

Final Project

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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, sub-national 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 micro-analysis 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.

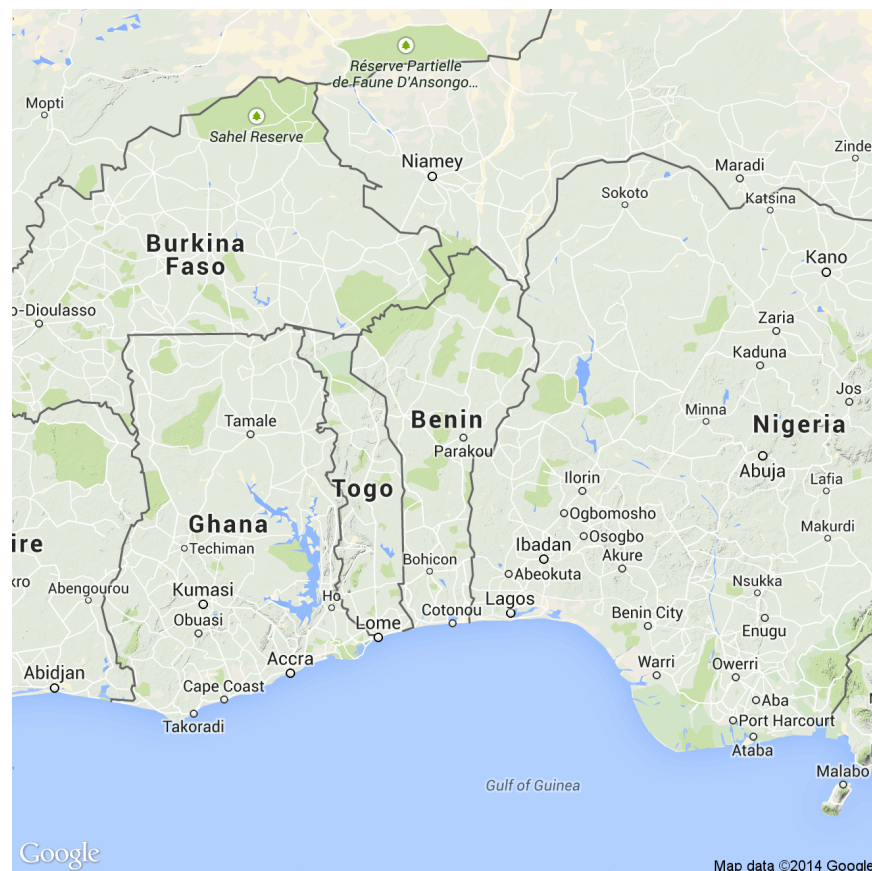


Figure 1:

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 sustainable development at both national and sub-national level. Decentralization has been incorporated as one of the core policy in these strategies. Alongside national development programs, the process has been 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 sub-national 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 favor 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 services 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 sub-national 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 access 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 sub-national 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 conferred to local governments. Therefore, we assume that there is a strong correlation between the macroeconomic overview and the outcomes on the sub-national 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. As we have limited information on the micro level, the macroeconomic overview allows us to frame assumptions on the overall provision of health-related services in Benin. To that end, We use data analytics tools to scrape openly available datasets from the World Bank and the World Health Organization.

World Bank indicators

The first dataset is obtained from the World Bank (WB) and includes the following variables:

- (i) health expenditure per capita: defined as the sum 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

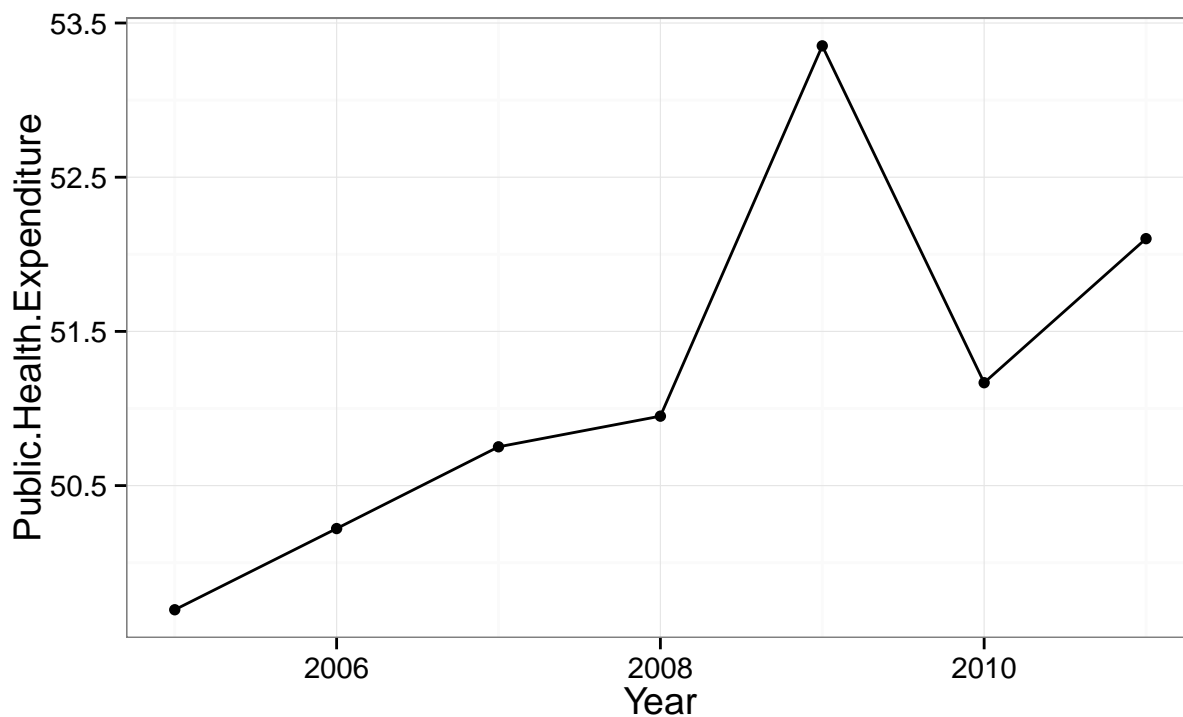
The second dataset is taken from the WHO databases, particularly from the Global Health Observatory Data which provides information on health infrastructures per 100,000 population in Benin including:

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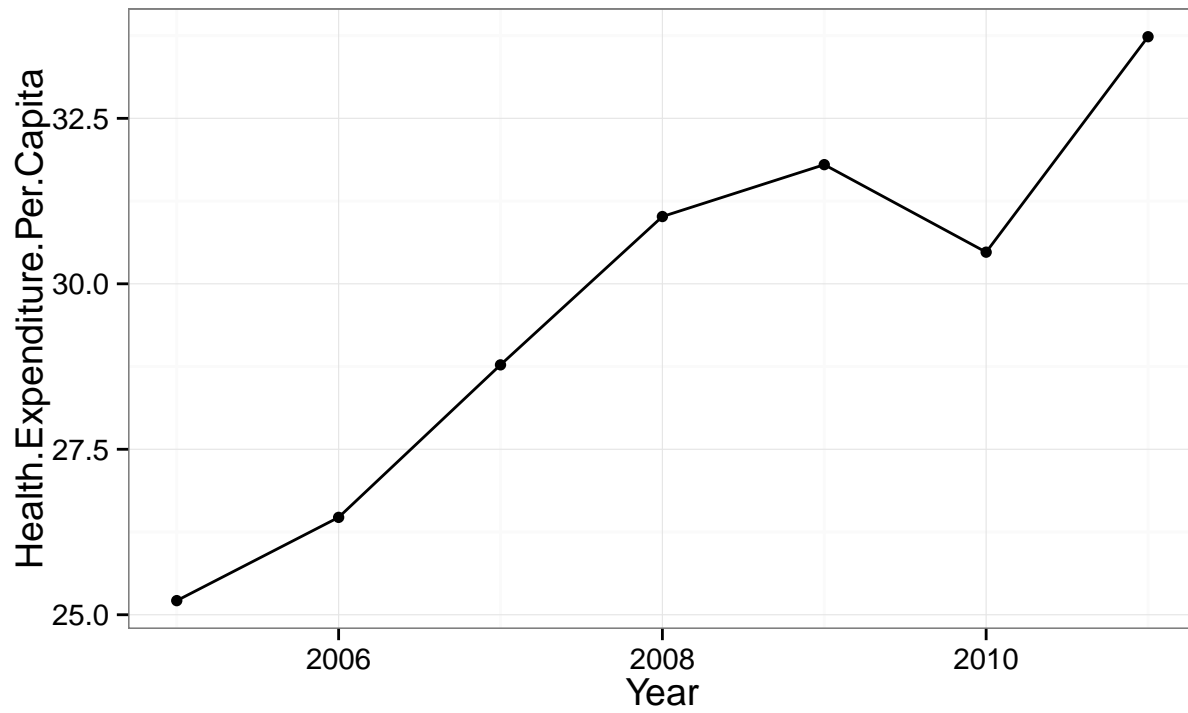
Unlike the dataset from the World Bank, this datasets only provide Benin-related indicators for the years 2010 and 2013, which we extracted for this project.

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.

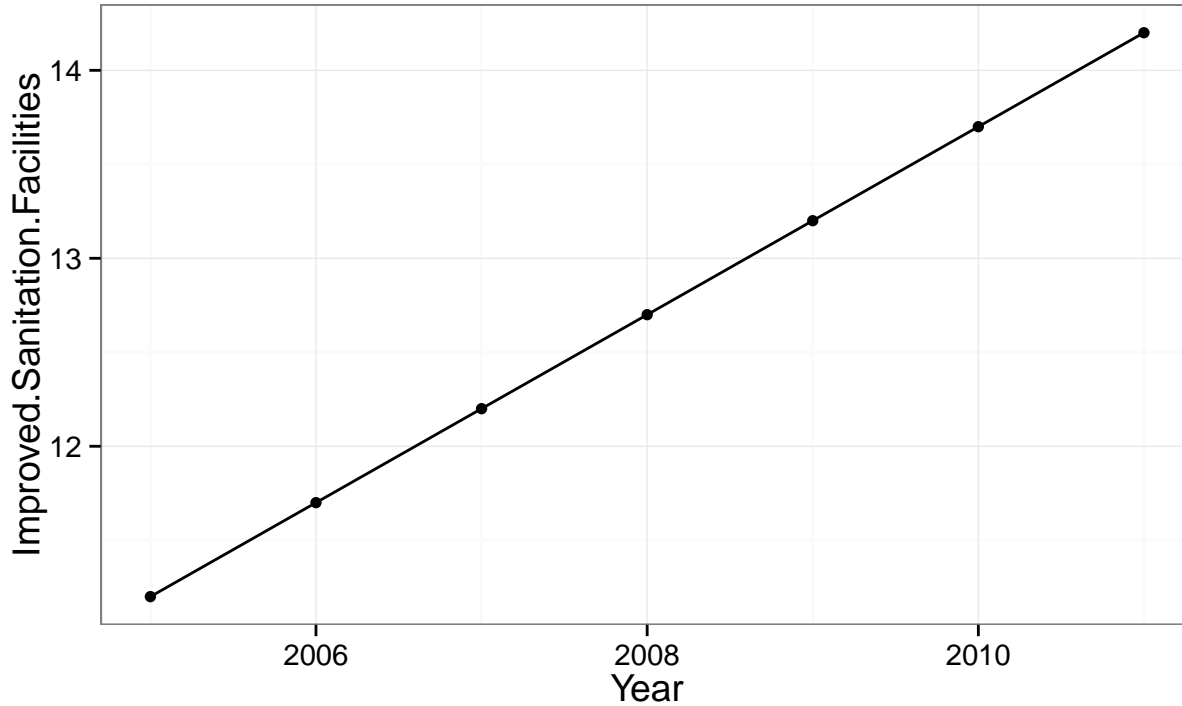
Trend of public expenditure over the years



Trend of health expenditure per capita over the years



Improvement in sanitation facilities over the years



Although the WHO data is only available for 2010 and 2013, this table indicates a small variation (decrease) in the number of provincial and specialized hospitals in Benin. As for the data from WHO, we will further assess these outcomes in the section below and with the microeconomic analysis.

	Indicator	Year	Display.Value
68	Total density per 100 000 population: Specialized hospitals	2010	0.12
113	Total density per 100 000 population: Provincial hospitals	2013	0.05
135	Total density per 100 000 population: Specialized hospitals	2013	0.11
169	Total density per 100 000 population: Health centres	2010	6.36
209	Total density per 100 000 population: Provincial hospitals	2010	0.06
527	Total density per 100 000 population: District/rural hospitals	2010	0.29

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 decentralization 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 autonomy (RA) indicator used by (Akai and Sakata 2002) and (Habibi et al. 2003) to proxy for decentralization. This indicator is defined as the ratio of own-source revenues over the total expenditures of a sub-national entity.

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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	440.69	1,376.65	8	10,917
pubexp.c	154	4,695.30	6,811.78	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 follows: (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.

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Table 2: Descriptive statistics of dependent variables

Statistic	N	Mean	St. Dev.	Min	Max
pop_wateraccess	154	70.31	17.07	32	100
pop_toiletaccess	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 mentioned 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 sub-national 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.

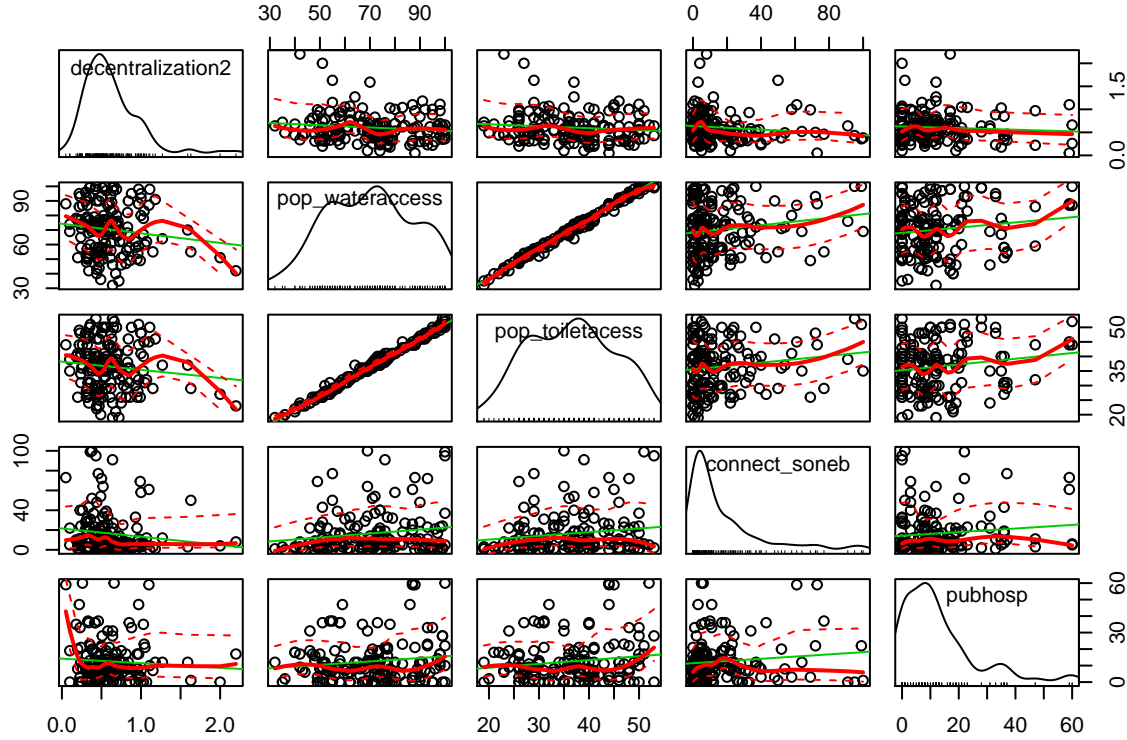


Figure 2:

Impact of Decentralization on Water Access

For our first estimation, we evaluate the impact of decentralization on access to water at the municipal level in Benin. As described in the econometric equation, decentralization is the independent variable, percentage

of households in the municipality that have access to water. In this model, decentralization reveals to be insignificant, as well as the other explanatory variables. This may be due to misspecification of the model.

Table 3: Impact of decentralization on water access

	<i>Dependent variable:</i>		
	pop_wateraccess		
	(1)	(2)	(3)
Decentralization	−6.57 (4.18)	−6.31 (4.12)	−5.87 (4.18)
Population		5.79* (3.35)	5.38 (3.62)
Population Density		0.001 (0.001)	0.0003 (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*** (2.88)	7.29 (38.33)	−7.48 (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

In all three models, decentralization does not reveal to be significant. In the second model, logarithm of population reveals to be significant such that an increase in population by one percent would increase access to water by approximately 5.8 percentage point. However, once we control for additional parameters, the variable turns out to be insignificant. In the final specification, Household health-related consumption and

education level of head of households are significant, respectively at 10% and 5% such that an increase in the average literacy of head of household in a particular municipality would increase access to water by 0.19 percentage point; and a growth in health consumption by one percent point would decrease access to water by 1.37 percentage point (*ceteris paribus*). The adjusted Rsquare however remain very low, suggesting a misspecification of our model, although the results from the tests for validation of linear models assumptions is on overall positive.

Impact of decentralization on access to toilet facilities

In this subsection, we estimate the impact of decentralization of access to toilet facilities at the municipal level. Alike the previous model, the computed indicator on decentralization as our independent variable, percentage of households in the municipality that have access to toilet facilities as our dependent variable. We also use the same set of explanatory variables to control for heterogeneity across municipalities.

As displayed by above regression table, decentralization does not seem to have any particular incidence on the access to toilet facilities at the municipal level. In the second restricted model, as we introduced demographic variables, population reveals to be significant at 10% such that a one percent increase in the population size is likely to increase access to toilet facilities by 3.064 percent point, far greater than the previous model on water access, although population is no longer meaningful in the final equation. Like in the equation on water access, the average literacy rate of head of households appear to have a positive impact on access to toilet facilities at 1% significance such that an increase in average literacy rate of households would increase access to toilet facilities by 0.09 percentage point. The final model also displays an increase in the adjusted R square. However, although the fitness test of the linear model assumptions hold (see annexes) the value of the adjusted R square remains relatively low, which again implies potential misspecification and the omission of key variables

Effect of Decentralization on provision of water facilities

Here we also use our basic regression model to assess the impact 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 infrastructure. In reverse, population density, public expenditures per capita and average literacy rate of heads of households reveal to be significant; households health consumption is slightly significant.

Unlike previous models, decentralization appears to be significant in our second restricted models (10%), such that an increase in decentralization by one unit would be associated with an decrease in the number of connections to water facilities by 7.82 units. This is a relatively surprising result and seems to contradict the assumptions that decentralization might lead to greater access of public goods on sub-national level. Once we control for other parameters, however, the variable decentralization turns insignificant. Alike previous models, average literacy rate of head of households appears to be a determinant of the average connection rate to water pipeline within a particular municipality. Public expenditure is positively significant at 5%, indicating that if public expenditure increases by 1 percent, the number of water pipeline connection would increase by 4.27 units. Households health-related consumption is also slightly significant.

It’s worth noting that the adjusted R square has significantly increased in comparison with the previous equation, signaling an improvement in the goodness fit of the model. The global validation test for linear models assumptions (in annexes) however reveals that the model suffers from heterogeneity and thus violation of Gauss Markov assumptions for an unbiased and efficient pooled-OLS estimates. We have chosen to run a robust regression model, shown in the last column of the table in which none of the variables is significant. Due to the limitations in the panel data (time dimension=2), we decided not to pursue more sophisticated specification (e.g. fixed or random effects models). Our results remain should be regarded as indication for further research on the topic or in that particular context.

Effect of decentralization on availability of public health facilities

Using our estimated model as indicated above, we assess the impact of decentralization on the access to public health infrastructures, notably access to provincials and rural hospitals. The data drawn from the World Health Organization has suggested a decrease in the number provincial as well as specialized hospitals from 2010 to 2013. Our microeconomic data provides the number of hospitals per municipalities over the period

Table 4: Effect of decentralization on toilet access

	<i>Dependent variable:</i>		
	pop_toiletaccess		
	(1)	(2)	(3)
Decentralization	−2.80 (2.07)	−2.67 (2.04)	−3.03 (2.08)
Population		3.06* (1.66)	2.71 (1.80)
Population Density		0.0004 (0.001)	0.0001 (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*** (1.43)	2.78 (18.96)	−3.03 (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

Table 5: Effect of decentralization on water delivery infrastructure

	<i>Dependent variable:</i>		
	connect_soneb		
	<i>OLS</i>		
	(1)	(2)	(3)
Decentralization	−8.32 (5.24)	−7.82* (4.60)	−6.26 (4.43)
Population		0.63 (3.75)	3.76 (3.83)
Population Density		0.01*** (0.001)	0.01*** (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*** (3.61)	10.74 (42.88)	−80.73 (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<

2010 and 2011. we considered publicly funded healthcare centers which we regress on our key explanatory variables to assess whether an increase in financial and administrative independence of Beninese municipalities might have led to an increase in the provision of healthcare facilities.

Table 6: Effect of decentralization on availability of healthcare centers

	<i>Dependent variable:</i>		
		pubhosp	
	(1)	(2)	(3)
Decentralization	-2.77 (3.20)	-2.49 (3.01)	-3.49 (2.83)
Population		11.25*** (2.45)	15.03*** (2.45)
Population Density		-0.002** (0.001)	-0.003*** (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*** (2.20)	-114.14*** (28.07)	-200.89*** (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

As indicated by above regression table, our indicator for decentralization does not appear to have a significant impact of the provision of healthcare facilities. In our second regression equation, population is highly and positively significant which indicates that the greater the population of a municipality, the higher the

propensity to have access to a healthcare center, even though the coefficient is relatively small. Population density is also negatively significant which indicates that the higher the population density, the less likely it is to have access to health care facilities. In the third and more specified equation, population and population density are similarly significant (density moving from 5% to 1%) with the exact same direction in the correlation with our dependent variable. Public expenditure per capita reveals to be significant at 5%, a result that goes along with favorable theories on decentralization. Once more, the average rate of literacy of head of household is strongly and positively significant, although the coefficient is relatively small. For this late model, monetary poverty index is positively significant, such as the higher the greater the number of poor people, the higher the propensity to have access to healthcare facilities. This latter is a surprising result and contrary to general expectations based on municipal income and poverty level. However, given that in recent years and with the millennium development goals, a special emphasis was put on provision of healthcare in rural areas, it might have been the case that the growth rate of provision of healthcare facilities was higher in rural than in urban areas, which may justify such as result.

With more specification, the adjusted R-square of the last regression equation has also considerably improved. However, the global validation of linear models assumptions test indicates that some assumptions, although the heterogeneity assumption is met. This imply that we should not consider these coefficients as unbiased and efficient even though they are significant. As for the previous case, these results must also be taken as an indicator for further research which may involve a more balanced panel dataset which could allow for sophisticated econometric models.

5 Conclusions and Discussion

This paper is an attempt to empirically assess the impact decentralization on provision of health-related facilities. As stated in the introduction, decentralization has been at the center stage of policy experiments in many developing countries, especially in Sub-Saharan Africa. Likewise, provision of health-related services has also been one of the core development policy in these countries, mainly as part of the millennium development goals. Bridging these two is very relevant as they both have as final aim the improvement of living standards of the poorest strata of the population within a country.

For this empirical assessment, we have chosen Benin as a case study. Decentralization has been at a pilot phase for the past 10 years, and a major vector in the provision of health related services on the sub-national level. We computed a proxy for decentralization, taken from existing literature (the ratio of own-revenue to total expenditures), and we assess the impact of this indicator on four dependent variables which are related to health. The overall result suggest that decentralization (proxied by our variable) does not have an impact of the provision of services considered in this paper (access to water, water facilities, toilet facilities and public healthcare centers). The overall result also suggests that average literacy rate of head of households, public expenditure per capita and demographic indicator such as population might have a significant impact of the provision of the above-mentioned services. Notwithstanding, and as stated in the first section, this paper is an attempt and results should be simply considered as indications for further research.

The scarcity of sub-national and local data, and the limitations to the empirical measurements of health provision or decentralization per se, have impeded a thorough analysis of the question. However, from a policy perspective, this exercise has indicated that education level of head of households might be an important component in the underlying process of rural development and that should be considered in the overall development policy of sub-national regions. Moreover, the results suggest that, more than a decentralized system, an increase in the overall public expenditure per capita at municipal level might have some significant impact on health provision. Relying on these, we remain confident that this exercise will be a start for further reflection on the topic as it joins the effort in looking for answers to key development questions.

6 Annexes

Impact of decentralization on water access

Global Validation of Linear Model Assumptions

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 -32.730 -13.316 0.321 11.087 38.321

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

(Intercept) -7.478644 51.206941 -0.146 0.8841

decentralization2 -5.865888 4.183760 -1.402 0.1631

log(population) 5.375814 3.618797 1.486 0.1396

Density 0.000252 0.001243 0.203 0.8396

log(pubexp.c) -1.514738 1.825540 -0.830 0.4081

log(consump.c) 0.768119 1.546177 0.497 0.6201

cons_health -1.369706 0.783335 -1.749 0.0825 . educ_adult 0.187641 0.072384 2.592 0.0105 * ind_pauv_mon 0.107438 0.136199 0.789 0.4315

gini -20.432062 16.990952 -1.203 0.2311

for_dentr. 0.132393 0.132117 1.002 0.3180

— Signif. codes: 0 ‘’ **0.001** ’’ 0.01 ’’ 0.05 ‘.’ 0.1 ‘.’ 1

Residual standard error: 16.46 on 143 degrees of freedom Multiple R-squared: 0.1309, Adjusted R-squared: 0.0701 F-statistic: 2.153 on 10 and 143 DF, p-value: 0.02398

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
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Global Stat 3.84233 0.42777 Assumptions acceptable. Skewness 0.33051 0.56536 Assumptions acceptable. Kurtosis 3.16739 0.07512 Assumptions acceptable. Link Function 0.24707 0.61915 Assumptions acceptable. Heteroscedasticity 0.09735 0.75503 Assumptions acceptable.

	Value	p-value	Decision
Global Stat	3.8423251	0.4277652	Assumptions acceptable.
Skewness	0.3305070	0.5653607	Assumptions acceptable.
Kurtosis	3.1673940	0.0751222	Assumptions acceptable.
Link Function	0.2470699	0.6191459	Assumptions acceptable.
Heteroscedasticity	0.0973542	0.7550281	Assumptions acceptable.

Impact of decentralization on access to toilet facilities

Global Validation of Linear Model Assumptions

Call: `lm(formula = pop_toiletaccess ~ 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 -16.3003 -6.2866 0.1583 5.5192 19.7883

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

(Intercept) -3.034e+00 2.544e+01 -0.119 0.90523

decentralization2 -3.027e+00 2.078e+00 -1.457 0.14740

log(population) 2.708e+00 1.798e+00 1.506 0.13417

Density 1.235e-04 6.173e-04 0.200 0.84173


```
log(pubexp.c) -7.563e-01 9.069e-01 -0.834 0.40570
log(consump.c) 3.194e-01 7.681e-01 0.416 0.67814
cons_health -2.071e-01 3.891e-01 -0.532 0.59545
educ_adult 9.398e-02 3.596e-02 2.614 0.00992 ** ind_pauv_mon 5.343e-02 6.766e-02 0.790 0.43102
gini -1.015e+01 8.441e+00 -1.203 0.23097
for_dentr. 6.499e-02 6.563e-02 0.990 0.32372
— Signif. codes: 0 ‘’ 0.001 ’’ 0.01 ’’ 0.05 ‘.’ 0.1 ‘.’ 1
```

Residual standard error: 8.179 on 143 degrees of freedom Multiple R-squared: 0.1232, Adjusted R-squared: 0.06188 F-statistic: 2.009 on 10 and 143 DF, p-value: 0.03641

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
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Global Stat	3.58986	0.46435	Assumptions acceptable.
Skewness	0.31607	0.57398	Assumptions acceptable.
Kurtosis	3.13198	0.07677	Assumptions acceptable.
Link Function	0.04135	0.83886	Assumptions acceptable.
Heteroscedasticity	0.10047	0.75127	Assumptions acceptable.

	Value	p-value	Decision
Global Stat	3.5898644	0.4643464	Assumptions acceptable.
Skewness	0.3160707	0.5739786	Assumptions acceptable.
Kurtosis	3.1319757	0.0767706	Assumptions acceptable.
Link Function	0.0413495	0.8388648	Assumptions acceptable.
Heteroscedasticity	0.1004685	0.7512682	Assumptions acceptable.

Impact of decentralization on provision of water facilities

Global Validation of Linear Model Assumptions

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 -24.324 -9.405 -4.388 4.940 86.785

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

(Intercept) -80.730067 54.180608 -1.490 0.1384

decentralization2 -6.264532 4.426717 -1.415 0.1592

log(population) 3.756138 3.828946 0.981 0.3283

Density 0.005636 0.001315 4.286 3.32e-05 **log(pubexp.c) 4.278293 1.931552 2.215 0.0283**

log(consump.c) 0.646652 1.635966 0.395 0.6932

cons_health -1.518761 0.828825 -1.832 0.0690 .

educ_adult 0.321684 0.076588 4.200 4.67e-05 * ind_pauv_mon 0.040695 0.144108 0.282 0.7781

gini 11.665619 17.977643 0.649 0.5174

for_dentr. -0.037225 0.139789 -0.266 0.7904

— Signif. codes: 0 ‘’ **0.001** ’’ 0.01 ’’ 0.05 ‘.’ 0.1 ‘.’ 1

Residual standard error: 17.42 on 143 degrees of freedom Multiple R-squared: 0.3789, Adjusted R-squared: 0.3355 F-statistic: 8.724 on 10 and 143 DF, p-value: 4.586e-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)

Value p-value Decision

Global Stat 391.7159 0.00000 Assumptions NOT satisfied! Skewness 118.1027 0.00000 Assumptions NOT satisfied! Kurtosis 267.3053 0.00000 Assumptions NOT satisfied! Link Function 0.8803 0.34813 Assumptions acceptable. Heteroscedasticity 5.4277 0.01982 Assumptions NOT satisfied!

	Value	p-value	Decision
Global Stat	391.7158872	0.0000000	Assumptions NOT satisfied!
Skewness	118.1026748	0.0000000	Assumptions NOT satisfied!
Kurtosis	267.3052701	0.0000000	Assumptions NOT satisfied!
Link Function	0.8802678	0.3481284	Assumptions acceptable.
Heteroscedasticity	5.4276746	0.0198201	Assumptions NOT satisfied!

Impact of decentralization on provision of healthcare facilities

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 -23.125 -6.656 -0.995 4.948 42.856

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

(Intercept) -2.009e+02 3.465e+01 -5.798 4.12e-08 **decentralization2 -3.487e+00 2.831e+00 -1.232 0.219999**

log(population) 1.503e+01 2.448e+00 6.140 7.71e-09 Density -2.843e-03 8.408e-04 -3.381 0.000931
log(pubexp.c) 3.853e+00 1.235e+00 3.120 0.002190 log(consump.c) -1.324e+00 1.046e+00 -1.265 0.207783

cons_health 7.140e-01 5.300e-01 1.347 0.180026

educ_adult 2.016e-01 4.897e-02 4.117 6.47e-05 **ind_pauv_mon 2.984e-01 9.215e-02 3.238 0.001498**

gini -4.197e+00 1.150e+01 -0.365 0.715557

for_dentr. 3.664e-02 8.939e-02 0.410 0.682498

— Signif. codes: 0 ‘**0.001**’ ‘0.01’ ‘0.05’ ‘0.1’ ‘1’

Residual standard error: 11.14 on 143 degrees of freedom Multiple R-squared: 0.3109, Adjusted R-squared: 0.2627 F-statistic: 6.451 on 10 and 143 DF, p-value: 3.629e-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 1.044e-14 Assumptions NOT satisfied! Skewness 27.557 1.525e-07 Assumptions NOT satisfied! Kurtosis 33.929 5.716e-09 Assumptions NOT satisfied! Link Function 9.888 1.663e-03 Assumptions NOT satisfied! Heteroscedasticity 0.215 6.429e-01 Assumptions acceptable.

	Value	p-value	Decision
Global Stat	71.5897486	0.0000000	Assumptions NOT satisfied!
Skewness	27.5574949	0.0000002	Assumptions NOT satisfied!
Kurtosis	33.9291206	0.0000000	Assumptions NOT satisfied!
Link Function	9.8881667	0.0016635	Assumptions NOT satisfied!
Heteroscedasticity	0.2149665	0.6429023	Assumptions acceptable.

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