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Decentralization's effects on education and health: Evidence from Ethiopia

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Decentralization's effects on education and health: Evidence from Ethiopia

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Abstract

We explore the effects of decentralization on education and health in Ethiopia using an original database covering all of the country's regions and *woredas* (local governments). Ethiopia is a remarkable case in which war, famine and chaos in the 1970s-80s were followed by federalization, decentralization, rapid growth and dramatic improvements in human development. Did decentralization contribute to these successes? We use time series and panel data analyses to show that decentralization improved net enrollments in primary schools and access to antenatal care for pregnant women. The main channel appears to be institutional, not fiscal. We offer the database as an additional contribution.

Keywords: decentralization, education, health, public investment, Ethiopia, local government

JEL: H41, H75, H77, 01

1. Introduction

Decentralization is one of the most widespread policy reforms in the world. It is currently being pursued, or was recently implemented, in all of the world's regions, across political systems and income brackets. It is particularly strong in Africa (Fessha and Kirkby 2008). In 1999 the World Bank estimated that decentralization was happening in 80-100 percent of the world's countries. For many working on the topic then, this moment felt like a wave that was surely cresting. But enthusiasm has only grown in the new millennium, with new or deepening reforms announced in countries as diverse as Bolivia, Cambodia, France, Japan, Kenya, and Turkey, to name just a few (Faguet and Pöschl 2015, Hooghe and Marks 2016, Rodden 2006, World Bank 1999).

The academic response has been similarly bountiful, with hundreds of papers published across the geography, economics, political science, development studies and public policy literatures. Adding the so-called "gray literature" of policy studies by the likes of the World Bank, IMF, think tanks, government agencies, and others pushes the total well into the thousands. For understandable reasons of data, funding, and policy interest, most of these studies focus on the high-income countries of the OECD. But most of the world's 190+ countries, and hence most of the world's decentralization, lie outside this 36-nation club. Indeed, a great deal of it can be found in Africa (Dickovick and Wunsch 2014). But Africa is notably under-represented in the decentralization literature.

This study seeks to add to our knowledge about decentralization in low-income countries, and in Africa, by exploring its effects in Ethiopia. With a population of 109 million (World Bank Open Data 2019), Ethiopia is a big, important country in its own right. It is also a remarkable case of development, suffering war, famine and chaos in the 1970s and 1980s, before transforming

itself into one of the fastest growing economies in the world. For ten of the past fifteen years, Ethiopia has sustained growth rates above 10%, with no year lower than 6.8 percent (World Bank Open Data 2019). Throughout this period, the economy has diversified rapidly. And Ethiopia is important for the policy experiment it represents: a low-income country with terrible human development indicators that both federalized and decentralized, and then saw dramatic improvements in human development.

These human development advances have been both broad and sustained. The latest Ethiopia Demographic and Health Survey data (2016) show that child mortality fell from 123 per thousand in 2005 to 67 per thousand in 2016.[4] Ethiopia achieved the MDG 4 (Child Mortality) target ahead of time (UNICEF 2013), and primary net enrollment rates rose from 68 percent in 2004 to 85 percent in 2015. These development milestones are coupled with a drastic reduction in poverty. Based on official data, the population below the poverty line fell from 39 percent in 2004 to 27 percent in 2015.

Was decentralization a cause of these successes, or was it incidental? We seek to answer this question for the important sectors of education and health. Ethiopia has over 90 ethnic and linguistic groups and considerable geographic diversity, providing natural sources of variation that a study such as this can exploit analytically. Its diversity is also representative of the developing world more broadly, which tends to be more heterogeneous in geography and ethnicity than the countries of the OECD. Ethiopia also has a federal structure and significant decentralization pursued since the early 1990s. It is thus an ideal context in which to study the effects of decentralization on social development. This paper does so with an original database

of *woreda* (read "district", i.e. sub-regional) economic, social and demographic data, painstakingly constructed from official sources.

The evidence Ethiopia can offer is especially welcome in light of the inconclusive nature of the empirical evidence accumulated over four decades. This is especially true of the older decentralization literature from the 1960s-1990s. Consider the broadest surveys of that work. Rondinelli, Cheema and Nellis (1983) note that decentralization has usually disappointed its partisans. Most developing countries implementing decentralization experienced serious administrative problems. Although few comprehensive evaluations of the benefits and costs of decentralization efforts were conducted, those that were indicate limited success in some countries but not others. A decade and a half later, surveys by Piriou-Sall (1998), Manor (1999) and Smoke (2001) are slightly more positive, but with caveats about the strength of evidence in decentralization's favor. Manor notes that the evidence, though extensive, is still incomplete, but ends his study with the opinion that 'while decentralization …is no panacea, it has many virtues and is worth pursuing'. Smoke, by contrast, finds the evidence mixed and anecdotal, and asks whether there is empirical justification for pursuing decentralization at all.

More recent empirical studies distinguish themselves in two important ways: (i) They are often technically more sophisticated than the older, more case-study based literature, as datasets have improved enormously over recent decades; and (ii) They are generally more positive about decentralization's potential. One good example is Gonçalves (2014), who marshals remarkably detailed data to show that participatory budgeting in decentralized municipalities in Brazil led to public expenditure allocations that closely matched citizen preferences, resulting in significant reductions in infant mortality rates. Another is Kyriacou et al. (2017), who estimate a

simultaneous equations model and find that fiscal decentralization accompanied by measures to improve government quality can reduce regional inequalities in the OECD. A third is Charron (2009), who finds that "ethno-federal" state structures are linked to higher quality-of-government indicators at the aggregate level, compared to centralized, unitary states. By contrast, Ezcurra and Rodríguez-Pose (2013) find no relationship between *political* decentralization and economic growth, and no robust link between political decentralization and regional disparities. And in a paper especially relevant for this study, Ishiyama (2012) finds that subnational fiscal grants in Ethiopia were targeted not in terms of need or service provision, but rather to buy off woredas that had supported the opposition in the 2005 election.

Few recent studies that we know of address the link between decentralization and substantive education and health outcomes directly and with rigorous quantitative evidence. Clark (2009) applies regression discontinuity to a natural experiment from Britain to show that schools that opt out of the centralized educational regime – in effect decentralizing themselves – enjoy large increases in student achievement. Barankay and Lockwood (2007) find that greater decentralization of education to Swiss cantons is associated with higher educational attainment, especially for boys. Amongst studies that look at both developing and developed countries, Escaleras and Register (2012), find that fiscal decentralization is associated with lower death rates from natural disasters, implying more effective disaster preparations and/or responses by countries with decentralized governments. Interestingly, this effect is more robust in developing countries. Galiani, Gertler and Schargrodsky (2008) find that decentralization of school control from central to provincial governments in Argentina had a positive impact on student test scores. The poorest, however, did not gain, and may indeed have lost. And Faguet and Sánchez (2014)

find that decentralization improved enrollment rates in public schools and access of the poor to public health services in Colombia. In both sectors, small increases in own-shares of spending led to surprisingly large increases in the access of the poor. The evidence implies that decentralization provided local officials with the information and incentives required to allocate resources responsively according to voters' needs, and improve the impact of public expenditures.

Decentralization is henceforth defined as the devolution of authority by the central government over specific functions, together with the administrative, political and economic attributes that these entail (e.g., tax-raising, expenditure, and decision-making powers), to elected regional and local governments that are independent of the center within a legally delimited geographic and functional domain. The rest of this paper is organized as follows: Section two discusses the Ethiopian decentralization program within the broader historical context of its long imperial, centralizing tradition, and provides descriptive statistics for public investment flows to education, health and agricultural services; Section three discusses the dataset and presents our methodology; Section four presents results of our analysis, focusing on health and education indicators; and Section five concludes.

2. Centralization and decentralization in Ethiopia

2.1 History and background

Ethiopia's remarkable ethnic heterogeneity is closely tied to its turbulent history. As the country consolidated during the medieval period, it was made up primarily of the Tigray, Agaw and Amhara peoples. With Menelik II's ascension to the throne in 1889, a period of territorial expansion began, in which power and administrative control were projected outward from the

province of Shoa in the region of Amhara. Areas consisting of today's Beneshangul-Gemuz, Gambella, Southern Nations and Nationalities, Afar, Oromia and Somali regions were brought under the feudal system of the Ethiopian empire. Following the battle of Adwa in 1896 and the resulting European recognition of Ethiopian statehood, a series of border treaties with the surrounding colonial powers were signed. The modern Ethiopian state was born.

Relations between the newly integrated areas and the historic center of the empire were troubled. Menelik sent governors from the center to administer the periphery, but owing to structural weakness at the center, successive Ethiopian governments struggled to gain effective control over these regions. Economic policies pursued by the center were exploitative, leading to poor integration with the national economy, relative under-development, and marginalization in the periphery (Mulugeta 2002). The revised constitution of 1955 exacerbated unequal centralization. It specified absolute power for the emperor, claiming "His dignity… inviolable and His power… indisputable"; it entrenched Amharic as sole the official language, and the Ethiopian Orthodox Church as the national religion. Over time, regional disparities between center and periphery grew larger and larger.

Radical communists seized control of the country in the 1970s and ushered in a new era. The period of rule by the Derg (1974-1991) was marked by huge economic and political changes, but no diminution in the center's hold over, and exploitation of, the periphery. Despite the regime's appeal to a socialist ideology, it outlawed any conduct promoting ethnic individualism that might challenge the integrity of the state. And so the Derg became identified with the "Amhara oppressor" by regional liberation movements (Weldemariam 2011).

Victory by the Ethiopian People's Revolutionary Democratic Front over the Derg in 1991 ushered in sweeping political and institutional changes. Elections were called, political prisoners freed, the market economy restored, and attempts at ethnic homogenization that had lasted over a century were reversed. More than the collapse of a government, or even of state communism in Ethiopia, the overthrow of the Mengistu regime effectively marked the failure of a project that dated back to Menelik, of creating a 'modern', centralized Ethiopian state around a Shoan core (Clapman 1994). Ethnic federalism now came to the fore, for example in the Transitional Charter, which allowed the right to self-determination of the country's various "nations and nationalities"; and in the new constitution of 1995, which recognized the rights of ethnic self-determination, including the right to secession (Solomon 2008). Decentralization was the centerpiece of the new fiscal and political order. The constitution created a federal government with nine regional states divided along ethno-linguistic lines: Tigray; Afar; Amhara; Oromia; Somali; Beneshangul-Gemuz; South Nations, Nationalities and Peoples; Gambella; and Harari.

Economic integration and equitable, rapid, broadly-shared growth and development became a primary focus of the new government, both for its own sake, and in the interest of maintaining peace in an ethnically fractured country (Zenawi 1997). The government adopted a policy of affirmative action towards developing regions whereby Beneshangul-Gemuz, Gambella, Afar and Somali would be provided preferential treatment in terms of budget allocations and public investments, such as increased enrollments in higher education. And it implemented a wide-ranging decentralization program to match regional preferences with subnational self-government.

Initial evidence implies that these policies are succeeding. Whereas few residents of Ethiopia's "developing regions" were initially involved in administering their own regional governments, today many more are. Cumulative investments in education, health, water and sanitation, and other physical infrastructure have abetted the emergence of local, native educated classes in peripheral regions capable of running them. And there is much evidence, both econometric and anecdotal, that systematic preferences for poorer regions are accelerating improvements in key social development indicators, spurring their convergence with the highland core (Bevan et al. 2010, Hill et al. 2017, Khan et al. 2014, Khan et al. 2017). But there is also evidence that Ethiopia's decentralization is increasingly insincere, a cosmetic overlay masking the reality of "reinforce[d] central authority at the expense of democracy, development, and accommodation of diversity" (Fessha and Kirkby 2008, 264). Does decentralization in Ethiopia deserve any credit for its impressive development successes?

2.2 The Ethiopian decentralization program

Ethiopian decentralization proceeded in two stages. The first, devolution, took place during the transitional period from 1991 to 1994. Central government devolved state powers to geographically-defined ethno-linguistic regions; associated legislation was passed creating regional and woreda (district) councils. As necessary, regions could decide to establish zones as intermediaries between regional and district administrations. In the name of self-determination, new regional governments were granted a range of executive, legislative, and judicial powers within their defined regions, and exercise jurisdiction over matters of social and economic development as well as basic service delivery. Accordingly, regions were mandated to create the necessary institutional features, such as a council, executive committee, judicial administration

office, public prosecutor, state auditor, police and security forces, and a service and development committee.

Proclamations 7/1992 and 33/1992 stipulated regional governments' revenue sources. These include: tax revenues derived within their jurisdictions, fiscal transfers from the center, domestic borrowing, and other sources of income. While this might appear to be an elaborate set of self-governing arrangements, regional governments in Ethiopia remain subordinate to the central government. Due to capacity constraints, regional governments have mostly been unable to raise their devolved revenues, and so remain highly dependent on central government grants to meet their new expenditure obligations, especially in the social sectors. And while regional councils are accountable to citizens living within their regional borders, they must legally also respond to the central government's Council of Representatives. In practice, the latter is the more binding constraint (Assefa 2010, Dom et al. 2010, Khan et al. 2017).

The promulgation of a new federal constitution in 1995 institutionalized this system further. The constitution affirmed the roles and functions of federal vs. regional governments. While the federal government retained authority over a broad range of functions and responsibilities (e.g. fiscal and monetary policy, international trade), regions and woredas were given responsibility for ensuring basic service delivery in their respective jurisdictions. The federal government retained authority over setting policies and standards in education, health, water and sanitation, and other important social service delivery sectors.

Ethiopia's second round of decentralization occurred in 2002, when decentralization was extended to woreda level. Woreda governments took on the bulk of service delivery responsibilities, and began receiving block grants from their respective regional governments.

These are determined by formulas set by regional governments, which are broadly similar in variables and weightings to those used by the center to calculate grants to regions (World Bank 2011).

2.3 Subnational investment and education and health outcomes

The resource implications of this second round of decentralization were significant. Table 1 shows the evolution of federal block grants (FBGs) to regions and woredas over time. We see that FBGs increased ten-fold between 1996 and 2013, from US $450 million to US $4,456 million. Regional transfers to woredas[5] increased less dramatically during this period, although by a still-impressive 150 percent. It is notable that, on average, regions transfer the equivalent of 55 percent of their own block transfers to woredas during this period.

FBGs are the main way regional governments are financed, hovering around 75-85 percent of their income through much of this period. More recently, FBGs have fallen as a proportion of total regional expenditure, from a peak of 88 percent in the early 2000s to around half, as subnational governments developed their own tax bases and new central transfers came on stream, implying even more resources for regions and woredas. But FBGs have increased as a share of federal government expenditures, from around 20 percent in the early 2000s to 40 percent more recently. A doubling in budget share is doubly impressive when we consider that the federal budget has more than tripled since 1996.

Table 1: Federal block grants (FBGs) to regions and woredas

Year (Western calendar)	Federal block grants to regions (USD million)	Regional block grants to woredas (USD million)	Woreda transfers/ Regional transfers
1996/97	450	--	--
1997/98	447	--	--
1998/99	414	--	--
1999/00	300	--	--
2000/01	427	--	--
2001/02	450	--	--
2002/03	527	--	--
2003/04	582	--	--
2004/05	635	--	--
2005/06	815	--	--
2006/07	1,067	--	--
2007/08	1,471	--	--
2008/09	1,663	1,009	61%
2009/10	1,547	883	57%
2010/11	1,544	875	57%
2011/12	1,777	976	55%
2012/13	1,955	1,120	57%
2013/14	2,228	1,238	56%
2014/15	3,098	1,407	45%
2015/16	3,456	1,850	54%
2016/17	4,456	2,570	58%

Sources: Ministry of Finance & Economic Development; National Bank of Ethiopia

How have subnational governments spent these increasing flows? Figure 1 shows the sectoral breakdown for a typical year, in this case 2011. Education takes the largest share at 62%, followed by agriculture and health in a distant near-tie for second place, at 18% and 17% respectively. Together these three sectors account for 97% of total expenditure, with expenditure on water & sanitation and roads summing to only 3%. This broadly accords with the pattern of expenditures across developing countries, which typically prioritize education and health above other sectors.

Figure 1: Woreda-level expenditures by sector, 2011
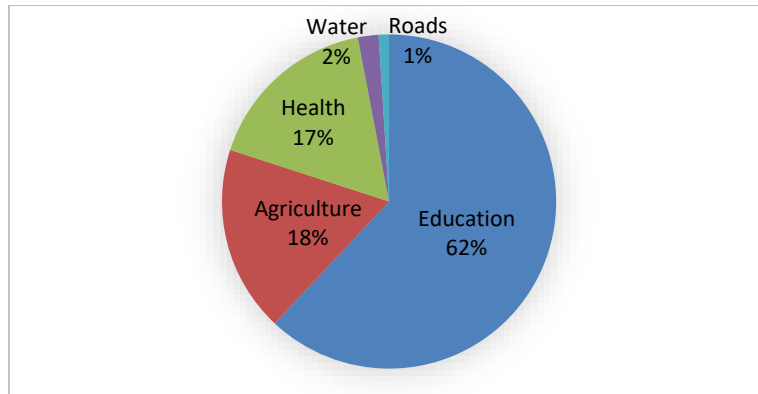
Source: Ministry of Finance & Economic Development

Have such expenditures affected education and health outcomes of interest? Are they having an effect on Ethiopia's development more broadly? Figure 2 shows the evolution of education expenditures at the regional and woreda levels (left axis), plotted against the net enrollment rate (right axis) between 1995-2012. We see a 17-fold rise in education expenditure throughout this period, with an acceleration after 2004, when woredas begin investing significant sums directly in education. This is associated with an equally remarkable rise in the net enrollment rate, from 26% in 1995 to 85% in 2012.

**Figure 2: Education expenditures and net enrollment rate, 1995-2012**
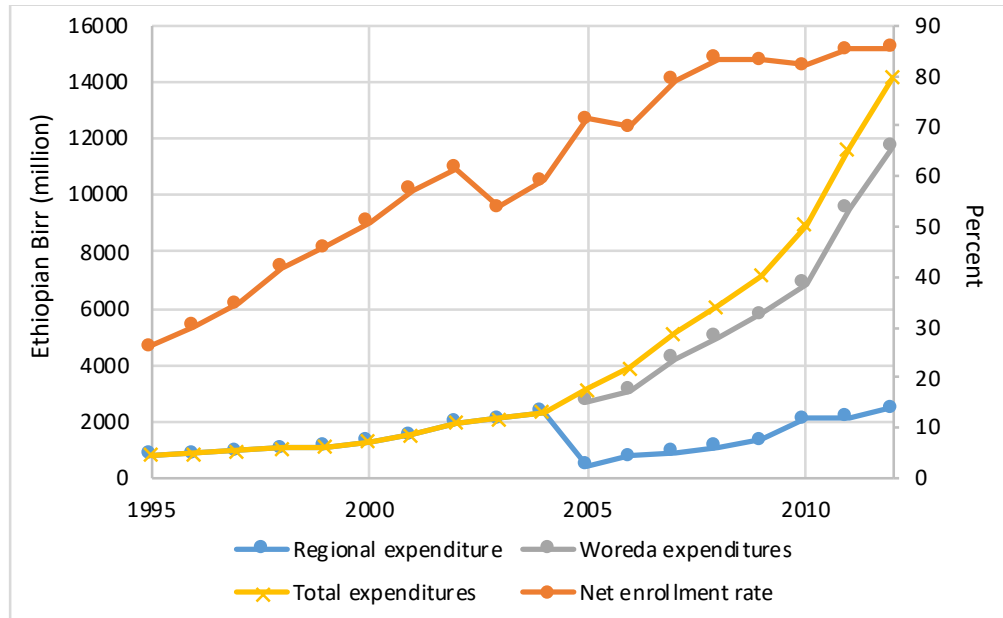
Source: Ministry of Finance & Economic Development; UNESCO

Figures 3-5 show similar information for the health sector. We see a 13-fold increase in total health expenditures by woreda, regional and national governments, accompanied by a huge increase in access to antenatal care (ANC, figure 3) by pregnant women, from 29 to 89 percent. Figure 4 shows a sharp rise in Diphtheria vaccination rates (DPT, figure 4) from 27% in 1999 to 65% in 2011. Figure 5 shows that the measles vaccination rate, previously stagnant around 30%, begins a secular rise in 2003, increasing from 27% to 68% by 2011. This coincides with Ethiopia's second round of decentralization to woredas.

In all of these cases, greater decentralization of health expenditure appears to be associated with improving indicators of health system outputs. As for education, there may well be other, omitted factors contributing to these improvements, such as changes in demand, the efficiency of service provision, or data quality. But even so, the broad correlation between increasing subnational and total expenditures and improving health indicators is notable.

Figure 3: Health expenditures and ANC rates, 2000-2012
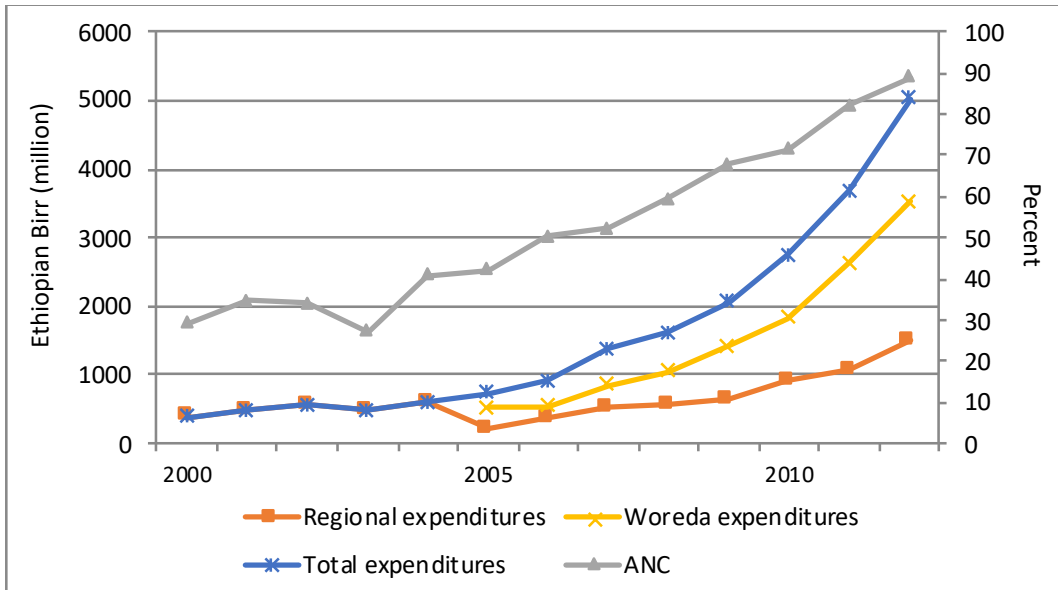
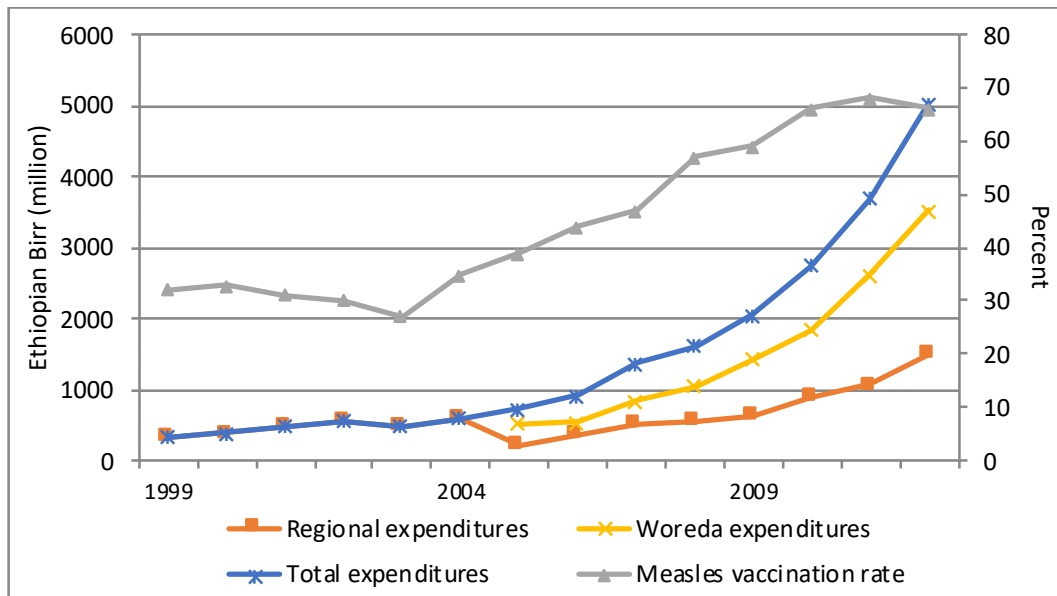*Source:* Ministry of Finance & Economic Development; WDI World Bank

Figure 4: Health expenditures & DPT vaccination rates, 1999-2012
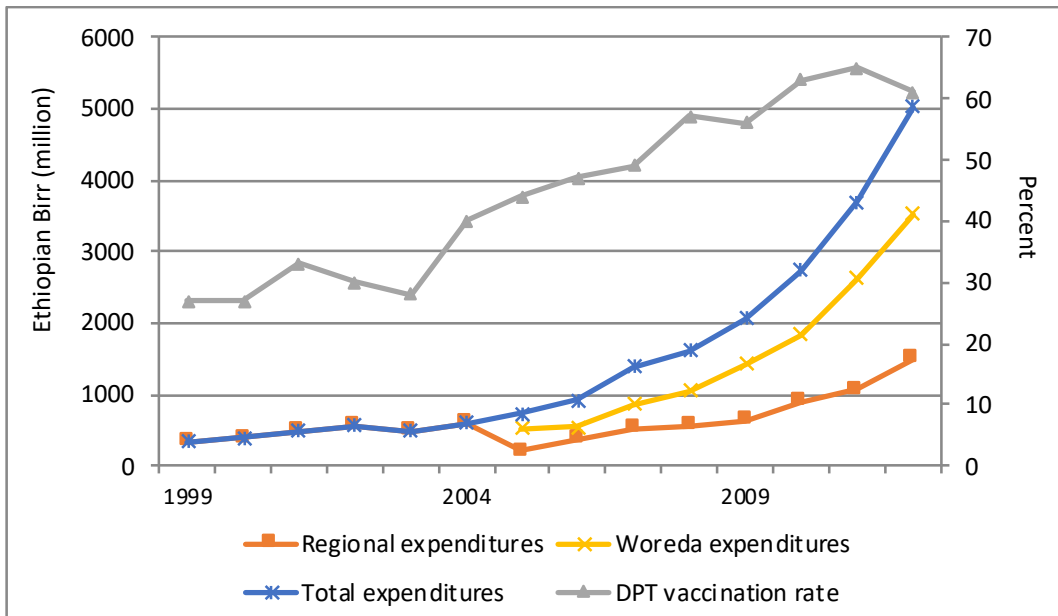
Source: Ministry of Finance & Economic Development; WDI World Bank

Figure 5: Health expenditures and measles vaccination rate, 1999-2012

Source: Ministry of Finance & Economic Development

What do these descriptive statistics tell us? The preceding figures are no more than suggestive. But what they suggest is that rapidly rising decentralized expenditures in education and health have led to significant increases in public sector outputs, such as education enrollments, antenatal care, and vaccinations against communicable diseases. And for three of the four indicators, improvements accelerate from the early-2000s onwards, with Ethiopia's second round of decentralization to woredas. Are these changes due to decentralization itself, or to the increase in expenditures that coincided with decentralization? While the descriptive statistics above cannot distinguish between these possibilities, the more detailed, analytical results that follow can.

3. Data and Methodology

3.1 Data

One reason an analysis of this sort has not been undertaken until now is the absence of woreda-level data on local economic, demographic, fiscal and other characteristics. Indeed, it is difficult to overstate the difficulty of doing subnational empirical work on Ethiopia. When we began this project, relatively little subnational data was collected, the data was often of poor quality, and few attempts were made to systematize the results into any obviously comparable framework. A few illustrations are telling. Fiscal data on subnational expenditures in health, education, agriculture, water, and roads were until very recently available only for EFY 2003. Their geographic identifying codes and names did not match those of census data, whose geographic codes and names vary in unpredictable but pervasive ways from fiscal data. The last census counted some 740 woredas, zones, and regions, but the fiscal dataset included more than 850. Consolidating these two yielded a dataset of 989 subnational units, 250 more than in the census. Many woredas were listed under the same name, and geographic codes in both data sets were not unique. Missing data abounded.

The database that the team has constructed includes woreda-level data from five ministries – Health, Education, Agriculture, Water and Energy, and Finance and Economic Development – as well as the Central Statistical Agency (CSA), the Disaster Risk Management and Food Security Sector of the Ministry of Agriculture. As standardization of woreda codes and the transliteration of Amharic names into Latin script is not yet consistent between ministries in Ethiopia, much time was dedicated to matching woredas from various sources into a single

format. For consistency, the team used the Population and Housing Census of Ethiopia (2007) codes as its base.

The database includes year-on-year investments and expenditures by sector, key results by sector, and information on ethnicity, poverty, rainfall, frequency of droughts, and a number of other control variables. It was built using regional and woreda-level annual budgets, as well as actual capital and recurrent expenditures, for the years 1995-2012 for 10 regions. The database is not organized at woreda level mainly because woreda boundaries changed significantly over this period, and thus woredas are not comparable. Also, woreda-level data are not available for the pre-decentralization period. Hence the database is organized to facilitate regional analysis, and woreda-level expenditure is aggregated up to the regional level. Building this database has required a huge amount of work and improvisation on the part of the research team. It is our hope that it will in time become a useful tool for researchers and students elsewhere in Africa and beyond.

3.2 Methodology

Our primary objective is to assess the effect of woreda-level expenditures, as a measure of decentralization, on important health and education indicators. This makes sense, as Ethiopian fiscal rules create a strong association between woreda-level spending in education and health and key service outputs such as the number of teachers and health extension workers. We focus on two outcome indicators: Net Enrollment Rate (NER), and Antenatal Care (ANC). NER is for primary school, grades 1-8; ANC is defined as the proportion of pregnant women who received at least one antenatal care visit by a skilled health worker during the previous year.

Of the various outcome indicators at our disposal, we select NER and ANC as our preferred indicators because: i) reliable data are available continuously at the regional level for the entire period of interest; ii) they are calculated in ways that tend to respond more smoothly to policy changes; and iii) they are less subject to exogenous shocks, and are thus far more stable over time than the alternatives. Unlike other education and health indicators, they do not tend to move suddenly with changes in demand or the environment, but rather incrementally in response to policy levers.

For example, by its nature the Pupil-Teacher Ratio can move suddenly and erratically, as relatively small increases or decreases in the denominator – the number of teachers – cause large swings in the ratio. NER, by contrast, is a rate, not a ratio. Moreover, it is based on demand for education that, in a country like Ethiopia, is high and steady and generally exceeds supply. Changes in NER thus tend to be incremental, caused by policy-driven supply changes. Similarly, measures linked to the incidence of diseases like measles, tuberculosis, or diphtheria are subject to biological shocks, leading to demand shocks, that may cause indicators to swing significantly even when health policy does not. ANC, by contrast, is based on a comparatively stable phenomenon – a steady flow of pregnant women. Like education, demand for ANC tends to be large and stable. Changes in ANC are thus also more likely to be incremental, caused by policy-driven changes in supply. All of these characteristics allows us to link changes in NER and ANC more clearly to changes in policy than interventions against infectious diseases, or the Pupil-Teacher Ratio.

Ideally we would estimate the effects of decentralization on NER and ANC at the woreda level using panel regressions. But the lack of pre-decentralization data at woreda level makes this

impossible. Instead we use an alternative, two-fold estimation strategy: 1) Time-series estimations for national-level education expenditures and NER outcomes, using a dummy for decentralization to woredas. Unfortunately, a lack of ANC data for the pre-decentralization period prevents us from doing the same for health. And, 2) Panel-data fixed effects at the regional level for health and education expenditures and outcomes, using both NER and ANC. Regional expenditures are constructed by aggregating post-decentralization woreda expenditures up to the regional level and adding them to regional governments' current and capital expenditures, for the period 1995-2012.

The strategy proceeds as follows:

1) Time-series OLS estimation using this specification:

$$O_t = \alpha + \beta_1 E_t + \beta_2 D_t + \beta_3 T_t + \beta_4 E_t * D_t + \varepsilon_t \tag{1}$$

where O is NER and ANC expressed as rates; E is expenditures in each sector; D is a dummy variable that equals 0 before 2002, when Ethiopia decentralized to Woredas, and 1 after; and T is a simple trend variable, all subscripted by year t. We expect sectoral expenditures to positively affect sectoral outcomes, and hence to be statistically significant with a positive sign. If decentralization affects outcomes generally, through administrative, political, or other channels, then we expect the dummy variable to be significant and large in effect. But if decentralization's main channel of influence is via local discretion over resource allocation, as opposed to more general effects, then we expect the E*D interaction term to take over significance when it is added to the model.

2) Panel estimates using this specification:

$$O_{rt} = \alpha_r + \zeta E_{rt} + \beta_1 D + \beta_2 D * E_{rt} + \beta_3 E^2_{rt} + \varepsilon_{rt} \tag{2}$$

where O is NER or ANC; α captures regional fixed effects; E is yearly population-weighted expenditure in the relevant sector (see below); D is a dummy for woreda-level decentralization per above; E^2 is a quadratic expenditure term (by sector) to capture non-linearities; and ε is the error term, subscripted by time, t, and region, r.

Absence of regional-level data for the period 1995-2012 prevents us from including geographic or demographic controls in our models. Poor data even affects regional population estimates, which are entirely based on two censuses 13 years apart (1994 and 2007), with no annual population data other than projections derived from these. To address potential inaccuracies in regional population data, we instead use each region's population share. More specifically, we calculate the average of population ratios in both censuses, and then weight expenditures by those ratios. Our assumption is that even if absolute population estimates are inaccurate, population shares will be more accurately estimated. This measure is likely to mask rural-urban migration within a region, unfortunately. But it seems a reasonable second-best option for dealing with poor data availability. Finally, we use a fixed effects model to address omitted variable bias and endogeneity issues. A Hausman test confirms that the fixed effects strategy is correct.

4. Results

Time-series estimations

What does national-level data reveal about the links between decentralization and education? Table 2 shows that the net enrollment rate rises with education expenditure, as we would expect, in our simplest model. But expenditure becomes insignificant when we add a time trend. Decentralization to woredas is insignificant in the first two models, but significant and

positive in the third, when we add an interaction term capturing decentralized expenditures. Although the sign of the interaction term is negative, as opposed to the decentralization dummy, its point estimate is zero.

By contrast, even though the significance level on woreda decentralization is only 10 percent, its point estimate is large: 34 percent of the NER average, or 73 percent of its standard deviation. Keeping in mind that the statistical power of time-series regressions with only eighteen observations is low, we interpret these results as providing suggestive evidence that decentralization improves primary school enrollments. The mechanism is not primarily financial, but rather associated with the fact of having woreda governments in charge of local education.

Table 2: Decentralization's effect on education (Time series)

	Net enrollment rate (Grades 1-8)		
VARIABLES	(1)	(2)	(3)
Education Expenditure (Total, Population Weighted)	0.01***	-0.00	0.00
	(0.00)	(0.00)	(0.00)
Woreda Decentralization Dummy	3.39	0.71	21.67*
	(5.37)	(5.20)	(11.39)
Time Trend		3.73***	3.66***
		(0.80)	(0.80)
Education Expenditure * Woreda Decent'n Dummy			-0.00**
			(0.00)
Constant	7.69	27.51***	11.00
	(5.68)	(5.52)	(6.65)
Observations	18	18	18
R-squared	0.91	0.95	0.96

Time series estimations. Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Panel estimations

Table 3 shows regression results for NER based on regional-level data. Once again, total expenditure on education is positively correlated with NER, this time strongly and consistently. Decentralization to woredas is also positively and significantly correlated with NER across all

three models. The decentralized expenditure interaction term is again negative and significant, but with a coefficient only one-third the size of expenditure on its own. And the quadratic expenditure term is statistically significant but with a point estimate of zero.

Keeping in mind that these results are based on a much larger, richer database, we interpret them as strong evidence that decentralization to woredas improved primary school net enrollment rates. Specifically, our estimates imply that decentralization's incremental effect would be to raise NER in a typical woreda from its mean value of 65 percent to as high as 83 percent. Once again, the main effect seems to go through the fact of decentralization, as distinct from decentralized education expenditures.

Table 3: Decentralization's effect on education (Panel data)

	Net enrollment rate (Grades 1-8)		
VARIABLES	(1)	(2)	(3)
Education Expenditure (Total, Population Weighted)	0.01**	0.03***	0.04***
	(0.00)	(0.01)	(0.01)
Woreda Decentralization Dummy	16.14***	18.01***	13.60***
	(3.01)	(3.31)	(3.10)
Education Expenditure * Woreda Decent'n Dummy		-0.01**	
		(0.00)	
Quadratic education expenditure term			-0.00***
			(0.00)
Constant	39.65***	31.12***	30.11***
	(4.17)	(6.32)	(3.87)
Observations	168	168	168
R-squared	0.51	0.53	0.55
Number of region	11	11	11

Panel regressions with fixed effects. Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows regression results for ANC based on regional-level data. Once again, total expenditure is positively correlated with ANC, in two of the three models. Decentralization to woredas is also positively and significantly correlated with ANC across all three models.

Interestingly, coefficients on expenditures and decentralization are very similar in magnitude to those for NER. The decentralized expenditure interaction term is insignificant, as is the quadratic expenditure term. We interpret these results as strong evidence that decentralization to woredas improved antenatal care across Ethiopia. Our estimates imply that decentralization would raise ANC in a typical woreda from a mean of 52 percent to as high as 65 percent. All of these estimates, for both education and health, are robust to alternative specifications, including year fixed effects.

As for education, the effect we find seems to go primarily through the *fact* of decentralization, as distinct from decentralized health expenditures. This suggests that local governments' management of primary health and education services improves outcomes via greater accountability, better information on local conditions or needs, greater outreach to citizens, higher bureaucratic efficiency, more qualified local workers, or some other effect that is not primarily financial in nature. While a rich literature explores such mechanisms,[6] Ethiopian data do not allow us to probe this issue further.

Table 4: Decentralization's effect on health (Panel data)

	Antenatal care		
VARIABLES	(1)	(2)	(3)
Health Expenditure (Total, Population Weighted)	0.02***	0.04***	0.03
	(0.00)	(0.01)	(0.04)
Woreda Decentralization Dummy	10.74**	12.59***	10.17***
	(3.64)	(3.57)	(3.03)
Health Expenditure * Woreda Decent'n Dummy		-0.01	
		(0.01)	
Quadratic health expenditure term			-0.00
			(0.00)
Constant	30.95***	27.78***	29.22**
	(3.50)	(3.28)	(9.74)
Observations	118	118	118
R-squared	0.24	0.24	0.24
Number of region	11	11	11

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

It is difficult to overstate the difficulty of doing subnational empirical work on Ethiopia. Creating the database required for this study required years of work and a huge amount of improvisation on the part of a well-qualified research team. One important contribution of this research is a standardized database of subnational expenditures, social development outcomes, and other characteristics, which will be made public.[7] It is our hope that this dataset will in time become a useful tool for researchers and students in Africa and beyond.

Our results imply that decentralization is improving performance in Ethiopia's public education and health sectors, specifically by raising enrollment rates in schools and increasing provision of antenatal care to pregnant women. Evidence for this comes from regional-level panel estimates, as well as national-level time series regressions. Our evidence is consistent across data types, methods of estimation, and specifications. The magnitudes are significant: the

incremental effect of decentralizing health and education service provision to the mean woreda is an estimated 12.6 percent for ANC and 18 percent for NER. The main channel for these improvements appears to be institutional, related to local control over education and health services, as opposed to local expenditures per se. Such effects might be supply-side, such as greater efficiency in public management, or better-informed decisions; demand-side, such as higher citizen demand for education and health services; or both, such as improved accountability of officials to citizens. With currently available data, it is impossible to disentangle these effects and determine which predominates. But what cannot be doubted is that Ethiopia has made remarkable progress in health and education during the past generation, and decentralization is an important part of this success.

Declaration of Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Annex 1: Data Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
Outcomes					
Net enrollment rate (Grades 1-8)	216	64.66	29.99	7.1	159
Antenatal care	153	51.54	27.42	3.2	139.1
Expenditure					
Education expenditure (Total, population weighted)	186	1615.44	2788.38	0.2144	13064.85
Health expenditure (Total, population weighted)	193	567.34	1043.78	0.1152	5281.58
Woreda decentralization dummy	216	0.61	0.49	0	1
Education expenditure x Woreda decentralization dummy	186	1208.40	2704.48	0	13064.85
Health expenditure x Woreda decentralization dummy	193	431.89	1024.30	0	5281.58
Quadratic education expenditure term	168	3168435	7919586	0.0460	4.43E+07
Quadratic health expenditure term	175	471022	1617659	0.0133	1.25E+07

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[2] World Bank, 1818 H Street, Washington, DC

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[4] We use Western dates throughout, as distinct from the Ethiopian (Julian) calendar.

[5] Woreda transfers began in 2002; we have data for them only from 2008 onwards.

[6] Faguet (2017 & 2014), Faguet et al. (2015), Khan et al. (2017), Khan et al. (2014), and Putnam (1993) are just a few examples.

[7] http://governancefrombelow.net