far too large to reflect sampling error. The growth figure of 17% is also out of keeping with other development indicators. Lokina, Nerman, and Sandefur (2011) show that consumption among farm households in rural Tanzania, as measured by a completely independent set of household surveys, grew by only 1% per annum over the period 2000 to 2007. The more rapid growth in the ARDS relative to the NPS is consistent with the overall conceptual framework of this section, in which agricultural extension agents have incentives to inflate production statistics relative to independent survey enumerators from the National Bureau of Statistics overseen by international technical consultants.

More puzzling, however, is that the NSCA – with a clearer and better documented methodology than the ARDS, but with a large sample, less field supervision, and lower levels of technical assistance than the NPS – reported the highest and least credible rate of agricultural growth. This hints at a separate set of institutional constraints (namely low technical capacity for the analysis of complex surveys) discussed in the following section.

In addition to perverse incentives for truthful reporting, the state of agricultural statistics in Tanzania also illustrates the potential gains from greater coordination. Data collection involves enormous economies of scale, implying big cost savings from omnibus surveys that span multiple interests. It is fairly obvious that conducting two separate surveys to measure maize production and fertilizer use among small farmers will not only prevent any analysis of the link between fertilizer and maize yields, but also incur nearly double the costs of recruiting and training enumerators, renting vehicles, etc.

Less obviously, there are enormous gains from coordination associated with two issues discussed in Section 2: sampling and time-series comparability. Coordinating two 5,000 household surveys with nationally representative samples to create a single 10,000 household sample makes it possible, in Tanzania with 25 mainland regions, to report regional level statistics, greatly increasing the usefulness of the information for government. And of course,

if this year's agricultural survey uses the same question phrasing as last year's, its usefulness is infinitely greater. Unfortunately, these simple lessons have been largely neglected in the design of an agricultural statistics system in Tanzania.

5   Discussion and conclusion

While recognizing the different uses and timing of administrative and survey data, our analyses of the discrepancies between administrative data and household survey-based estimates in education, agriculture, health and poverty suggest that in some African countries- there are significant inaccuracies in the data being published by national and international agencies. These inaccuracies are due in part to political interference, limited capacity as well as perverse incentives created by connecting data to financial incentives without checks and balances, and to competing priorities and differential funding associated with donor support.

Further, in spite of international declarations to support statistical capacity in Busan and a concerted effort by the World Bank's IDA and Paris21 to support national statistical strategies, indices prepared by the World Bank and UNECA suggest that performance has not improved much over time, in large part because statistical agencies in the region – particularly those in Anglophone Africa – lack functional independence, fail to attract and retain high-quality staff, depend on external funders for the majority of their spending and experience significant volatility and unpredictability in their year-to-year budgets. Plans are often divorced from budget realities, thus forcing NSOs to prioritize "paying customers" rather than national priorities and core statistical activities as articulated in country developed plans.

Together, these inaccuracies, perverse incentives and lack of functional independence mean that public and private investment decisions based on poor data can be deeply flawed, with major implications for well-being and public expenditure efficiency. Further, open data initiatives and pressure to open data spreading rapidly worldwide- can result in "garbage in, garbage out" if measures are not taken to strengthen underlying source data.

There are clear opportunities to redesign accountability relationships in ways that can serve all kinds of data clients, whether national governments, donors or citizens. Getting administrative and survey data to "speak to each other" is one strategy, where household surveys can be used to provide regular checks on administrative data at different levels.

This analysis has shown that a system to identify perverse incentives currently operating within various sectors including the NSO and line ministries' statistics units could provide a valuable measure of the statistical capacity that matters, and can suggest alternative policy or measurement arrangements. This would be one way to deliberately assess the extent to which administrative data contains avoidable biases and to understand where the introduction of additional checks and balances would be needed to correct the accuracy issues within that data.

New pay-for-performance initiatives between national governments and providers – such as those supported by the World Bank's Health Results Innovation Trust Fund (HRITF) – have deployed both survey and administrative data, using survey data in small, local samples to improve the accuracy of the administrative data used to report performance. HRITF verifies data reported by participating facilities using a representative sample, visited unannounced, while also including penalties for over-reporting measured using the micro-household survey. A clear and relatively rapid jump in the accuracy of self-reported data on quantity of services delivered has been observed. In Cameroon, for example, independent verification of administrative data helped reduce over-reporting of outpatient consultations by over 90% in less than a year. Still, there remains much to learn about the optimal strategy for measuring and verifying service quality.

These kinds of mutually reinforcing administrative plus survey data verification arrangements will make all kinds of results-based funding work better, whether between a national government and subnational providers, or between donors and recipient country governments.

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