Final Project

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27 novembre 2014

Contents

1 Introduction

Since the beginning of the 1990s, most developing countries have embarked in a process of subsequent decentralization, combining political, administrative and fiscal aspects. Decentralization has also been at the center stage of the international development agenda, being considered as a major mechanism for poverty reduction in low and middle-income countries. As part of this process, subnational governments have been increasingly strengthened, and granted more power in terms decision-making regarding their communities.

Devolution of public administration is an important step in the overall decentralization process. In that regard, central governments, supported by numerous development agencies, have slowly transfers raising-revenues powers as well as expenditures assignments to local governments. Central governments, in their redistribute policies, have also invested in transferring grants to local entities, allowing them to meet their newly assigned expenditure requirements. Among these assignments, and along with the Millennium Development Goals are listed basic sanitation and health-related services, as well as primary education. Decentralization of health expenditures and policies have taken place across many countries in Ghana, Zambia, Benin, Uganda, and on a broader scale all over the world as a step in a process of improving living standards of rural population. The political and administrative decentralization of health provision have been accompanied by several bilateral and multilateral projects both in time and resources.

Decentralization is said to have many benefits such as improving efficiency in allocation of services. That has been supported by economic theory and empirical findings. This paper aims at investigating the impact of decentralization on the delivery of health-related services in the context of a developing country: Benin. More particularly, it will examine the following question: **what impact does decentralization have on the provision of health-related services in Benin?**. In other words, whether health provision has been efficient in improving the access to basic health-related services such as access to water and health-care centers at the municipal level.

This paper is divided into four sections. The first section presents an overview of Benin and its decentralization policy. The second part presents a brief overview of the theoretical background on decentralization as well as the empirical findings with regards to its contribution to poverty-related services and local governance. The third presents our analytical framework, more particularly a macroeconomic overview of health-related expenditures and provision in Benin over the past few years; and a microanalysis which uses an econometric model to assess the impact of decentralization on some key health-related services at the municipal level. The fourth and final section discusses the findings, the limitations of this paper and potential windows for research.

2 Overview of Benin

Benin is a french-speaking west-African country with a GDP/capita of US$ 804.67 in 2013 (5.6% growth in 2013) and an estimated population of 10.32 million habitants in 2013. The country is bordered by Nigeria on the east, Togo on the west, Burkina Faso and Niger on the North. The country is categorized as low-income and is currently ranked 165 out of 187 countries in the 2014 Human Development Index.

Figure 1: plot of chunk unnamed-chunk-1

Benin is a young democracy. Alike many developing countries, Benin has embarked in a process of subsequent decentralization in 2000s which combines political, administrative and fiscal aspects. Legal provisions on the administrative and territorial reforms of 1999 created 77 municipalities and 12 departments and outlines competencies - ranging from tax raising power to local public expenditure (elementary schooling, health-related services, sanitation) - to be transferred from central to local governments. In order to offset fiscal imbalance and allow local governments to meet their newly assigned expenditure requirements, the central government has been providing increasing amount of fiscal grants to local governments.Since 2002, the country

has also been involved in a successive national strategy, also known as the Growth and Poverty Reduction Strategy (GPRS) which aims at fostering susntainable development at both national and subnational level. Decentralization has been incorporated as one of the core policy in these strategies. Alongside national development programs, the process has been backed by backed by the international community via technical support of implemented projects and programs such as PDDC (GIZ), PACTE (European Union), PA3D (UNDP), and PNDDC (World Bank), PDDC (GIZ). Although at its very early stage decentralization has brought a huge transformation to the political and administrative organization of subnational entities in Benin.Taking advantage of a unique dataset on Benin's municipalities, combining financial data and development indicators, this paper is an attempt to bring an answer to that research question.

3 Literature review

Proponents of decentralization share the view that local governments are the major vehicles for specific poverty alleviation policies. This argument is sustained by economic theory which suggest that decision-making should occur at the lowest level of government in order to reach allocation efficiency, reflecting economies of scale and benefit???cost spill outs (Shah and Mundial 1994). The demand-side argument in favour of decentralization is derived from the existence of information asymmetries. It advances that local government has an informational advantage, which is essential to improve provision of public services (Oates 1972). On the supply side, decentralization is also seen as a mechanism to enhance accountability of policy makers through greater participation of nearby communities in political decisions (Crook and Manor 1998) (Tiebout 1956).

Federalism and devolution of public administration and servcices have been long studied in well-established federalist countries such as the United States, Germany and Switzerland. With the recent trends of similar reforms in the developing world, there have been numerous attempts to check the underlying theories and to empirically assess the impact of decentralization on provision of public goods and services. In that regards, there are several positive evidences. For instance, (Santos 2005) studying the case of the city Porto-Alegre in Brazil found that decentralization has contributed to double the level of access to basic sanitation as well as enrollment in elementary schools between 1989 and 1996, while revenue collection increased by 48%. Moreover,(Bardhan and Mookherjee 2000) found greater fiscal autonomy of local governments expands the volume of service delivery in West Bengal, while (Faguet 2004) studying Bolivia finds that public investment in education, water and sanitation rose significantly with decentralization and devolution of administrative authorities. Additionally, (Bird and Rodriguez 1999) in a comparative study of Asian and Latin-American economies also found positive effect of decentralization on health, primary education and infrastructure. On the comparison between centralized and decentralized in delivery of public goods or pro-poor programs, (Galasso and Ravallion 2005) studied a decentralized food-for-education program in Bangladesh and found out that a somewhat larger fraction of the poor received benefits from the program compared to the non-poor. They also found that that the program shifted the balance of power in favor of the poor.

In contrast to these positive outcomes, there are many controversies with regards to the efficiency of decentralization mechanisms on public goods delivery. there are many controversies with regards to the efficiency of decentralization mechanisms on public goods delivery.For instance, a greater number of publications have indicated the pitfalls of decentralization policies, such as local capture and corruption of sub-national authorities. For instance (Reinikka and Svensson 2004) highlights the capture of decentralized school grants by local officials in Uganda. On this topic, (Treisman 2000) also suggests that more levels of government induce higher perceived corruption, less effective provision of public health services and lower adult literacy, especially in developing countries. Several additional pitfalls of decentralization in developing countries are stressed by (Prud'Homme 1995), such as inter-jurisdictional disparities or ethnic biases in elections. Other studies are those of (Granado, Martinez-Vazquez, and Simatupang 2008), that suggests a process of yardstick competition between local governments in Indonesia, and (Grégoire, Caldeira, and Foucault 2010), that establishes the existence of strategic complementarities of local public goods among Beninese communes.

With the recent trends in public finance reforms in developing countries, especially in Sub-Saharan Africa, there is a growing body of researchers devoted to investigating the impact of such reforms on the well-being

of communities, thereby bridging public and development economics. Despite this growing interest, there is still very limited evidence of the contribution of these reforms, particularly decentralization, on health provision at subnational level. Unavailability or inaccuracy of local finances data as well as finding a proper measurement for health provision have been stated as some of the key challenges for such a research project. Considering the importance of acess to basic health services, especially in a geographically and ethnically fragmented country like Benin, and given the weight of decentralization as a reform in the political and development agenda of the country over the past decade, it is worth investigating the impact of such a reform on the provision of health services at the subnational level. This research wants to join the attempts to bring answers to fundamental questions at the border of public and development economics.

4 Analytical approach

Conducting an empirical study on the relationship between decentralization and health provision is a very challenging exercise as it requires consistent and reliable microeconomic data which are, very often, not openly available or not consistent. In the case of Benin, due to some limitations in the dataset which are detailed in following sections, we have decided to broaden our approach by first looking at aggregate health-related data of Benin, such as health public expenditures over the past few years. As stated from previous sections, a large part of health-related expenditures has been confered to local governments. Therefore, we assume that there is a strong correlation between the macroeconomic overview and the outcomes on the subnational level. In addition to the macroeconomic overview, we explore microeconomic and sub-national data on health provision, in order words, we study the impact of decentralization on access to basic health-related services and infrastructures. We based our inference on an econometric methods and accounting for heterogeneity across municipalities.

4.1 Macroeconomic overview

This section brings a general overview of health-related expenditures and outcome in Benin over the years 2005 to 2010. We use data analytics tools to scrape openly available datasets. The first dataset is obtained from the World Bank (WB) and includes the following indicators:

(i) health expenditure per capita: defined as thesum of public and private health expenditures as a ratio of total population. This indicator covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. Data are in current U.S. dollars.

(ii) public health expenditure: defined as recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds.

(iii) improved sanitation facilities: defined as the access to improved sanitation facilities as the percentage of the population using improved sanitation facilities. This indicator includes flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet.

World Health Organization Indicators

The second dataset is taken from the WHO databases, particularly from the Global Health Observatory Data which provides information on health infrastructures per 100,000 population in Benin including:

(i) Health posts, that are either community centres or health environments with a very limited number of beds with limited curative and preventive care resources normally assisted by health workers or nurses,

(ii) Health centers,which includes the number of health centres from the public and private sectors, per 100,000 population

(iii) Number of district/rural hospitals from the public and private sectors, per 100,000 population,

(iv) Number of provincial hospitals from the public and private sectors, per 100,000 population,

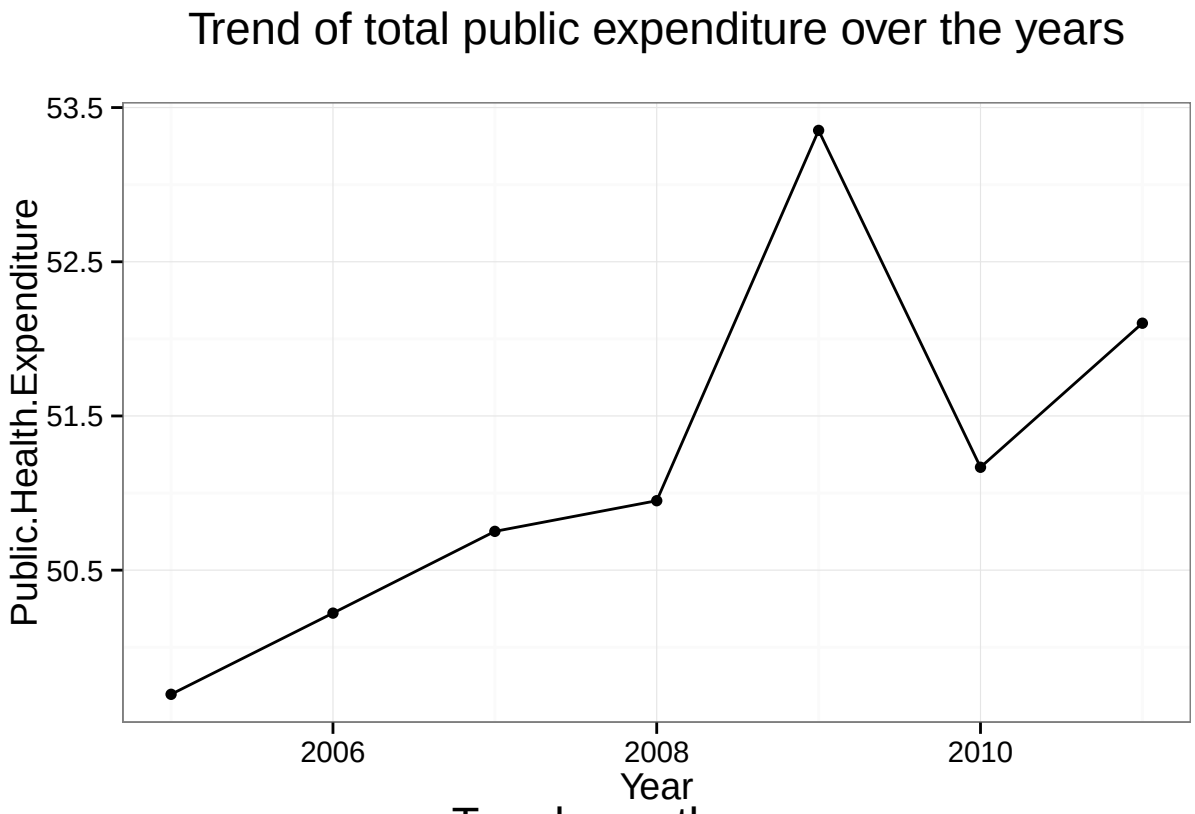
(v) Number of specialized hospitals delivering mainly tertiary care from the public and private sectors, per 100,000 population. These specialized hospitals could be regional, specialized, research hospitals or Federal/National Institutes.

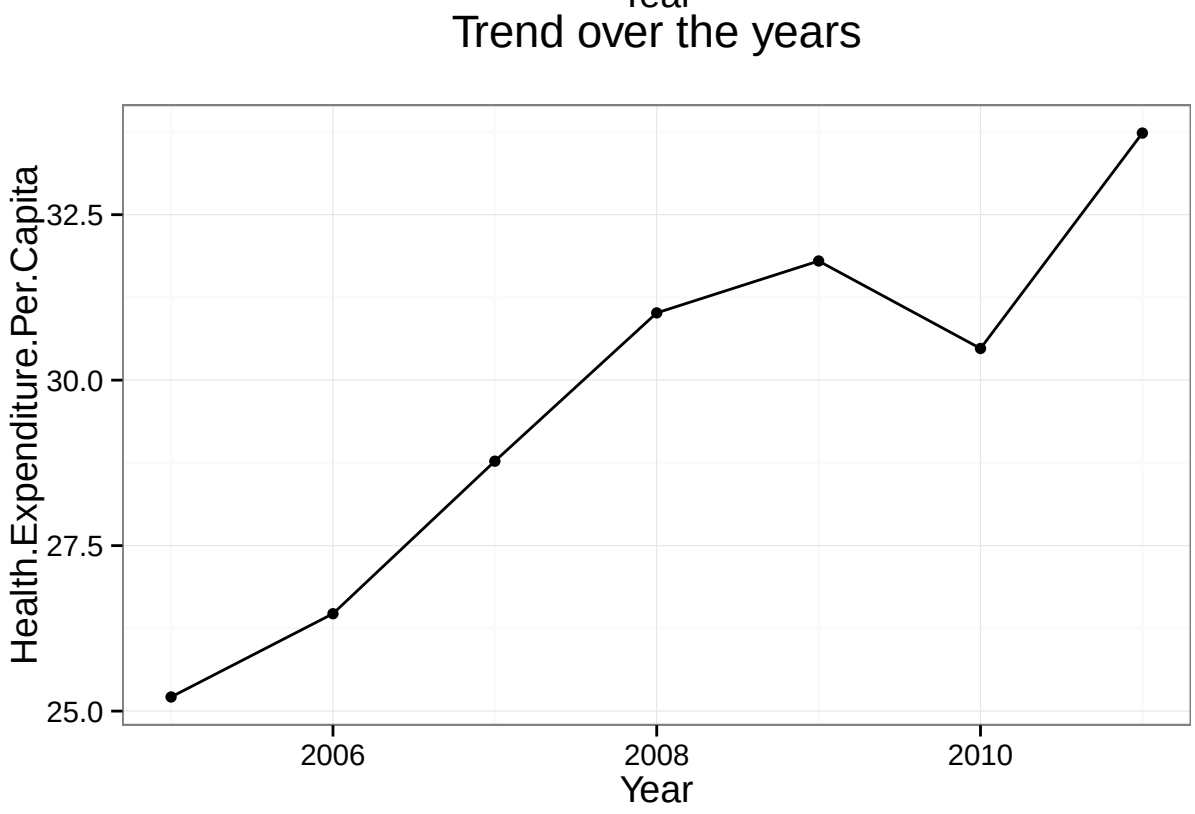
(vi) Number of specialized hospitals delivering mainly tertiary care from the public and private sectors, per 100,000 population. These specialized hospitals could be: regional, specialized, research hospitals or Federal/National Institutes.

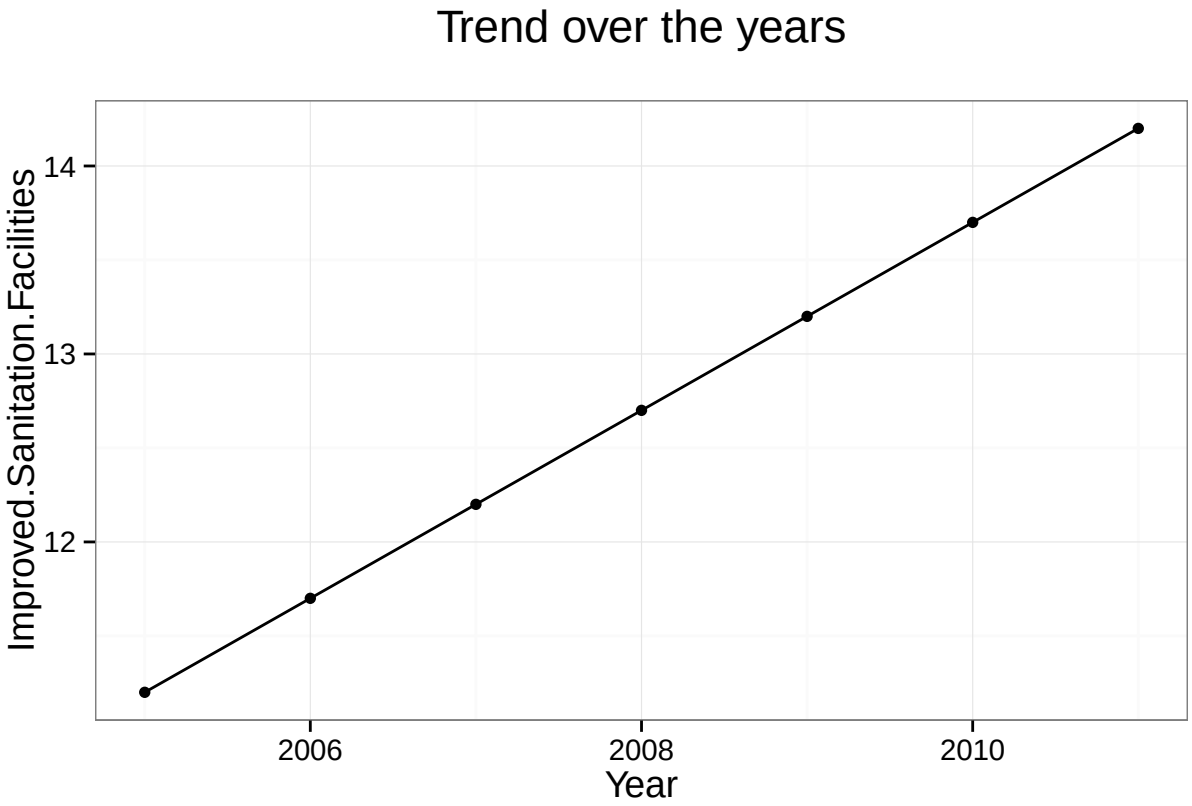
Unlike the dataset from the World Bank, this datasets only provide Benin-related indicators for the years 2010 and 2013, which we extracted for this project.

We also cleaned the dataset eliminating superfluous columns and rows. We also used the command 'tidy' to organize it in a way that would make the merging of the datasets easier.

Once we have our datasets, it is useful to merge them together so as to work easily and quickly with one dataset that would include all the needed variables. Thus, firstly we change the names of the variables "country" and "year", so that they have exactly the same capital letters in both datasets, and secondly we use the 'merge' function.


Trend of total public expenditure over the years
Public.Health.Expenditure
53.5
52.5
51.5
50.5
2006
2008
2010
Year


Trend over the years
Health.Expenditure.Per.Capita
32.5
30.0
27.5
25.0
2006
2008
2010
Year



The graphs above suggest that all three elements: public health expenditure, health expenditure per capita, and improved sanitation, have considerably increased over the time-span 2005 to 2011. Since health expenditure is highly decentralized, we could therefore assume that the macroeconomic overview is a reflection of the microeconomic data. The microeconomic analysis will therefore look to confirm this assumption.

4.2 Microeconomic Analysis

In this section, we explore provision of health-related services and infrastructures on a municipal level. Particularly, we look at the impact of decentralization on the access to basic health-related services and infrastructure.

As stated from section 1, we constructed a unique dataset combining data on municipal finances obtained from the National Commission on Local Finances, the Ministry of Economy and Finances, and development indicators obtained from Benin's Benin's Integrated Modular Surveys on Household Living Conditions (EMICoV), the Demographic and Health Survey and the National Census.

The several gap years in the household survey do not allow for a panel data analysis with sophisticated econometric methods. We therefore restricted the model to pooled-OLS regressions, with data on the 77 municipalities of Benin for the years 2010 and 2011, and accounting for heterogeneity across municipalities. The appendix presents results of our statistical tests (for issues of endogeneity, multicollinearity of key variables) attesting the fitness of our econometric model which is defined as follows:

Estimated Model

$$H_{it} = \alpha + \beta_1 Decentralization_{it} + X\beta + e$$

where H represents our dependent variables, decentralization a composite indicator used as proxy for the degree of decentralization of municipality i at time t, X a set of explanatory variables accounting for heterogeneity across municipalities and for economic conditions at the municipal level and e as the error term.

Description of variables

Decentralization

Decentralization is typically defined in public planning, management and decision making, as the transfer of authority and power from higher to lower levels of governing, or from national to sub-national levels. It has different characteristics for different writers which often describe it as either delegation, devaluation, de-concentration and privatization of responsibility and authority of tasks to lower level of administration. Yet, decentralization is a very complex mechanism. In general, its measurement involves two elements: (i)the level and (ii)the degree where the level can be regarded as the distribution of power over decision-making inside a particular administrative system while the level takes into account sociological and anthropological aspects.

The definition and measurement of decentralizaiton has led to a long academic debate, with several authors proposing new indicators as the most reliable proxy, giving birth to a multiplicity of indicators using different approaches. Due to this high degree of complexity, which encompasses a number of political, fiscal and administrative dimensions, it is difficult to assess and measure the outcome of decentralization mechanisms in an empirical study. A large part of the debate on decentralization measurement regards the choice between revenue versus expenditure decentralization. Because decentralized health provision implies both decentralized revenues and expenditure, we propose here to use the Revenue authonomy(RA) indicator used by (**???**) and (**???**) to proxy for decentralization. This indicator is defined as the ratio of own-source revenues over the total expenditures of a subnational entity.

% Table created by stargazer v.5.1 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Lun, Dic 08, 2014 - 15:30:13

Table 1: Descriptive statistics/selected variables

Statistic	N	Mean	St. Dev.	Min	Max
decentralization2	154	0.61	0.33	0.05	2.20
Density	154	440.70	1,377.00	8	10,917
pubexp.c	154	4,695.00	6,812.00	207	72,654

Dependent variables

To account for health provision, we have therefore decided to focus on some key variables that reflect the data from the macroeconomic overview on improved sanitation. These variables are drawn from Benin's EmiCoV (2010,2011) and are defined as follwos: (i) access to water: defined as the percentage of households in the municipality that have access to water (ii)access to toilet facilities: percentage of households in the municipality that have access to toilet facilities (iii)water provision infrastructure: percentage of households in that municipality that are connected to SONEB (water pipeline) (iv) hospital: the number of existing hospitals or public healthcare centers in the municipality.

% Table created by stargazer v.5.1 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Lun, Dic 08, 2014 - 15:30:13

Table 2: Descriptive statistics of dependent variables

Statistic	N	Mean	St. Dev.	Min	Max
pop_wateraccess	154	70.31	17.07	32	100
pop_toiletacess	154	36.51	8.44	19	53
pubhosp	154	12.55	12.97	0	60
connect_soneb	154	16.53	21.37	0	100

Explanatory variables

As mentionned above, Benin is a geographically, ethnically and economically fragmented country. We therefore use a set of parameters to account for heterogeneity across the municipalities. These are population, population density, per capita consumption (to account for subnational economic conditions), public expenditure per capita, households consumption in health-related services, monetary poverty index, average literacy rate of the head of households, and decentralization perception index, all drawn from Benin's EMICoV(2010,2011), Demographic and Health Survey (2011,2012) and National Census(2002,2013).

We assume that these variables might have some impact either on health health-related expenditures on municipal or households level, and also some impact on decentralization process per se.

```
## Warning: package 'car' was built under R version 3.1.2
```

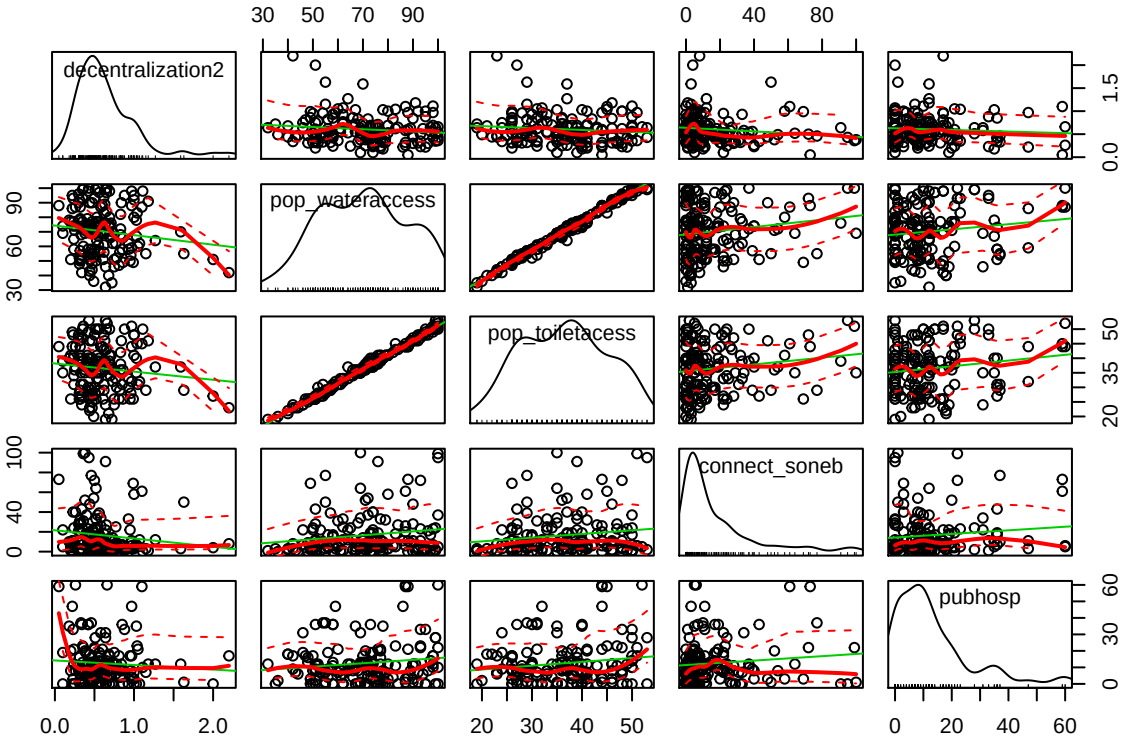


Figure 2: plot of chunk unnamed-chunk-11

Effect of Decentralization on Water Access

In this model, decentralization reveals to be insignificant,as well as the other explanatory variables. This may be due to mispecification of the model.

decentralization2 log(population) Density log(pubexp.c) 1.065 1.833 1.652 1.145 log(consump.c) cons_health educ_adult ind_pauv_mon 1.133 1.136 1.176 1.167 gini for_dentr. 1.058 1.026 decentralization2 log(population) Density log(pubexp.c) FALSE FALSE FALSE FALSE log(consump.c) cons_health educ_adult ind_pauv_mon FALSE FALSE FALSE FALSE gini for_dentr. FALSE FALSE Non-constant Variance Score Test Variance formula: ~ fitted.values Chisquare = 0.4696 Df = 1 p = 0.4932

```
studentized Breusch-Pagan test
```

data: R3water BP = 10.66, df = 10, p-value = 0.3847

Call: lm(formula = pop_wateraccess ~ decentralization2 + log(population) + Density + log(pubexp.c) + log(consump.c) + cons_health + educ_adult + ind_pauv_mon + gini + for_dentr., data = combined-data.data)

Residuals: Min 1Q Median 3Q Max -32.73 -13.32 0.32 11.09 38.32

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) -7.48e+00 5.12e+01 -0.15 0.884
decentralization2 -5.87e+00 4.18e+00 -1.40 0.163
log(population) 5.38e+00 3.62e+00 1.49 0.140
Density 2.52e-04 1.24e-03 0.20 0.840
log(pubexp.c) -1.51e+00 1.83e+00 -0.83 0.408
log(consump.c) 7.68e-01 1.55e+00 0.50 0.620
cons_health -1.37e+00 7.83e-01 -1.75 0.083 . educ_adult 1.88e-01 7.24e-02 2.59 0.011 * ind_pauv_mon 1.07e-01 1.36e-01 0.79 0.432
gini -2.04e+01 1.70e+01 -1.20 0.231
for_dentr. 1.32e-01 1.32e-01 1.00 0.318
— Signif. codes: 0 ‘’ ***0.001*** ’’ *0.01* ’’ 0.05 ‘.’ 0.1 ‘’ 1

Residual standard error: 16.5 on 143 degrees of freedom Multiple R-squared: 0.131, Adjusted R-squared: 0.0701 F-statistic: 2.15 on 10 and 143 DF, p-value: 0.024

ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM: Level of Significance = 0.05

Call: gvlma(x = R3water)

```
                    Value p-value                Decision
```

Global Stat 3.8423 0.4278 Assumptions acceptable. Skewness 0.3305 0.5654 Assumptions acceptable. Kurtosis 3.1674 0.0751 Assumptions acceptable. Link Function 0.2471 0.6191 Assumptions acceptable. Heteroscedasticity 0.0974 0.7550 Assumptions acceptable.

Effect of decentralization on access to toilet facilities

Alike the model on water access, decentralization seems to not have a particular effect on the access to toilet facilities, while average literacy rate of head of households results to be slightly significant.

decentralization2 log(population) Density log(pubexp.c) 1.065 1.833 1.652 1.145 log(consump.c) cons_health educ_adult ind_pauv_mon 1.133 1.136 1.176 1.167 gini for_dentr. 1.058 1.026 decentralization2 log(population) Density log(pubexp.c) FALSE FALSE FALSE FALSE log(consump.c) cons_health educ_adult ind_pauv_mon FALSE FALSE FALSE FALSE gini for_dentr. FALSE FALSE Non-constant Variance Score Test Variance formula: ~ fitted.values Chisquare = 0.3966 Df = 1 p = 0.5289

```
studentized Breusch-Pagan test
```

data: R3toilet BP = 11.11, df = 10, p-value = 0.3492

Call: lm(formula = pop_toiletacess ~ decentralization2 + log(population) + Density + log(pubexp.c) + log(consump.c) + cons_health + educ_adult + ind_pauv_mon + gini + for_dentr., data = combined-data.data)

Residuals: Min 1Q Median 3Q Max -16.300 -6.287 0.158 5.519 19.788

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) -3.03e+00 2.54e+01 -0.12 0.9052
decentralization2 -3.03e+00 2.08e+00 -1.46 0.1474
log(population) 2.71e+00 1.80e+00 1.51 0.1342
Density 1.23e-04 6.17e-04 0.20 0.8417
log(pubexp.c) -7.56e-01 9.07e-01 -0.83 0.4057
log(consump.c) 3.19e-01 7.68e-01 0.42 0.6781
cons_health -2.07e-01 3.89e-01 -0.53 0.5954

Table 3: Effect of decentralization on water access

	Dependent variable:		
	pop_wateraccess		
	(1)	(2)	(3)
Decentralization	−6.57	−6.31	−5.87
	(4.18)	(4.12)	(4.18)
Population		5.79*	5.38
		(3.35)	(3.62)
Population Density		0.001	0.0003
		(0.001)	(0.001)
Log Public Expenditure per capita			−1.51
			(1.83)
Log Consumption per Capita			0.77
			(1.55)
Average Households Health Consumption Ratio			−1.37*
			(0.78)
Average Literacy Rate of Head of Households			0.19**
			(0.07)
Monetary Poverty Index			0.11
			(0.14)
gini			−20.43
			(16.99)
perception of decentralization			0.13
			(0.13)
(Intercept)	74.29***	7.29	−7.48
	(2.88)	(38.33)	(51.21)
Observations	154	154	154
R^2	0.02	0.06	0.13
Adjusted R^2	0.01	0.04	0.07
Residual Std. Error	16.99 (df = 152)	16.71 (df = 150)	16.46 (df = 143)
F Statistic	2.47 (df = 1; 152)	3.26** (df = 3; 150)	2.15** (df = 10; 143)
Note:			*p<0.1; **p<0.05; ***p<0.01

educ_adult 9.40e-02 3.60e-02 2.61 0.0099 ** ind_pauv_mon 5.34e-02 6.77e-02 0.79 0.4310
gini -1.02e+01 8.44e+00 -1.20 0.2310
for_dentr. 6.50e-02 6.56e-02 0.99 0.3237
— Signif. codes: 0 ‘’ ***0.001*** ’’ *0.01* ’’ 0.05 ‘.’ 0.1 ‘’ 1

Residual standard error: 8.18 on 143 degrees of freedom Multiple R-squared: 0.123, Adjusted R-squared: 0.0619 F-statistic: 2.01 on 10 and 143 DF, p-value: 0.0364

ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM: Level of Significance = 0.05

Call: gvlma(x = R3toilet)

```
                    Value p-value                Decision
```

Global Stat 3.5899 0.4643 Assumptions acceptable. Skewness 0.3161 0.5740 Assumptions acceptable. Kurtosis 3.1320 0.0768 Assumptions acceptable. Link Function 0.0413 0.8389 Assumptions acceptable. Heteroscedasticity 0.1005 0.7513 Assumptions acceptable.

Effect of Decentralization on provision of water facilities

In this model, our key explanatory variable ‘decentralization’ seems to have no impact of connection to water delivery infrastrucure. In reverse, population density, public expenditures per capita and average literacy rate of heads of households reveal to be significant; housholds health consumption is slightly significant.

decentralization2 log(population) Density log(pubexp.c) 1.065 1.833 1.652 1.145 log(consump.c) cons_health educ_adult ind_pauv_mon 1.133 1.136 1.176 1.167 gini for_dentr. 1.058 1.026 decentralization2 log(population) Density log(pubexp.c) FALSE FALSE FALSE FALSE log(consump.c) cons_health educ_adult ind_pauv_mon FALSE FALSE FALSE FALSE gini for_dentr. FALSE FALSE Non-constant Variance Score Test Variance formula: ~ fitted.values Chisquare = 3.951 Df = 1 p = 0.04683

```
studentized Breusch-Pagan test
```

data: R3soneb BP = 11.6, df = 10, p-value = 0.3126

Call: lm(formula = connect_soneb ~ decentralization2 + log(population) + Density + log(pubexp.c) + log(consump.c) + cons_health + educ_adult + ind_pauv_mon + gini + for_dentr., data = combined-data.data)

Residuals: Min 1Q Median 3Q Max -24.32 -9.41 -4.39 4.94 86.78

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) -80.73007 54.18061 -1.49 0.138
decentralization2 -6.26453 4.42672 -1.42 0.159
log(population) 3.75614 3.82895 0.98 0.328
Density 0.00564 0.00131 4.29 3.3e-05 ***log(pubexp.c) 4.27829 1.93155 2.21 0.028***
log(consump.c) 0.64665 1.63597 0.40 0.693
cons_health -1.51876 0.82882 -1.83 0.069 .
educ_adult 0.32168 0.07659 4.20 4.7e-05 * ind_pauv_mon 0.04069 0.14411 0.28 0.778
gini 11.66562 17.97764 0.65 0.517
for_dentr. -0.03723 0.13979 -0.27 0.790
— Signif. codes: 0 ‘’ ***0.001*** ’’ *0.01* ’’ 0.05 ‘.’ 0.1 ‘’ 1

Residual standard error: 17.4 on 143 degrees of freedom Multiple R-squared: 0.379, Adjusted R-squared: 0.335 F-statistic: 8.72 on 10 and 143 DF, p-value: 4.59e-11

ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM: Level of Significance = 0.05

Call: gvlma(x = R3soneb)

Table 4: Effect of decentralization on toilet access

	Dependent variable:		
	pop_toiletacess		
	(1)	(2)	(3)
Decentralization	−2.80	−2.67	−3.03
	(2.07)	(2.04)	(2.08)
Population		3.06*	2.71
		(1.66)	(1.80)
Population Density		0.0004	0.0001
		(0.001)	(0.001)
Log Public Expenditure per capita			−0.76
			(0.91)
Log Consumption per Capita			0.32
			(0.77)
Average Households Health Consumption Ratio			−0.21
			(0.39)
Average Literacy Rate of Head of Households			0.09***
			(0.04)
Monetary Poverty Index			0.05
			(0.07)
gini			−10.15
			(8.44)
perception of decentralization			0.06
			(0.07)
(Intercept)	38.20***	2.78	−3.03
	(1.43)	(18.96)	(25.44)
Observations	154	154	154
R^2	0.01	0.06	0.12
Adjusted R^2	0.01	0.04	0.06
Residual Std. Error	8.42 (df = 152)	8.26 (df = 150)	8.18 (df = 143)
F Statistic	1.83 (df = 1; 152)	3.25** (df = 3; 150)	2.01** (df = 10; 143)
Note:			*p<0.1; **p<0.05; ***p<0.01

Value p-value Decision

Global Stat 391.72 0.0000 Assumptions NOT satisfied! Skewness 118.10 0.0000 Assumptions NOT satisfied! Kurtosis 267.31 0.0000 Assumptions NOT satisfied! Link Function 0.88 0.3481 Assumptions acceptable. Heteroscedasticity 5.43 0.0198 Assumptions NOT satisfied!

t test of coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) -80.73007 NA NA NA decentralization2 -6.26453 NA NA NA log(population) 3.75614 NA NA NA Density 0.00564 NA NA NA log(pubexp.c) 4.27829 NA NA NA log(consump.c) 0.64665 NA NA NA cons_health -1.51876 NA NA NA educ_adult 0.32168 NA NA NA ind_pauv_mon 0.04069 NA NA NA gini 11.66562 NA NA NA for_dentr. -0.03723 NA NA NA

Effect of decentralization on availability of public health infrastructure

Like the previous models, decentralization does not seem to be a significant elements in the availability of healthcare centers at the subnational level. With regards to the explanatory variables: population, population density, and average literacy rate of the head of households seem to be strongly determinants of the existence of healthcare centers. Public expenditures per capita and poverty level result to be significant as well.

Call: lm(formula = pubhosp ~ decentralization2 + log(population) + Density + log(pubexp.c) + log(consump.c) + cons_health + educ_adult + ind_pauv_mon + gini + for_dentr., data = combined-data.data)

Residuals: Min 1Q Median 3Q Max -23.13 -6.66 -1.00 4.95 42.86

Coefficients: Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.01e+02 3.46e+01 -5.80 4.1e-08 ***decentralization2 -3.49e+00 2.83e+00 -1.23 0.22000*** ***log(population) 1.50e+01 2.45e+00 6.14 7.7e-09*** Density -2.84e-03 8.41e-04 -3.38 0.00093 ***log(pubexp.c) 3.85e+00 1.24e+00 3.12 0.00219*** *log(consump.c) -1.32e+00 1.05e+00 -1.27 0.20778*
cons_health 7.14e-01 5.30e-01 1.35 0.18003
educ_adult 2.02e-01 4.90e-02 4.12 6.5e-05 **ind_pauv_mon 2.98e-01 9.21e-02 3.24 0.00150** gini -4.20e+00 1.15e+01 -0.37 0.71556
for_dentr. 3.66e-02 8.94e-02 0.41 0.68250
— Signif. codes: 0 ‘’ ***0.001*** ’’ *0.01* ’’ 0.05 ‘.’ 0.1 ‘’ 1

Residual standard error: 11.1 on 143 degrees of freedom Multiple R-squared: 0.311, Adjusted R-squared: 0.263 F-statistic: 6.45 on 10 and 143 DF, p-value: 3.63e-08

ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM: Level of Significance = 0.05

Call: gvlma(x = R3pubhosp)

Value p-value Decision

Global Stat 71.590 1.04e-14 Assumptions NOT satisfied! Skewness 27.557 1.52e-07 Assumptions NOT satisfied! Kurtosis 33.929 5.72e-09 Assumptions NOT satisfied! Link Function 9.888 1.66e-03 Assumptions NOT satisfied! Heteroscedasticity 0.215 6.43e-01 Assumptions acceptable. decentralization2 log(population) Density log(pubexp.c) 1.065 1.833 1.652 1.145 log(consump.c) cons_health educ_adult ind_pauv_mon 1.133 1.136 1.176 1.167 gini for_dentr. 1.058 1.026 decentralization2 log(population) Density log(pubexp.c) FALSE FALSE FALSE FALSE log(consump.c) cons_health educ_adult ind_pauv_mon FALSE FALSE FALSE FALSE gini for_dentr. FALSE FALSE Non-constant Variance Score Test Variance formula: ~ fitted.values Chisquare = 40.51 Df = 1 p = 1.959e-10

studentized Breusch-Pagan test

data: R3pubhosp BP = 22.17, df = 10, p-value = 0.01426

Table 5: Effect of decentralization on water delivery infrastructure

	Dependent variable:		
	connect_soneb		
	(1)	(2)	(3)
Decentralization	−8.32	−7.82*	−6.26
	(5.24)	(4.60)	(4.43)
Population		0.63	3.76
		(3.75)	(3.83)
Population Density		0.01***	0.01***
		(0.001)	(0.001)
Log Public Expenditure per capita			4.28**
			(1.93)
Log Consumption per Capita			0.65
			(1.64)
Average Households Health Consumption Ratio			−1.52*
			(0.83)
Average Literacy Rate of Head of Households			0.32***
			(0.08)
Monetary Poverty Index			0.04
			(0.14)
gini			11.67
			(17.98)
perception of decentralization			−0.04
			(0.14)
(Intercept)	21.58***	10.74	−80.73
	(3.61)	(42.88)	(54.18)
Observations	154	154	154
R^2	0.02	0.25	0.38
Adjusted R^2	0.01	0.23	0.34
Residual Std. Error	21.26 (df = 152)	18.69 (df = 150)	17.42 (df = 143)
F Statistic	2.53 (df = 1; 152)	16.66*** (df = 3; 150)	8.72*** (df = 10; 143)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6: Effect of decentralization on availability of healthcare centers

	Dependent variable:		
	pubhosp		
	(1)	(2)	(3)
Decentralization	−2.77	−2.49	−3.49
	(3.20)	(3.01)	(2.83)
Population		11.25***	15.03***
		(2.45)	(2.45)
Population Density		−0.002**	−0.003***
		(0.001)	(0.001)
Log Public Expenditure per capita			3.85***
			(1.24)
Log Consumption per Capita			−1.32
			(1.05)
Average Households Health Consumption Ratio			0.71
			(0.53)
Average Literacy Rate of Head of Households			0.20***
			(0.05)
Monetary Poverty Index			0.30***
			(0.09)
gini			−4.20
			(11.50)
perception of decentralization			0.04
			(0.09)
(Intercept)	14.22***	−114.10***	−200.90***
	(2.20)	(28.07)	(34.65)
Observations	154	154	154
R^2	0.005	0.13	0.31
Adjusted R^2	−0.002	0.11	0.26
Residual Std. Error	12.98 (df = 152)	12.24 (df = 150)	11.14 (df = 143)
F Statistic	0.75 (df = 1; 152)	7.32*** (df = 3; 150)	6.45*** (df = 10; 143)
Note:			*p<0.1; **p<0.05; ***p<0.01

5 Potential Issues

The macroeconomic overview suggests that Benin's has experienced an improvement on health-services delivery over the past few years. Given that health-related services is highly decentralized, we have tested the impact of decentralization on some key health-related variables, issued from Benin's Households Survy. The microeconomic analysis, however, did not find any significant imapct of decentralization (proxied by the ratio of own-revenue to total expenditures) on the provision of health-related services and infrastructures. Given that exisiting literatures provide various decentralization indicators, the significance found in the microeconomic analysis might be the result of a misleading indicator. Moreover, because public services in Benin is highly financed by intergovernmental (rather than own-source revenues), it might be more reliable to consider an indicator or a model that takes into account this factor. Therefore, we propose to revise our proxy for decentralization and to further work on our model specification.

References

Bardhan, Pranab, and Dilip Mookherjee. 2000. "Capture and Governance at Local and National Levels." *American Economic Review*, 135–39.

Bird, Richard, and Edgard R Rodriguez. 1999. "Decentralization and Poverty Alleviation. International Experience and the Case of the Philippines." *Public Administration and Development* 19 (3): 299–319.

Crook, Richard C, and James Manor. 1998. *Democracy and Decentralisation in South Asia and West Africa: Participation, Accountability and Performance*. Cambridge University Press.

Faguet, Jean-Paul. 2004. "Does Decentralization Increase Government Responsiveness to Local Needs?: Evidence from Bolivia." *Journal of Public Economics* 88 (3). Elsevier: 867–93.

Galasso, Emanuela, and Martin Ravallion. 2005. "Decentralized Targeting of an Antipoverty Program." *Journal of Public Economics* 89 (4): 705–27.

Granado, Javier Arze del, Jorge Martinez-Vazquez, and R Renata Simatupang. 2008. "Local Government Fiscal Competition in Developing Countries: The Case of Indonesia." *Urban Public Economics Review* 8. Universidade de Santiago de Compostela: 13–45.

Grégoire, ROTA-GRAZIOSI, Emilie Caldeira, and Martial Foucault. 2010. "Decentralization in Africa and the Nature of Local Governments' Competition: evidence from Benin." CERDI.

Oates, Wallace E. 1972. *Fiscal Federalism*. Harcourt Brace Jovanovich.

Prud'Homme, Remy. 1995. "The Dangers of Decentralization." *The World Bank Research Observer* 10 (2). World Bank: 201–20.

Reinikka, Ritva, and Jakob Svensson. 2004. "Local Capture: evidence from a Central Government Transfer Program in Uganda." *The Quarterly Journal of Economics*, 679–705.

Santos, Boaventura de Sousa. 2005. "Participatory Budgeting in Porto Alegre: toward a Redistributive Democracy." *Democratizing Democracy: Beyond the Liberal Democratic Canon*. Verso.

Shah, Anwar, and Banco Mundial. 1994. *The Reform of Intergovernmental Fiscal Relations in Developing and Emerging Market Economies*. Vol. 23. World Bank Washington, DC.

Tiebout, Charles M. 1956. "A Pure Theory of Local Expenditures." *The Journal of Political Economy*, 416–24.

Treisman, Daniel. 2000. "The Causes of Corruption: a Cross-National Study." *Journal of Public Economics* 76 (3): 399–457.