A DISCOURSE ON THE EFFECTIVENESS OF PUBLIC HEALTH EXPENDITURES ON HEALTH OUTCOMES IN EAST AFRICA: A COMPARATIVE ANALYSIS OF RWANDA`S PERFORMANCE

By

Ntegano Abel

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

MASTER OF DEVELOPMENT POLICY

2014

A DISCOURSE ON THE EFFECTIVENESS OF PUBLIC HEALTH EXPENDITURES ON HEALTH OUTCOMES IN EAST AFRICA: A COMPARATIVE ANALYSIS OF RWANDA'S PERFORMANCE

By

Ntegano Abel

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

MASTER OF DEVELOPMENT POLICY

2014

Professor Kye-Woo Lee

A DISCOURSE ON THE EFFECTIVENESS OF PUBLIC HEALTH EXPENDITURES ON HEALTH OUTCOMES IN EAST AFRICA

A COMPARATIVE ANALYSIS OF RWANDA'S PERFORMANCE

By

Ntegano Abel

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

MASTER OF DEVELOPMENT POLICY

Committee in charge:

Professor Kye-Woo LEE, Supervisor

Professor Seulki CHOI

Professor Jaeun SHIN

Approval as of May, 2014

ABSTRACT

A DISCOURSE ON THE EFFECTIVENESS OF PUBLIC HEALTH EXPENDITURES ON HEALTH OUTCOMES IN EAST AFRICA: A COMPARATIVE ANALYIS OF RWANDA'S PERFORMANCE

By

NTEGANO Abel

This study employed the fixed effects regression model to ascertain the effectiveness of public health expenditures on health-outcomes in the currently five members East African Community, between the period 1995 and 2010. In this study, public health expenditures were not statistically significant, in determining the infant mortality and life expectancy rates. This result conforms to Kabir (2008)'s findings. However, urbanization, improved access to water and sanitation, coupled with real per capita income were indispensable in clarifying the infant mortality rate performance, all registering statistically significant negative signs.

Real per capita income, urbanization, nutritious food consumption, plus improved access to water and sanitation were statistically significant, and positively related to the life expectancy rate. The HIV/AIDS prevalence rate was also statistically significant, and negatively related to the life expectancy rate.

Owing to Rwanda`s considerable infant mortality rate, as well as low life expectancy rate, despite its relatively high public health expenditures during the period between 1995 and 2010,

the aforementioned significant determinants of health outcomes, were invoked to inform the policy prescriptions the East African Community, and Rwanda in particular can adopt to better the health status.

Dedicated to Florentine UWASE

ACKNOWLEDGEMENTS

Research work as modest as it is, does not belong to the author alone. There is more in joy and distress that many people are indebted. This research is by and large a collective effort.

Many thanks to God Almighty, the Heavenly Father, Who has protected me and given me the capacity, the ability to complete my studies at KDI School.

My sincere gratitude is addressed especially to my supervisors; Professor Lee Kye Woo and Professor Seulki Choi, despite their multiple obligations, they have provided me with leadership to this research. Their scientific strictness, their openness, their insightful thoughts and constructive advices have been the source of its fulfillment.

I would like to thank all KDI School staff and friends who, consistently, provided me with assistance and support that helped me to accomplish this research.

Many thanks are expressed to KOICA and KDI School for awarding me the Fellowship which enabled me to study in Korea.

My thanks are also addressed to my dear wife Florentine UWASE, for her constant encouragement and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

EAC	East African Community
GER	African Development Fund
HIV/AIDS	Human Immunodeficiency Virus Infection / Acquired Immunodeficiency Syndrome
MDGs	United Nations' Millennium Development Goals
GER	Gross enrolment ratio
GDP	Gross Domestic Product
IMRs	Infant Mortality Rates
OECD	Organization of Economic Co-operation and Development
R & D	Research and Development
VIP	Ventilated Improved Pit
WDI	World Development Indicators

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

The main purpose of this research is to ascertain the effectiveness of public funds expended on the health sector in the East African Community, in improving the health status between 1995 and 2010. To this end, Rwanda`s performances in terms of reducing the HIV/AIDS prevalence rate, decreasing the infant mortality rate, increasing the life expectancy rate, and registering success in treating Tuberculosis are compared to other four East African Community countries of Kenya, Uganda, Tanzania and Burundi. Performed data analysis suggests that despite Rwanda`s relatively substantial public health expenditures, the infant mortality rate was instead high, and the life expectancy rate was the lowest in the region, which begs the question why no salutary effects were imposed on the latter health outcomes.

Against this background, this paper by and large seeks to answer the aforementioned telling question. Expending money on the health sector is predicated upon the productivity of a healthy work-force, with capacity to work smarter, harder, and longer. Albeit "macroeconomists acknowledge the contribution of human capital to economic growth, their empirical studies define human capital solely in terms of schooling" (Bloom et al 2001). Granting that health`s impact on economic growth is as great as schooling's impact on economic growth, this paper submits that sustainable and increased commitment of funds to the health sector can only be justified, if it translates into desired health benefits such as low HIV/AIDS prevalence rates, longer life expectancy rates, low Malaria death rates, low Infant Mortality Rates, and Tuberculosis treatment success.

1.2 PROBLEM STATEMENT

Notwithstanding its large Public Health Expenditures, relative to its East African Community counterparts, the infant mortality rate in Rwanda was high and the life expectancy rate rather low, in the period between 1995 and 2010. As part of the "United Nation's Millennium Development Goals (MDGs)" targets, it proves very imperative to comprehensively understand other mechanisms via which, the latter health outcomes can be bettered, so as to improve the quality of life in Rwanda. If channeling huge funds into the health sector alone hardly conduces to good health, therefore other viable options such as subsisting on a nutritious diet, dwelling in hygienic conditions, etc ought to be explored.

1.3 STUDY OBJECTIVES

This paper`s overarching objective, is to take stock of Rwanda`s health outcomes performance, given the relatively large financial commitments into its health sector, over the period 1995 and 2010. Specifically stated, this study`s overarching objective is to:

- Ascertain the effectiveness of public health expenditures in achieving the desired health benefits, for instance reducing infant mortality as well as increasing life expectancy rates.

1.4 STUDY SIGNIFICANCE

The study ascertains other determinants of health outcomes in the East African Community, besides public health expenditures, with high statistical significance, and thus plausibly high policy import that can be implemented by Rwanda. In so doing, the study aims to show that public health expenditures, given the country`s low level of economic development, should for instance be supplemented by programs geared towards increasing the consumption of food high in nutritious value, improving the real income per capita, and urbanization, so as to create desired health benefits in an effective and sustainable manner.

1.5 STUDY MOTIVATION

Analyzing the trend of health expenditures and aggregate health indicators constitutes the overarching motivation for this study. For instance, preliminary investigations on Rwanda show that the trend of public health expenditures was on the rise, but health indicators such as life expectancy rates were not rising, or infant mortality rate reducing commensurate with the high public health expenditures. Then aspersions are cast on the efficacy of public health expenditures. Perchance other significant factors explaining variations in health outcomes exist, besides public health expenditures, which can inform policy prescriptions in improving the health status in the East African Community in general, and Rwanda in particular.

1.6 RESEARCH QUESTIONS AND HYPOTHESIS

The cardinal question sought to be answered by this paper, is whether public expenditures on health in the East African Community conduced to desired health benefits. Precisely stated:

- Do health indicators such as the infant mortality and life expectancy rates improve, as public health expenditures get increased?
- If so, why did Rwanda`s relatively large public health expenditures in the East African Community, not translate into reduced infant mortality rates as well as increased life expectancy rates?

1.7 THE STRUCTURE OF THE PAPER

This paper is structured as follows: After the introduction, in chapter two the existing literature is reviewed, the employed analytical methodology and data presented in chapter three, the related results are discussed in chapter four, coupled with policy implications and conclusive remarks in chapter five.

CHAPTER TWO: LITERATURE REVIEW

"There is an extensive literature on health expenditures and their growth in OECD countries. However evidence from developing countries is relatively scarce." (Saksena and Holly 2011). Indeed researchers such as Bichaka and Gutema (2008), Kaseje (2006), Jaunky and Khadaroo (2006) submit that insufficient health-care funding in Africa, frustrates efforts to improve health outcomes, for instance infant mortality and life expectancy rates. To this end, this study`s overarching purpose is to analyze the success of public health care expenditures on health outcomes, in the five East African countries, particularly Rwanda`s performance relative to its regional counterparts. Prior to expatiating on the efficacy of public health expenditures in perking up the healthiness status, a brief definition of what constitutes national health spending is introduced. Finally the factors explaining variations in desired health outcomes, to ascertain prevailing controversies in the extant literature are discussed.

It is vitally important to state from the outset that East African Community used to include only the three countries of Kenya, Tanzania, and Uganda. [1]However, Rwanda and Burundi joined the East African Community on June 18, 2007, which essentially implies that this study`s definition of what constitutes East African Community, uniquely differs from other related papers researching on particular regions in Africa, or Africa as a whole (Anyanwu and Erhijakpor 2007 and Okunade 2005).

"Total health care expenditure is generally categorized as public and private health care expenditure" (Novignon et al 2012). Public health expenditures include essentially domestic

[1] Accessed http://www.afrol.com/articles/23097, on the integration of Rwanda and Burundi into the East African Community.

resources and external funding channeled to all government's health related activities. [2] Private health expenditures constitute "payments made by the patients at the point of receiving medical services" (Saksena and Holly 2011). By and large, some researchers use total health expenditures, in their studies germane to health spending and related outcomes (Olaniyan et al 2013, Anyanwu and Erhijakpor 2007, and Novignon et al 2012). Other researchers employ either public or private health care expenditures (Guerriere et al 2008 and Costa-Font and Pons-Novell 2007). Furthermore, researchers focus on say the OECD member countries, when explaining variations in health care outcomes (Or 2000, Jee and Or 1999). Needless to say, related studies have been done on Africa as previously indicated in this chapter.

Using "panel data from 1995 to 2010, covering 44 countries in Sub-Saharan Africa," Novignon et al. (2012) ran fixed and random effects regression models to determine the effect of total health care expenditures on health outcomes. They explain that basically health outcomes comprise "life expectancy, infant mortality, and the death rate". Researchers in existing literature are divided according to health-care expenditures' salutary effect on the latter health-outcomes, and health expenditures` lack of statistical insignificance in determining the health status. For instance, Bhalotra (2007) used similar specifications in the existing literature, but did not find any reductive result of "public health expenditures on infant mortality rate in India." [3] By invoking "cross-sectional data on 98 developing countries, to ascertain the impact of public

[2] Novignon et al.: "The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis". Health Economics Review 2012, 2.

[3] Sonia, Bhalotra. "Spending to Save? State Health Expenditure and Infant Mortality in India." Discussion Paper Series IZA DEP, no. 2914, 2007, 4.

health expenditure on infant mortality" [4], Filmer and Pritchett (1999) found a tenuous and statistically insignificant effect of the former on the latter.

On the other hand, by "employing Ordinary Least Square (OLS) and panel data techniques on 160 countries," Issa and Ouattara (2005) showed that a strong negative relationship exists between health outlays expenditures and infant mortality rates (IMRs). Gupta et al (2002) despite showing the existence of "a negative correlation between public health expenditure and child mortality" [5], this relationship was not robust to other model specifications. In addition, by invoking a 22-developing country cross-sectional data in 1985, Ravallion et al (1993) discovered a beneficial effect of "health expenditures on life expectancy", albeit income had no effect.

Central to this study, is that Issa and Ouattara (2005) show that "Alves and Belluzo (2005) estimated static and panel data models, using census data from Brazil for the period 1970-2000 to investigate the determinants of infant mortality rates. The findings of their paper confirm that poor child health, in terms of mortality rates in Brazil, can be explained by the levels of education, sanitation, and poverty." Moreover in his study on the "determinants of life expectancy in developing countries," where he employed multiple regression and probit frameworks, Kabir (2008) found that "most of the explanatory variables turned out to be statistically insignificant, implying that the important socio-economic factors such as income per capita, education, public health expenditure, access to safe water, and urbanization cannot always be considered to be influential in determining life expectancy in developing countries."

---

[4] Ibid.; 5.

[5] Gupta, S., M. Verhoeven and E. Tiongson. "Public spending on health care and the poor", *Health Economics*, 2003, 12: 685-96.3.

In a nutshell, it suffices to say that tenuous salutary effect of public health expenditures on health outcomes can plausibly be explained, inter alia, by the existence of other statistically significant factors in explaining the variations in say infant mortality and life expectancy. The latter cogent possibility forms the most integral part of this study. Precisely stated, if Rwanda`s relatively high public health expenditures are not conducing to a reduction in infant mortality rates, and an increase in life expectancy. If other significant determinants of health outcomes abound besides public health expenditures, then they worth being considered by the Rwandan government, in its efforts to improve its country`s health status.

CHAPTER THREE: MODEL SPECIFICATION AND METHODOLOGY

3.1 MODEL SPECIFICATIONS

To demonstrate the effectiveness of public health care expenditures in achieving the desired health benefits, a panel data fixed effects regression is run using the STATA econometric software, for the period between 1995 and 2010; it comprises the currently five East African Community countries (i.e. Uganda, Kenya, Tanzania, Burundi and Rwanda). The data employed in this study came from the "World Bank`s World Development Indicators database". [6] The standard static model enables the predictor intercepts to represent country effects, it takes the basic structure, with "i" denoting each country, whereas "t" represents a period of time as follows:

$LINFMO_{it} = \beta_0 + \beta_1 LPHEY_{it} + \beta_2 LIWA_{it} + \beta_3 LISAF_{it} + \beta_4 LFPI_{it} + \beta_5 LURB_{it} + \beta_6 LCLEAN_{it} + \beta_7 LHIVPREV_{it} + \beta_8 LRYC_{it} + \beta_9 EDUC2_{it} + \mu_{it}$ ………………………………………………… (1)

$LLIFE_{it} = \beta_0 + \beta 1LPHEY_{it} + \beta_2 LIWA_{it} + \beta_3 LISAF_{it} + \beta_4 LFPI_{it} + \beta_5 LURB_{it} + \beta_6 LCLEAN_{it} + \beta_7 LHIVPREV_{it} + \beta_8 LRYC_{it} + \beta_9 EDUC2_{it} + \mu_{it}$ ………………………................................ (2)

Where:

LINFMO= logarithmic transformation of Infant Mortality Rate.

LLIFE= logarithmic transformation of life expectancy at birth**.**

LPHEY= logarithmic transformation of "public health expenditures as a share of GDP" ("**- sign in Model 1 and + sign in Model 2**"). **LPHEY** is the main predictor of this study.

[6] Accessed http://www.data.worldbank.org/indicator.

LIWA=logarithmic transformation of Improved Access to Water ("**- sign in Model 1 and + sign in Model 2**")

LHIVPREV=logarithmic transformation of HIV/AIDS Prevalence Rate ("**+ sign in Model 1 and – sign in Model 2**")

LISAF = logarithmic transformation of Improved Access to Sanitation Facilities ("**- sign in Model 1 and + sign in Model 2**")

LFPI = logarithmic transformation of Food Production Index ("**- sign in Model 1 and + sign in Model 2**")

LCLEAN = Interaction Term of LISAF and LIWA ("**-sign in Model 1 and + sign in Model 2**")

LURB= logarithmic transformation of urbanization ("**- sign in Model 1 and + sign in Model 2**")

LRYC= logarithmic transformation of Real GDP Per capita ("**- sign in Model 1 and + sign in Model 2**")

$LEDUC_2$= logarithmic transformation of school enrollment, secondary, female (% gross). ("– **sign in Model 1 and + sign in Model 2**")

μ_{it} = Error Term

Model 1 seeks to measure public health expenditures (PHEY) effectiveness in reducing the infant mortality rate, while **Model 2** measures measure public health expenditures (PHEY) effectiveness in increasing the life expectancy rate. The expected signs of the controlled variables` coefficients are also duly attached, as anticipated in the paper`s third chapter.

Akin to other researchers in the existing literature on "public health expenditure and health outcomes (infant mortality, life expectancy, etc)", urbanization, "share of public health expenditure in GDP", female education, and "real income per capita" are also controlled for in **Model 2 (**Kabir 2008, Filmer and Pritchett 1999). An interaction term between improved water access (LIWA) and improved sanitation access facility (LISAF) is also controlled for in both Models to proxy general cleanliness. More so, as per the World Bank, FPI represents the "Food production index", covering "food crops that are considered edible and that contain nutrients; coffee and tea are excluded because, although edible, they have no nutritive value." It is used in this study to proxy malnutrition.

3.2 VARIABLES AND DATA DESCRIPTION[7]

1. "Mortality rate, infant (per 1,000 live births)".

The World Bank defines the "infant mortality rate as the number of infants dying before reaching one year of age, per 1,000 live births in a given year." This is one of "the health outcomes" being tested in this study, and as such a dependent variable.

2. "Life expectancy at birth, total (years)"

According to World Bank, "life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life." It is also one of the health outcomes being tested in this study, and as such a dependent variable.

[7] As indicated in this chapter, this research used the data from "World Bank's World Development Indicators data base". Therefore, the definitions of variables used are also from the World Bank's description and definitions in order to keep their meanings as defined by the World Bank.

3. "Health expenditure, public (% of GDP)"

As per the World Bank, "public health expenditure consists of recurrent and capital spending from government budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds." These expenditures can potentially lead to good health outcomes, but their effectiveness in doing so, is being investigated in this study. This variable is consistently used in the literature (Novignon et al 2012).

4. "Health expenditure, public (% of government expenditure)"

The World Bank also explains that "public health expenditure consists of recurrent and capital spending from government budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds." For any robustness test, this plausible independent variable should exert a salutary effect, akin to the aforementioned (Kabir 2008).

5. "Tuberculosis treatment success rate (% of registered cases)"

As per the World Bank, "Tuberculosis treatment success rate is the percentage of new, registered smear-positive (infectious) cases that were cured or in which a full course of treatment was completed." This variable`s movement with public health expenditures over the study period is graphically illustrated.

6. "Improved water source (% of population with access)"

The World Bank defines "access to an improved water source as the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes,

tube wells or boreholes, protected dug wells, protected springs, and rainwater collection).” It is expected to reduce the infant mortality rate, by decreasing the incidence of water-borne diseases, or to increase the life expectancy rate (Novignon et al 2012 and Kabir 2008).

7. “Improved sanitation facilities (% of population with access)”

According to the World Bank, this variable refers to the “access to improved sanitation facilities, shown as the percentage of the population using improved sanitation facilities. The improved sanitation facilities include flush or pour flush (to piped sewer system, septic tank, and pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet.” It is expected to either reduce the infant mortality rate, or increase the life expectancy rate via ensuring the environment is maintained in proper salubrious conditions, free from pathogenic organisms (Novignon et al. 2012 and Kabir 2008).

7. “Prevalence of HIV, total (% of population ages 15-49)”

The World Bank defines the “prevalence of HIV as the percentage of people ages 15-49 that are infected with HIV.” Its incidence can potentially increase the infant mortality rate, and also decrease the life expectancy rate, especially in cases where early detection is not possible or denied by the victim, hence precluding medical treatment (Novignon et al 2012).

9. “Food production index (2004-2006 = 100)”

As per the World Bank, “food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value.” Consumption of food with high nutritious value can either reduce the infant mortality rate, or increase the life expectancy rate. Researchers such as Shaw et al (2005) instead used “fruit and vegetable consumption, including fat consumption.”

10. "Urban population (% of total)"

The World Bank describes "urban population as people living in urban areas, as defined by national statistical offices." It is used in this study as a proxy for urbanization. It is expected to increase access to facilities and infrastructure related to health, such as quality hospitals, with the adequate number of beds and physicians. Therefore urbanization would reduce the infant mortality rate, and also increase life expectancy (Anyanwu and Erhijakpor 2007 and Kabir 2008).

11. "School enrollment, secondary, female (%gross)"

As per the World Bank, "Gross enrolment ratio, Secondary for female is the total female enrollment in secondary education, regardless of age, expressed as a percentage of the female population of official secondary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition." It can either reduce the infant mortality rate, or increase the life expectancy rate, as awareness of pro-good health practices and measures increases (Issa and Ouattara 2005 and Kabir 2008).

12. "GDP per capita (constant 2000 US$)"

According to the World Bank, "GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2005 U.S. dollars." It captures the people's wealth as well as their capacity to access medical services and facilities, which in turn produces desired health outcomes (Novignon et al 2012, and Kabir 2008).

For purposes of clarity and simplicity, a tabular illustration in **Table 1** shows the description of the data used in this study and their related sources are shown below:

Table 1: Data and their related sources

VARIABLE	ACRONYM	DESCRIPTION	SOURCE
"Mortality rate, infant (per 1,000 live births)"	INFMO	Dependent Variable	WDI
"Life expectancy at birth, total (years)"	LIFE	Dependent Variable	WDI
"Health expenditure, public (% of GDP)"	PHEY	Independent Variable	WDI
"Health expenditure, public (% of government expenditure)"	PHEGE	Independent Variable	WDI
"Tuberculosis treatment success rate (% of registered cases)"	TTS	Independent Variable	WDI
"Improved water source (% of population with access)"	IWA	Independent Variable	WDI
"Improved sanitation facilities (% of population with access)"	ISAF	Independent Variable	WDI
"Prevalence of HIV, total (% of population ages 15-49)"	HIVPREV	Independent Variable	WDI
"Improved water source (% of population with access) x Improved sanitation facilities (% of population with access)"	CLEAN (Interaction term)	Independent Variable	WDI
"Food production index (2004-2006 = 100)"	FPI	Independent Variable	WDI
"Urban population (% of total)"	URB	Independent Variable	WDI
"School enrollment, secondary, female (% gross)"	EDUC	Independent Variable	WDI
"GDP Per Capita (Constant 2000US$)"	RYC	Independent Variable	WDI

It suffices to say that central to this study, is its primary focus on public health expenditures, as opposed to "out-of-pocket payments"[8] (akin to private health expenditures). Furthermore, despite the fact that this study seeks to tease out Rwanda`s comparative performance, vis-à-vis the other four East African countries, a separate OLS regression to capture its unique experience is not run, due to data insufficiency. Nonetheless, bar graphs and tabular data analyses, pertaining to country specific mean health-performance indicators are used, to ascertain Rwanda`s relative performance.

Regarding robustness of the model specified a Hausman test whose results are shown below, so as to choose between either the fixed or random effects model was performed, where the null hypothesis is that the preferred model is random effects versus the alternative fixed effects. The probability result was found to be statistically significant, rejecting the null hypothesis and thus opting for the fixed effects model. "The fixed effects model controls for all time-invariant differences between the individuals, so that the fixed effects models cannot be biased because of time-invariant characteristics" (Kohler et al. 2009).

```
hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lphey	-.0566539	.0320842	-.0887381	.0163404
lfpi	-.14888	-.4381057	.2892256	.
lhivprev	.0473291	.2046855	-.1573565	.
lurb	-.5548965	-.1914732	-.3634233	.0801205
lisaf	-.4876823	.0008025	-.4884848	.3170951
lclean	.2841503	-.0103162	.2944665	.
lryc	-.7388655	-.5778008	-.1610646	.0707735
leduc2	-.0081334	.0100812	-.0182146	.

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

  Test:  Ho:  difference in coefficients not systematic

              chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =      191.45
            Prob>chi2 =      0.0000
            (V_b-V_B is not positive definite)
```

[8] "Out-of pocket payments are payments made by patients at the point of receiving medical services" qualifying them as an integral part of national health spending (Saksena and Holly 2011).

CHAPTER FOUR: RESULTS OF EMPIRICAL ANALYISIS AND RELATED DISCUSSION

4.1 Descriptive Analysis

To begin the econometric analysis, a brief descriptive analysis of the data, including the correlation matrix is demonstrated in Table 2 below.

Table 2: Descriptive Statistics

PANEL A: SUMMARY STATISTICS

	INFMO	LIFE	PHEGE	PHEY	RYC	TTS	IWA	ISAF	HIVPREV	FPI	URB	EDUC2	CLEAN
OBS	80	80	80	80	80	80	80	80	80	80	80	80	80
MEAN	79.86	49.78	10.35	3.14	292.06	74.53	59.55	32.85	6.05	90.74	19.053	19.30	2048.57
STD.DEV	21.47	4.84	3.75	2.25	107.28	12.18	10.06	14.37	2.28	17.61	4.84	13.26	1107.154
MIN	41.5	30.47	6.18	1.40	128.30	33	38	8	1.6	49.5	8.29	4.79	432
MAX	138.9	57.38	22.44	10.77	470.58	92	72	55	11.1	137.37	26.28	57.10	3630

PANEL B: CORRELATION MATRIX WITH LOGARITHMIC VARIABLES

	LINFMO	LLIFE	LPHEGE	LPHEY	LRYC	LTTS	LIWA	LISAF	LHIVPREV	LFPI	LURB	LEDUC2	LCLEAN
LINFMO	1.000												
LLIFE	-0.866	1.000											
LPHEGE	-0.330	0.199	1.000										
LPHEY	-0.062	-0.063	0.722	1.000									
LRYC	-0.764	0.628	0.058	-0.230	1.000								
LTTS	-0.535	0.555	0.197	0.268	0.236	1.000							
LIWA	0.395	-0.417	0.369	0.489	-0.737	-0.055	1.000						
LISAF	0.257	-0.303	0.094	0.449	-0.475	-0.172	0.491	1.000					
LHIVPREV	-0.113	0.083	-0.377	-0.749	0.612	-0.360	-0.734	-0.533	1.000				
LFPI	-0.670	0.560	0.377	0.210	0.251	0.330	0.139	0.183	-0.209	1.000			
LURB	-0.407	0.597	-0.055	-0.022	0.028	0.688	-0.128	-0.328	-0.282	0.289	1.000		
LEDUC2	-0.732	0.650	-0.075	-0.046	0.649	0.447	-0.489	0.062	0.109	0.460	0.270	1.000	
LCLEAN	0.318	-0.363	0.173	0.505	-0.590	-0.160	0.66	0.976	-0.638	0.191	-0.311	-0.069	1.000

From the aforementioned **Table 2 Panel B**, it is shown that both LPHEGE an LPHEY are negatively related to LINFMO. LPHEGE is also positively related to LIFE. LFPI, the proxy for nutritive food consumed shows a negative relation to LINFMO and a positive relation to LLIFE while LURB exhibits a negative relation to LINFMO and a positive relation to LLIFE. Secondly, tabular illustrations of countries sampled in this study, including the related investigated variable means are exhibited in Table 3.

Table 3: Sampled Countries and their Mean Variables (1995-2010)

COUNTRY	INFMO	LIFE	PHEGE	PHEY	RYC	TTS	IWA	ISAF	HIVPREV	FPI	URB	EDUC2	CLEAN
BURUNDI	97.162	46.969	8.968	3.1476	133.95	77.188	71.688	45.562	3.4	90.489	23.31	11.08	3266
KENYA	63.4125	53.841	7.326	1.786	427.0	80.128	45	29.187	8.05	93.194	20.83	41.74	1319
RWANDA	**89.218**	**47.277**	**14.605**	**6.67**	**257.36**	**72.531**	**66**	**48.875**	**4.088**	**90.743**	**14.867**	**14.839**	**3225**
TANZANIA	70.218	52.365	10.723	2.327	352.45	81.375	53.813	9.187	7.069	86.212	23.311	14.271	494
UGANDA	79.281	48.451	10.101	1.799	289.57	61.437	61.25	31.437	7.643	93.063	12.944	15.035	1937
EAC	79.852	44.781	10.345	3.145	292.06	74.53	59.55	32.85	6.05	90.74	19.053	19.309	2048

From the aforementioned data, Rwanda has the highest mean public health expenditure-PHEGE (14.605) among the East African Community member countries, above the EAC average of 10.345. Rwanda also registered the highest mean PHEY of 6.67, well above the East African Community average of 3.14. Second to Burundi in the East African Community region, Rwanda has a decent mean improved water access (IWA) of 66, above the EAC average of 59.55, while its HIVPREV is the second lowest in East Africa, after Burundi, below the region`s average of 6.05. Rwanda`s mean Tuberculosis Treatment Success (TTS) is plausibly above the East African Community average (74.53), at 72.531. Rwanda also had the highest improved sanitation access facility (ISAF); (48.875) relative to the EAC average of 32.85. Rwanda`s mean urbanization (URB) was the second lowest in the East African Community after Uganda`s at 14.87.

Forming the integral part of this study, **Figures 1**[9] and **2** show the movement of the desired health benefits with public health expenditures over the study period (1995-2010) in the East African Community and Rwanda respectively. The idea here is to illustrate the East African Community's general trend pertaining to say, the Infant Mortality Rate, HIV/AIDS Prevalence Rate, Life Expectancy Rate, and Public Health Expenditures (LPHEY and LPHEGE). By and large, Infant mortality (LINFMO) for the East African Community is shown to reduce as Public

[9] Figure 1 shows a five country East African Community historical evolution, in terms of public health expenditures and related outcomes, which comprises Kenya, Tanzania, Uganda, Burundi, and Rwanda.

Health Expenditures (LPHEY) increases, while for Rwanda`s case in **Figure 2** the desired reductive effect of LINFMO by LPHEY is not significant, prompting the plausible question whether other factors can impose a more telling effect in Rwanda.

Figure 1: Panel health indicators' trend in the East African Community (1995-2010)

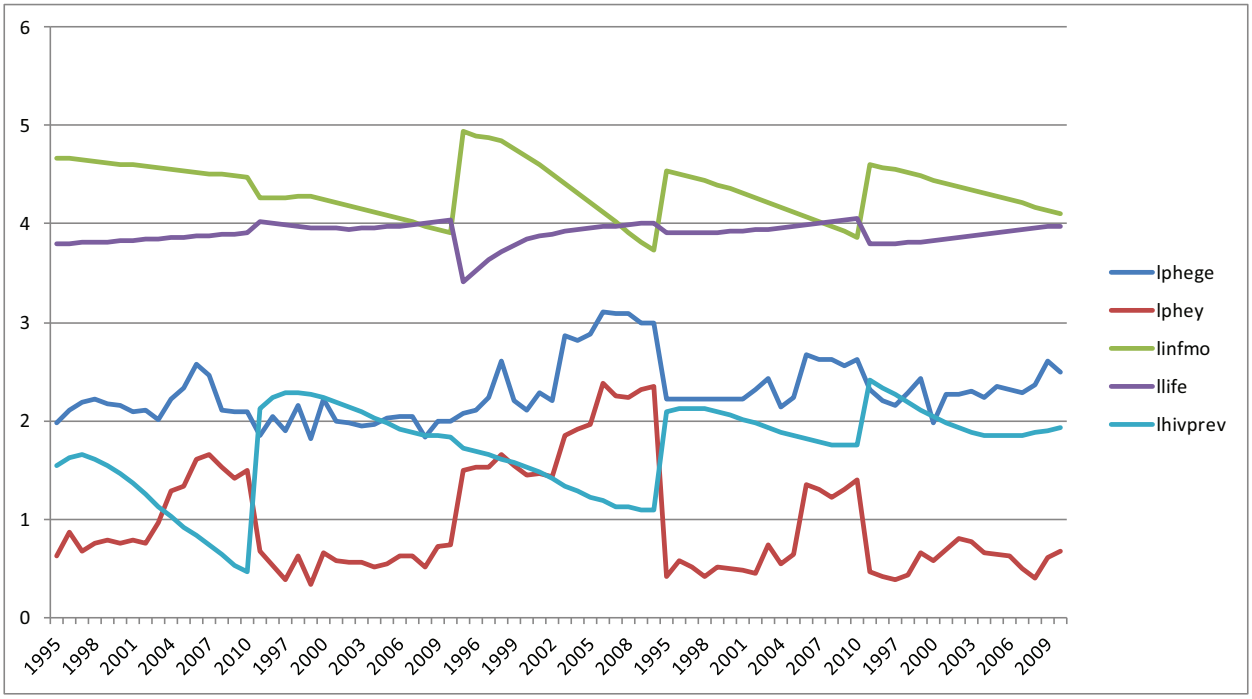
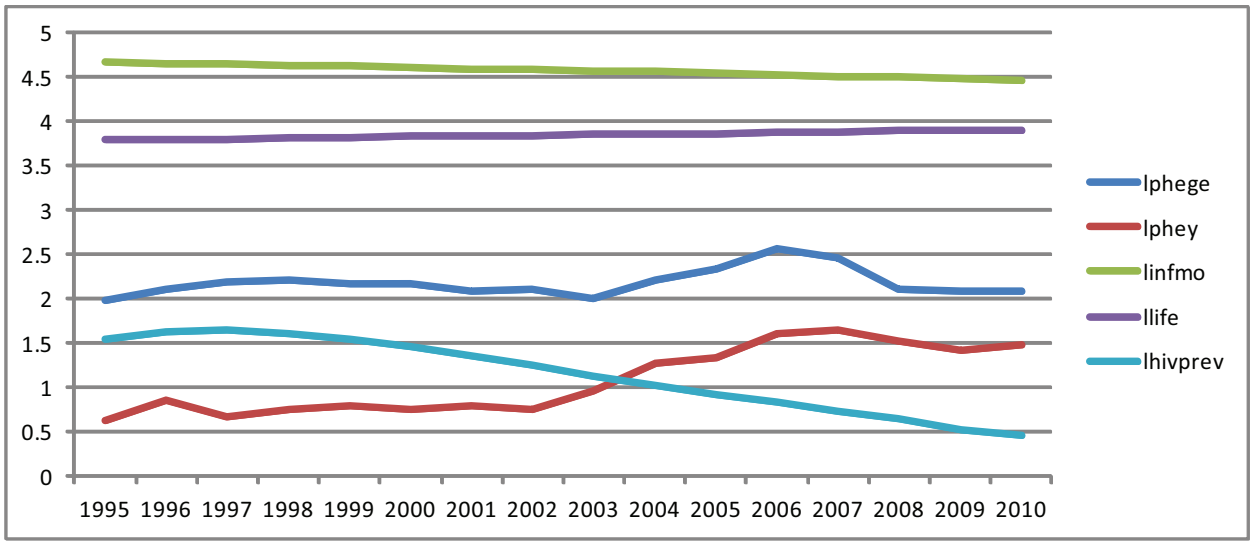


Figure 2: Health Indicators trend in Rwanda (1995-2010)



The following scatter-plots show the relative ratios of each country`s health status variable to Kenya`s, computed on the basis that [10]Kenya`s economy is the strongest in the East African Community at an average Real Income Per Capita of 427.00, Rwanda`s 257.37, Uganda`s 289.257, Tanzania`s 352.451, Burundi`s 133.957, and the EAC`s 292.069. The latter information is "GDP per capita (constant 2000 US$)", sourced from the "World Development Indicators" data-base (WDI), and computed from the study period (1995-2010). Next up are scatter plots, coupled with bar graphs from the STATA econometric software.

Figure 3: Mean Infant Mortality Rate and Mean Public Health Expenditures

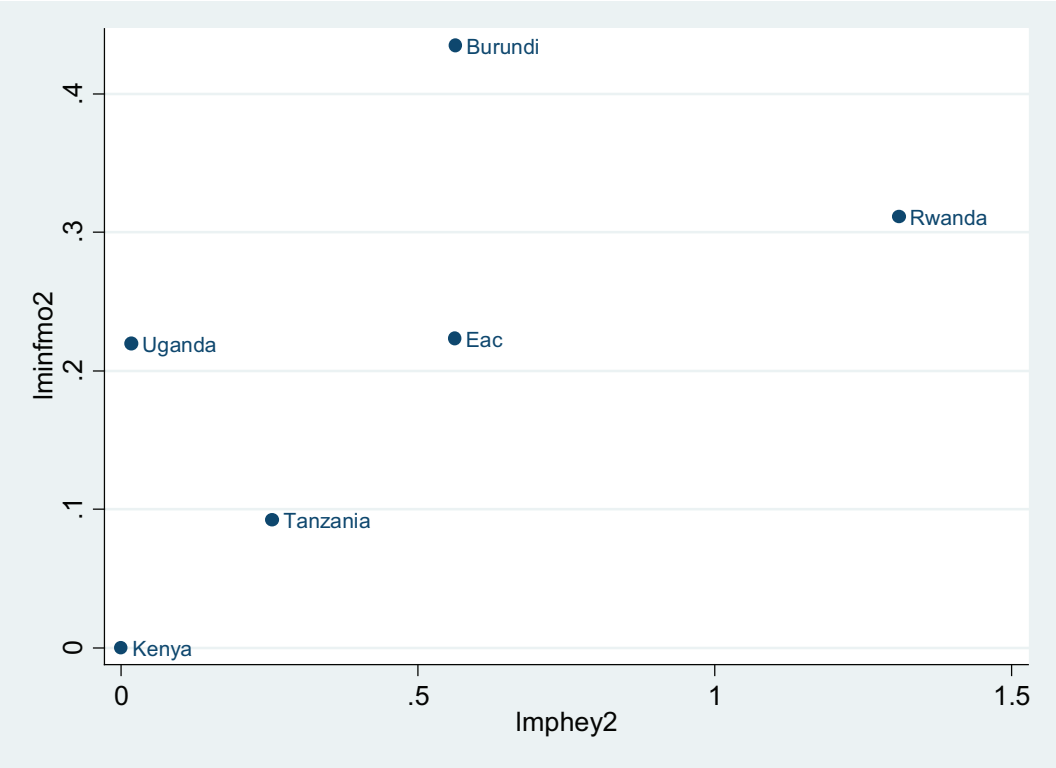


Figure 3 above suggests as denoted initially in the paper that despite Rwanda`s relatively huge public health expenditures, its infant mortality rate was the second highest in the East African Community region, after Burundi, way above the EAC average.

[10] See Table 3 above.

This consequently begs the question why public health expenditures (PHEY) between 1995 and 2010 in Rwanda hardly facilitated a reduction in the infant mortality rate. To partly answer the latter question, a fixed effects regression with Infant mortality (LINFMO) as the dependent variable is run to explain its variation, while controlling for LPHEY. It is surmised that other predictors besides LPHEY may significantly affect LINFMO.

Figure 4: Mean Life Expectancy Rate and Mean Public Health Expenditures.

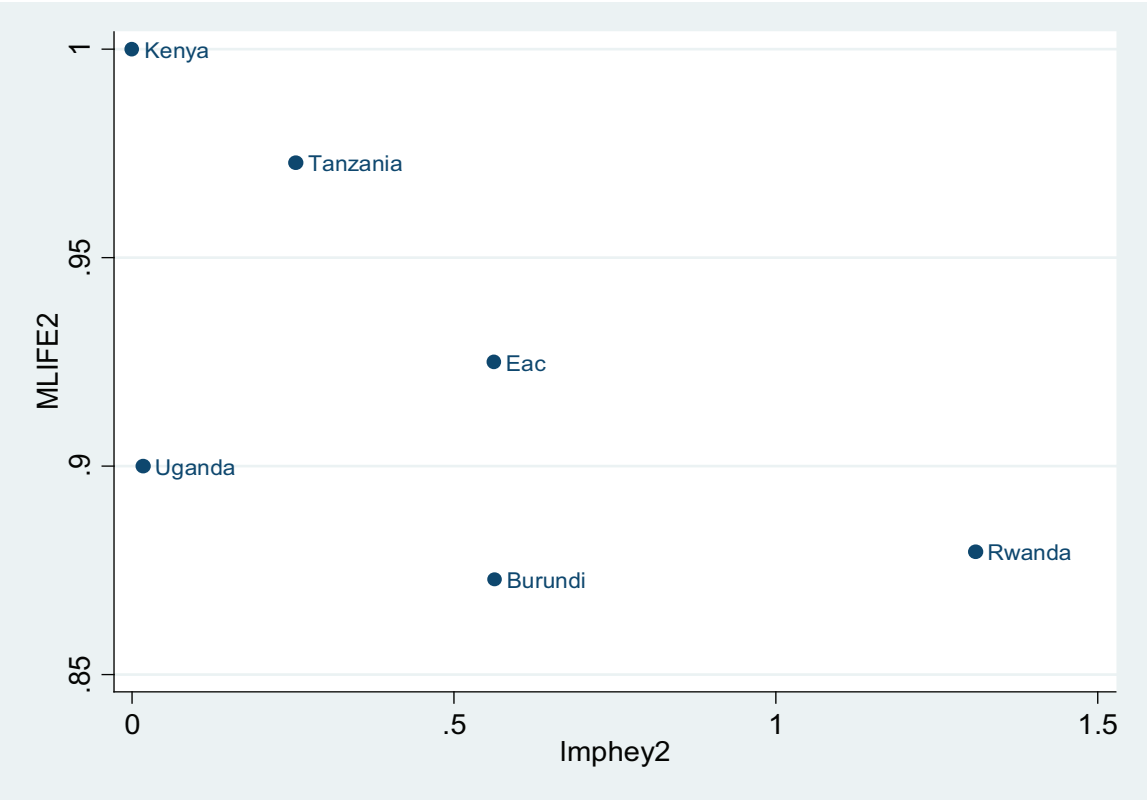


Figure 4 above illustrates that Rwanda on average had the lowest mean LIFE in the East African Community region, notwithstanding its highest PHEY. Here also a plausible empirical question arises why Rwanda`s relatively huge LPHEY did not translate into a lower life expectancy rate. With LLIFE as the dependent variable, a fixed effects regression is run, while controlling for other variables in the literature, including LPHEY to assess its effectiveness in facilitating an increase in life expectancy (LLIFE).

Figure 5: Mean Tuberculosis Treatment Success rate and Mean Public Health Expenditures.

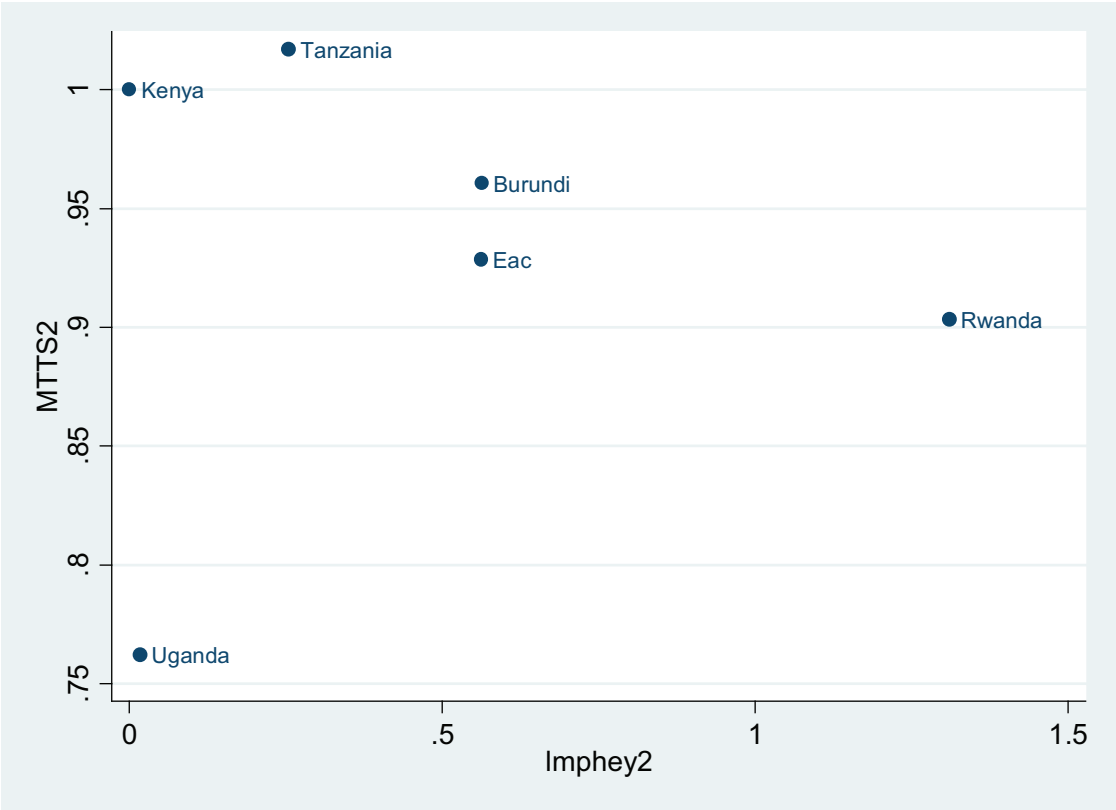


Figure 5 above demonstrates that Rwanda`s relatively large PHEY in the East African Community region, basically corresponded with an increase in Tuberculosis Treatment Success (TTS), although Uganda registered the worst relative performance in this regard. Nonetheless, the policy implication that can be drawn from this figure is how Kenya, Tanzania and Burundi are able to achieve higher TTS, at relatively lower PHEY, because although Rwanda`s TTS is decent, it lags behind the EAC average, besides being attained at a comparatively higher PHEY.

Figure 6: Mean Improved Water Access and Mean Public Health Expenditures

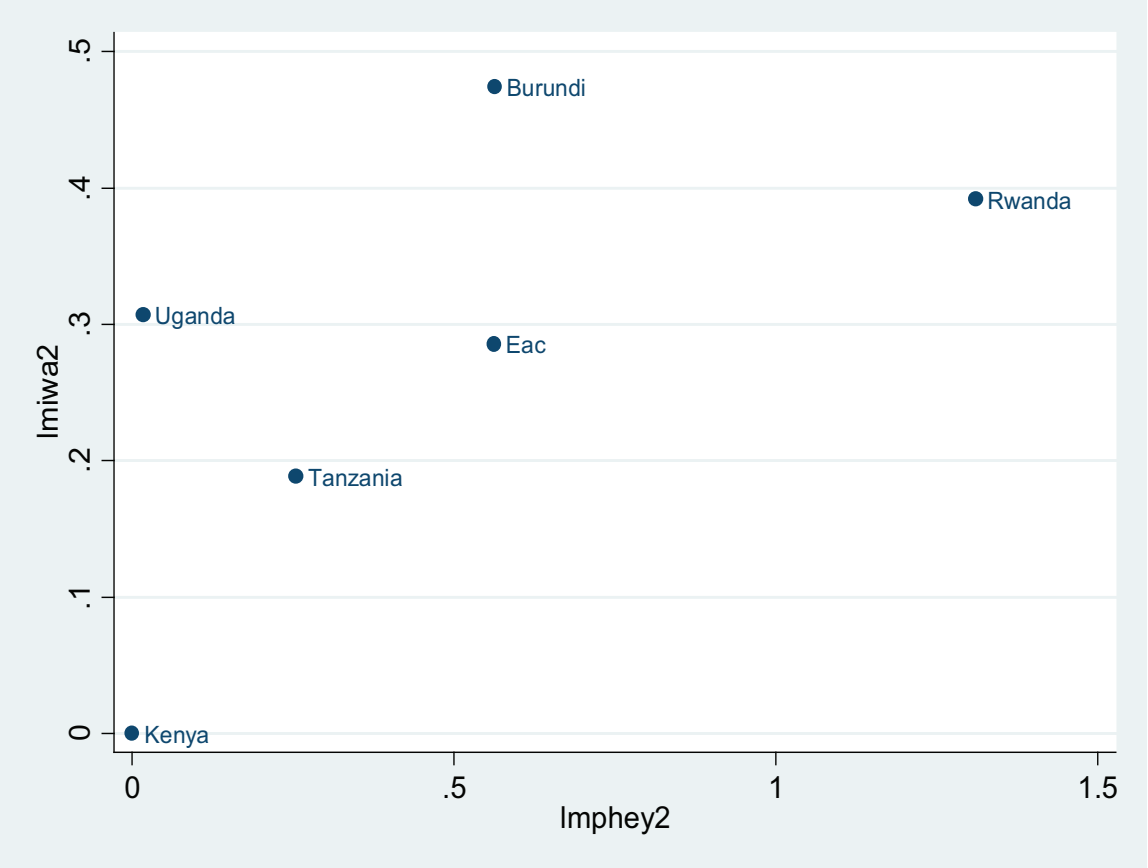


Figure 6 above illustrates that Rwanda on average had the second highest improved water access (IWA) in the East African Community region, supplemented by commensurately huge public health expenditure (PHEY).

Figure 7 below shows Rwanda`s reduction in HIV/AIDS prevalence (HIVPREV) plausibly occurred with a relatively large PHEY. It suffices to say that the effectiveness of public health expenditure in reducing HIV prevalence is also worthy of empirical investigation.

Figure 7: Mean HIV/AIDS Prevalence Rate and Mean Public Health Expenditures

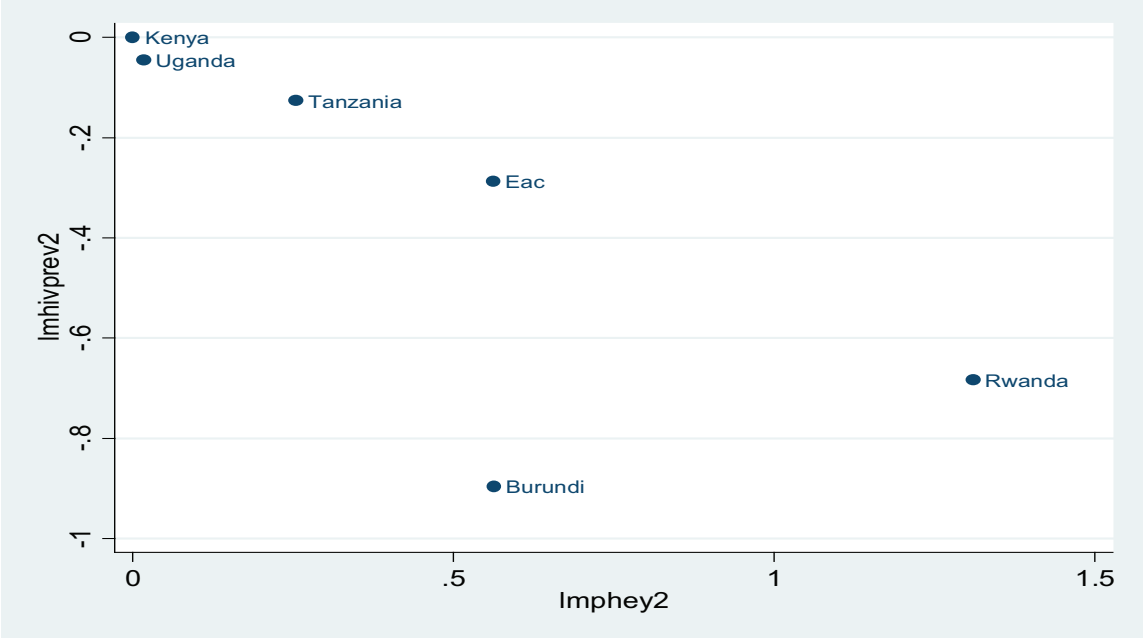


Figure 8 is also presented to show how infant mortality (INFMO) by and large reduces with increases in PHEY. This figure captures the five East African Community member-countries for the period between 1995 and 2010.

Figure 8: Public Health Expenditures and Infant Mortality Rate

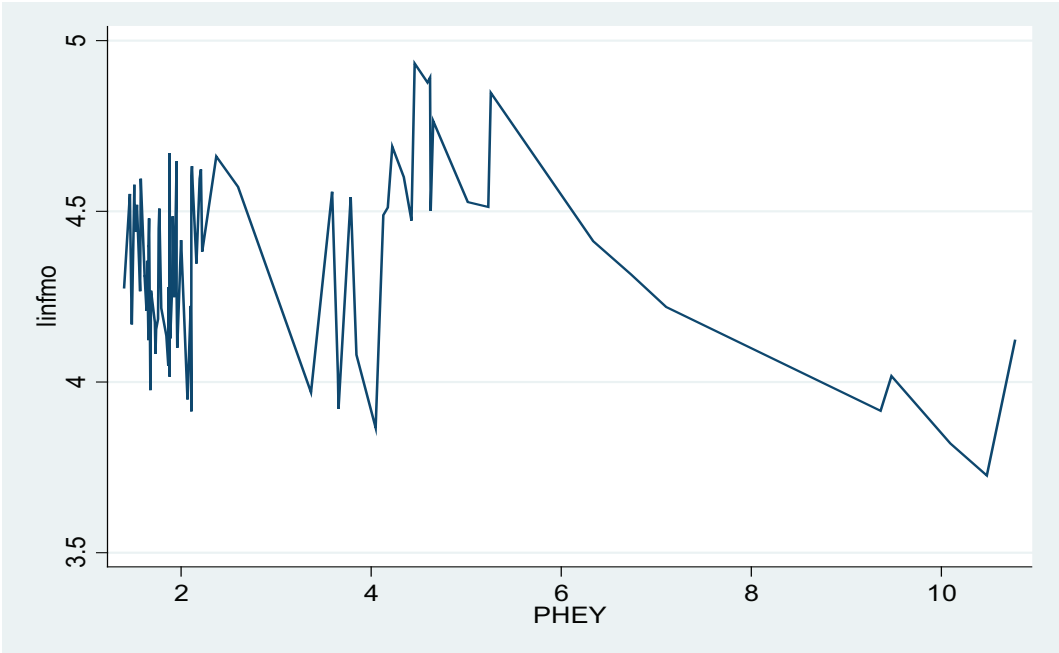
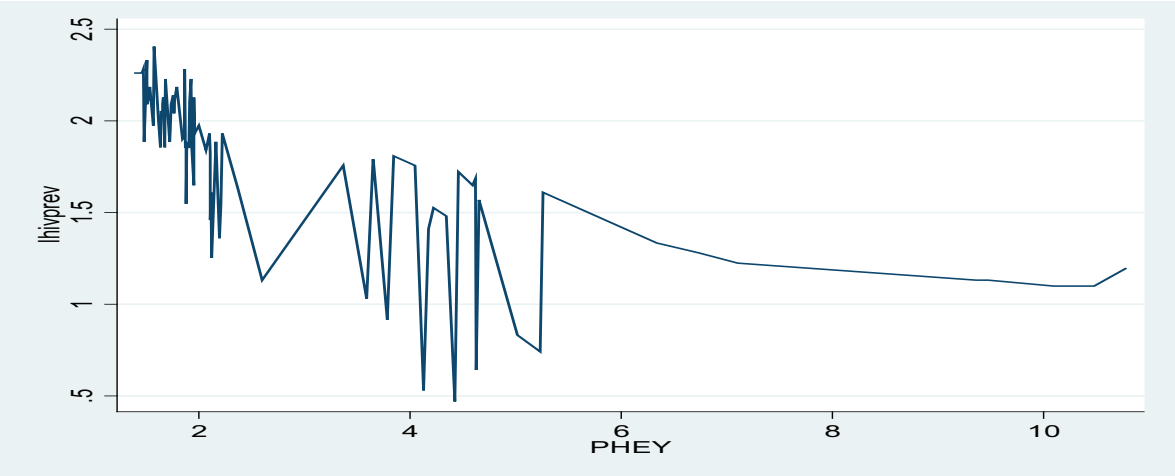


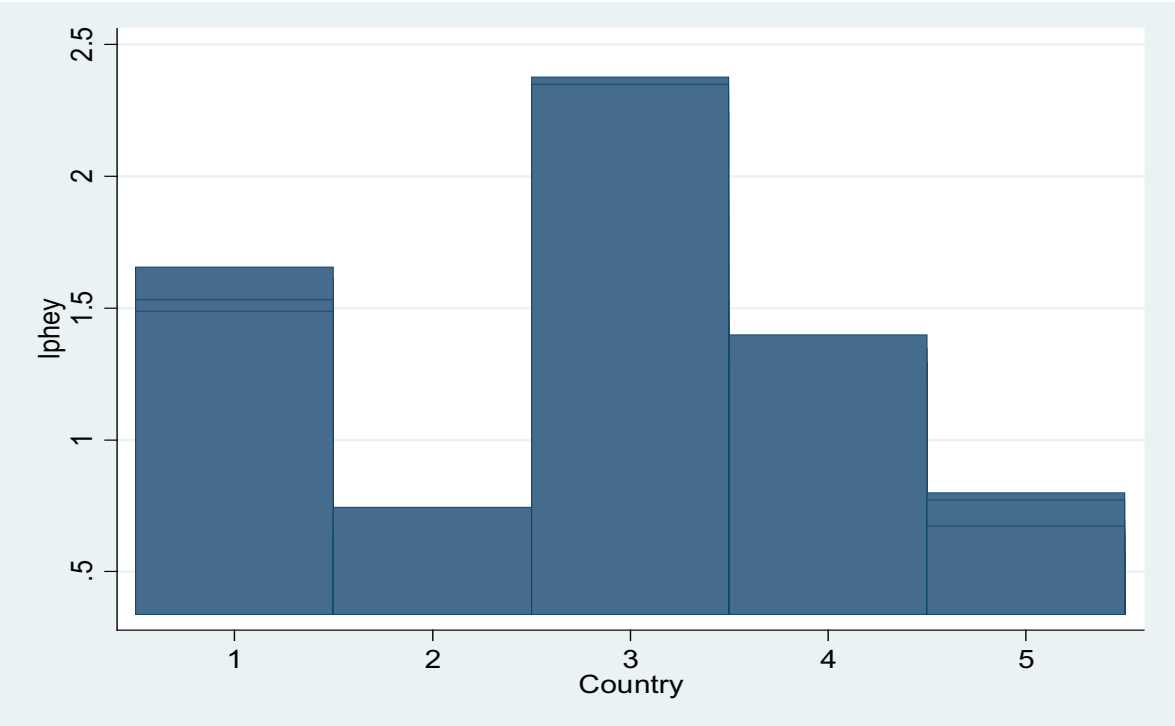
Figure 9 furthermore shows that generally HIV/AIDS prevalence (HIVPREV) reduces with increases in public health expenditures (PHEY).

Figure 9: Public Health Expenditures and HIV/AIDS Prevalence Rate



Next up, the bar graph supplements figures 4-7, shown as figures 10.

Figure 10: Public Health Expenditures as a share of GDP in the East African Community



1= Burundi, 2= Kenya, 3= Rwanda, 4= Tanzania, 5= Uganda.

Figure 10 illustrates that Rwanda had the largest PHEY in the East African Community, between 1995 and 2010. Basically, Rwanda had the lowest HIV/AIDS prevalence rate among its East African Community counter parts, though at proportionately high public health expenditures. However, its mean Infant Mortality Rate (INFMO) was second highest in the East African Community after Burundi`s, despite registering the highest mean high public health expenditures (PHEY) outlays.

Noticeably too, Rwanda had the lowest mean life expectancy (LIFE), notwithstanding its highest mean PHEY in the East African Community. Besides, its Tuberculosis Treatment Success was also below the computed EAC average, notwithstanding its huge commitment of funds into the health sector. Therefore panel fixed effects regressions (**Model 1 and 2**) were run to ascertain the efficacy of public health expenditures in reducing the "Infant Mortality Rate", and increasing "Life Expectancy". Then implications are drawn to inform the policy prescriptions that Rwanda can adopt, in order to achieve the latter targeted health benefits.

Indeed other than PHEY, other variables may significantly influence INFMO and LIFE. More so, Kenya and Tanzania were able to register rather high Tuberculosis Treatment Success (TTS) at significantly very low PHEYs, plausibly justifying studies on these countries experiences. **Tables 4** and **5** show the regression models **1** and **2** mentioned in chapter 3.

4.2. Regression Results on effectiveness of Public Health Expenditure in reducing Infant Mortality and increasing Life Expectancy.

Table 4: Public Health Expenditures and Infant Mortality Rate

Infant Mortality Rate	"Fixed Effects Model"	"Fixed Effects Model"	"Fixed Effects Model"
"Variables"	(1)	(2)	(3)
Constant	47.809(4.23)	10.285(15.03)	10.563 (18.22)
LPHEY	**-0.050(-1.27)**	**-0.053(-1.34)**	**-0.080(-2.73)****
LFPI	-0.110(-1.88)	-0.149(-2.44)**	-0.131(-2.33)**
LHIVPREV	0.065(1.13)	0.047(0.77)	
LURB	-0.720(-6.49)***	-0.555(-5.22)***	-0.594(-6.36)***
LISAF	-10.960(-3.37)***	-0.204(-0.69)	-0.219(-0.75)
LIWA	-8.901(-3.22)***	0.284(2.12)	0.024(2.04)
LCLEAN	2.755(3.32)***		
LRYC	-1.027(-8.02)***	-0.739(-7.31)***	-0.711(-7.57)***
LEDUC2	0.017(0.69)	-0.008(0.32)	-0.016(-0.67)
"R-square Within"	0.962	0.956	0.955
"R-square between"	0.969	0.832	0.800
"R-square overall"	0.641	0.824	0.818

Note: "*** reflects significance at 1%," "** reflects significance at 5%"
t- Statistics are reported in parenthesis
(1) Is equation 1 as described in chapter three.
(2) Is equation 1 excluding LCLEAN.
(3) Is equation 1 excluding LHIVPREV and LCLEAN.

While Novignon et al. (2012) found that health care expenditure both public and private reduce death and infant mortality rates, public heath care spending relatively having a higher impact, in this study, Table 4 model 1, LPHEY is also showing a negative relationship with LINFMO; but its coefficient does not reflect any statistical significance. LFPI is negatively related to LINFMO as well similar to initial expectation, but not statistically significant.

LURB is negatively related to LINFMO as envisaged and statistically significant at 1% level. Although LISAF and LIWA are negatively related to LINFMO as envisaged and statistically significant at 1% level, their interaction term instead had a positive coefficient, and statistically significant at 1% level. LRYC was negatively related to LINFMO, at a statistical significance level of 1%. LEDUC2 had a positive sign attached to its coefficient, but statistically insignificant.

In the same table 4, the interaction term of LISAF and LIWA (LCLEAN) is excluded in model 2 to explain more the effectiveness of public health expenditure in reducing infant mortality rate. The results show that LPHEY is again negatively related to LINFMO but not statistically significant, LFPI is negatively related to LINFMO as expected and statistically significant at 5% level, akin to Kabir (2008). LHIVPREV has a positive sign attached to its coefficient as expected but without any statistical significance. LISAF shows a negative relationship with LINFMO as well, although lacking a statistical significance. LRYC shows also a negative relationship with LINFMO as anticipated and statistically significant at 1% level. LEDUC2 (female education) although is negatively related to LINFMO as expected nevertheless it is not statistically significant.

Finally in model 3, both LHIVPREV and LCLEAN are excluded from the analysis and the results show that LPHEY is negatively related to LINFMO as initially expected and statistically significant at 5% level, in concurrence with Novignon et al. (2012). LFPI is also negatively related to LINFMO as envisaged and statistically significant at 5% level, LURB exhibits a negative relation with LINFMO along with a statistical significance of 1% level. LISAF is negatively related to LINFMO but statistically insignificant. LRYC shows a negative relation to LINFMO with a statistical significance at 1% level. LEDUC2 (female education)

displays a negative relation to LINFMO but statistically insignificant. Table 5 seeks to explain the variation in life expectancy in the East African Community between the period 1995 and 2010.

Table 5: Public Health Expenditures and Life Expectancy Rate

Life Expectancy Rate	"Fixed effects model"	"Fixed effects model"
"Variables"	(1)	(2)
Constant	30.242 (6.52)	2.022(5.90)
LPHEY	**-0.027(-1.65)**	**-0.019(-0.54)**
LRYC	0.005(0.09)	0.296(3.86)***
LURB	0.586(12.87)***	
LHIVPREV	0.011(0.45)	-0.116(-2.86)***
LFPI	0.025(1.05)	0.099(2.09)**
LEDUC2	0.011(1.11)	
LISAF	-8.247(-6.19)***	
LIWA	-6.940(-6.11)***	
LCLEAN	2.021(5.94)***	
"R-square Within"	0.960	0.666
"R-square between"	0.193	0.632
"R-square overall"	0.290	0.606

Note: "*** Reflects significance at 1%," "** reflects significance at 5%," "* reflects significance at 10%."
t- Statistics are reported in parenthesis
(1) Is equation 2 as described in chapter three
(2) Specified predictors without LURB

Note that Table 5 is consistent with the literature, by testing public health expenditures` impact, along with the variables controlled for, on the life expectancy rate (Kabir 2008).

In Table 5, LPHEY is negatively related to LIFE, which is contrary to theory, but statistically insignificant, akin to LRYC in Kabir (2008) `s study. However, LURB and LCLEAN are

positively related to LLIFE as expected, but LISAF and LIWA have negative coefficient signs, at a statistical significance of 1%, contrary to theory.

Table 5 then has LURB, LEDUC2, LISAF, LIWA, and LCLEAN excluded from, as found statistically insignificant by other researchers (Kabir 2008). A shown in this table in model 2 LPHEY is negatively related to LLIFE but statistically insignificant. LHIVPREV is negatively related to LLIFE as anticipated at a statistical significance of 1% level. LFPI has the expected positive coefficient, at a 5% level of statistical significance. LRYC is positively related to LLIFE as expected, at 1% level of statistical significance.

Akin to Kabir (2008), LPHEY was negatively related to LLIFE, and statistically insignificant. However, LHIVPREV showed a negative relation with LLIFE a long with a statistical significance of 1% level. Consumption of nutritious food, LFPI displayed a positive relation with LLIFE with a statistical significance of 5% level. Moreover, LRYC revealed a positive relation with LLIFE coupled with a statistical significance of 1% level.

CHAPTER FIVE: SAMMURY CONCLUSION AND POLICY IMPLICATIONS

5.1 Conclusion

This paper employed a standard panel fixed effects model to show how desired health benefits are determined by public spending on the health sector, between the period 1995 and 2010, sampling five states of the East African Community, while taking into account the integration of Rwanda and Burundi in the East African Community in 2007. The study uniquely differs from other studies on Africa (or Sub-Saharan Africa) which basically referred to the East African Community as a three-member region, comprising only Kenya, Tanzania, and Uganda. With special emphasis on Rwanda`s health status, vis-à-vis the other four East African Community members, the study used mean variable ratios, relative to the East African Community`s strongest economy`s (Kenya) values to demonstrate the country`s performance. It is shown in the paper that Rwanda on average had a large infant mortality rate, second to Burundi, and higher than the computed East African Community average.

Another key finding of this paper was that the life expectancy rate in Rwanda was low, despite proportionately high public health expenditures.

5.2 Policy implications

The policy implication drawn from this study`s findings is that improving access to medical facilities and related infrastructure, proxied by urbanization, consumption of nutritious food, and reduction of HIV/AIDS prevalence rates, improving real per capita income, and broadening access to water and sanitation are key factors that the Rwandan Government may plausibly harness, in order to reduce the infant mortality rate. Mainly the latter factor may

require government intervention and oversight, in reference to the water and sewerage infrastructure, present in urban and peri-urban areas.

Further studies, disintegrating the public health expenditures to tease out how funds directed to say medical research can reduce the incidence of diseases are recommended. The Rwandan Government may render due attention to reducing HIV/AIDS prevalence, support programs for nutritious food consumption, coupled with improving real income per capita, coupled with increasing the accession to clean water and sanitation, if life expectancy also raises a needs of being increased besides public health expenditures. [11]Worth mentioning also, is that increasing access to pipe water may significantly reduce the number of hours and kilometers girls have to travel in order to fetch and carry water, hence affording them more time to focus on their education, by reducing tardiness and truancy, including increased time for their after-school assignments. This in turn has the potential to reduce the infant mortality rate. Moreover, government expenditures should place more emphasis on the expansion of water and sanitation expenditures since they are more effective in achieving the objective of health sector public expenditures.

In a nutshell, since public health expenditures were not effectively significant in creating desired health outcomes, the East African Community in general, and Rwanda in particular may have to structure and supplement their public health expenditures with donor funds, instituting strict monitoring and evaluation mechanisms, so that the funds achieve the desired health results, especially if related gains are to be sustained, and funds deficient health aspects are to be improved.

[11] http://www.unicef.org/esaro/7310_Gender_and_WASH.html

It suffices to say that healthy Rwandese, will not only live longer, but also ably ply their trades to ensure that economic development is attained. Precisely stated, public health expenditures alone can hardly suffice, to reduce say the infant mortality rate, or increase the life expectancy rate if other key factors are not taken into consideration by the Rwandan Government.

More study should be conducted on the structure of public health expenditures to indentify the reasons for their ineffectiveness. For example, the health expenditures should be disaggregate into tertiary health service expenditures, secondary health service expenditures, primary health service expenditures, R and D, etc. Indeed as an integral part of future studies on infant mortality rate and health expenditures, rigorous model specifications addressing endogeneity issues should be employed, to better explain the variation in the former.

APPENDICES

APPENDIX A

STATA Output for Table 4, Model (1): Public Health Expenditures and Infant Mortality Rate (EAC)

```
. xtreg linfmo  lphey lfpi lhivprev lurb lisaf liwa lclean lryc leduc2, fe

Fixed-effects (within) regression               Number of obs      =        80
Group variable: ct1                             Number of groups   =         5

R-sq:  within  = 0.9619                         Obs per group: min =        16
       between = 0.9690                                        avg =      16.0
       overall = 0.6406                                        max =        16

                                                F(9,66)            =    185.20
corr(u_i, Xb)  = -0.9359                        Prob > F           =    0.0000
```

linfmo	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lphey	-.050076	.0394375	-1.27	0.209	-.1288156	.0286637
lfpi	-.1094935	.0581202	-1.88	0.064	-.2255342	.0065473
lhivprev	.0649518	.0575576	1.13	0.263	-.0499657	.1798693
lurb	-.7203155	.1109399	-6.49	0.000	-.9418141	-.4988169
lisaf	-10.95961	3.247401	-3.37	0.001	-17.44325	-4.475961
liwa	-8.901279	2.766043	-3.22	0.002	-14.42386	-3.378695
lclean	2.754919	.8287549	3.32	0.001	1.100256	4.409582
lryc	-1.027197	.1280667	-8.02	0.000	-1.28289	-.7715032
leduc2	.0171266	.0246793	0.69	0.490	-.0321473	.0664005
_cons	47.80932	11.30646	4.23	0.000	25.23526	70.38339
sigma_u	.48940047					
sigma_e	.04750028					
rho	.99066764	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(4, 66) =    30.34                 Prob > F = 0.0000
```

APPENDIX B

STATA Output for Table 4, Model (2): Public Health Expenditures and Infant Mortality Rate (EAC) excluding LCLEAN

```
. xtreg linfmo lphey lfpi lhivprev lurb lisaf liwa lryc leduc2, fe

Fixed-effects (within) regression               Number of obs      =        80
Group variable: ct1                             Number of groups   =         5

R-sq:  within  = 0.9555                         Obs per group: min =        16
       between = 0.8321                                        avg =      16.0
       overall = 0.8238                                        max =        16

                                                F(8,67)            =    179.97
corr(u_i, Xb)  = -0.7005                        Prob > F           =    0.0000
```

linfmo	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lphey	-.0566539	.0422388	-1.34	0.184	-.140963	.0276551
lfpi	-.14888	.0610181	-2.44	0.017	-.2706726	-.0270873
lhivprev	.0473289	.0614613	0.77	0.444	-.0753485	.1700062
lurb	-.5548968	.10633	-5.22	0.000	-.7671323	-.3426612
lisaf	-.2035315	.2950945	-0.69	0.493	-.7925427	.3854796
liwa	.2841497	.133805	2.12	0.037	.0170738	.5512256
lryc	-.7388655	.101041	-7.31	0.000	-.9405441	-.5371869
leduc2	-.0081334	.0251799	-0.32	0.748	-.0583927	.0421259
_cons	10.28473	.6844929	15.03	0.000	8.918472	11.65098
sigma_u	.15975691					
sigma_e	.0509384					
rho	.90771699	(fraction of variance due to u_i)				

F test that all u_i=0: F(4, 67) = 24.16 Prob > F = 0.0000

APPENDIX C

STATA Output for Table 4, Model (3): Public Health Expenditures and Infant Mortality Rate (EAC) excluding both LCLEAN and HIVPREV

```
. xtreg linfmo lphey lfpi lurb lisaf liwa lryc leduc2, fe

Fixed-effects (within) regression               Number of obs      =        80
Group variable: ct1                             Number of groups   =         5

R-sq:  within  = 0.9551                         Obs per group: min =        16
       between = 0.8000                                        avg =      16.0
       overall = 0.8176                                        max =        16

                                                F(7,68)            =    206.84
corr(u_i, Xb)  = -0.6742                        Prob > F           =    0.0000
```

linfmo	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lphey	-.0799886	.0293377	-2.73	0.008	-.1385311	-.0214461
lfpi	-.1306563	.0560734	-2.33	0.023	-.2425491	-.0187635
lurb	-.5937801	.0932953	-6.36	0.000	-.779948	-.4076122
lisaf	-.2192361	.2935066	-0.75	0.458	-.8049195	.3664472
liwa	.2282596	.1120734	2.04	0.046	.0046206	.4518986
lryc	-.7107755	.0939442	-7.57	0.000	-.8982382	-.5233127
leduc2	-.0154784	.0232336	-0.67	0.508	-.0618403	.0308835
_cons	10.56283	.5797232	18.22	0.000	9.406011	11.71965
sigma_u	.15750462					
sigma_e	.05078573					
rho	.90582393	(fraction of variance due to u_i)				

F test that all u_i=0: F(4, 68) = 27.55 Prob > F = 0.0000

APPENDIX D

STATA Output for Table 5, Model (1): Public Health Expenditures and Life Expectancy (EAC)

```
. xtreg llife lphey lryc lurb lhivprev lfpi leduc2 lisaf liwa lclean, fe

Fixed-effects (within) regression               Number of obs      =        80
Group variable: ct1                             Number of groups   =         5

R-sq:  within  = 0.9597                         Obs per group: min =        16
       between = 0.1934                                        avg =      16.0
       overall = 0.2902                                        max =        16

                                                F(9,66)           =    174.54
corr(u_i, Xb)  = -0.8865                        Prob > F          =    0.0000
```

llife	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lphey	-.0267404	.0161863	-1.65	0.103	-.0590573	.0055765
lryc	.0048411	.0525621	0.09	0.927	-.1001025	.1097847
lurb	.5859046	.0455328	12.87	0.000	.4949955	.6768137
lhivprev	.0106524	.0236232	0.45	0.654	-.0365129	.0578177
lfpi	.0250402	.0238541	1.05	0.298	-.0225861	.0726665
leduc2	.0112442	.0101291	1.11	0.271	-.0089792	.0314675
lisaf	-8.247418	1.332822	-6.19	0.000	-10.90848	-5.586352
liwa	-6.939997	1.13526	-6.11	0.000	-9.206617	-4.673378
lclean	2.021428	.3401437	5.94	0.000	1.342309	2.700546
_cons	30.24176	4.640479	6.52	0.000	20.97674	39.50677
sigma_u	.21094549					
sigma_e	.01949542					
rho	.99153103	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(4, 66) =    83.69                 Prob > F = 0.0000
```

APPENDIX D

STATA Output for Table 5, Model (2): Public Health Expenditures, HIV/AIDS Prevalence, and Life Expectancy (EAC)

```
. xtreg llife lphey lhivprev lfpi lryc, fe

Fixed-effects (within) regression               Number of obs      =        80
Group variable: ct1                             Number of groups   =         5

R-sq:  within  = 0.6657                         Obs per group: min =        16
       between = 0.6316                                        avg =      16.0
       overall = 0.6060                                        max =        16

                                                F(4,71)            =     35.34
corr(u_i, Xb)  = -0.5326                        Prob > F           =    0.0000
```

llife	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lphey	-.0188335	.0348418	-0.54	0.591	-.0883062	.0506391
lhivprev	-.1159407	.0405218	-2.86	0.006	-.1967389	-.0351425
lfpi	.0985396	.0470904	2.09	0.040	.0046441	.1924351
lryc	.295576	.07658	3.86	0.000	.14288	.4482721
_cons	2.022286	.3429	5.90	0.000	1.338563	2.70601
sigma_u	.0561262					
sigma_e	.0541253					
rho	.51814255	(fraction of variance due to u_i)				

F test that all u_i=0: F(4, 71) = 4.22 Prob > F = 0.0040

BIBLIOGRAPHY

REFERENCES

Alves Denisard and Walter Belluzzo. "Child Health and Infant Mortality in Brazil." Research Network Working papers R, no. 493 (2005).

Anand, S. and M. Ravallion (1993), Human Development in Poor Countries: On the Role of Private incomes and Public Services, Journal *of Economic Perspectives*, 1(3), pp 133-50.

Bichaka,F. and Paulos,G.: *A Health Production Function for Sub-Saharan Africa (SSA),* A Working Paper Series JEL classification: (2008): I12

Bloom, David E., David Canning and Jaypee Sevilla. "The effect of Health on Economic growth: A Production Function Approach." World Development 32, 1(2004):1-13.

CJ Anyanwu; EOA Erhijakpor "Health expenditures and health outcomes in Africa," *African Development Bank Economic Research Working Paper No 91*, (2007).

Costa-Font, Joan, and Jordi Pons Novell. "Public Health Expenditure and Spatial Interactions in a Decentralized National Health System." Health Economist 16, no. 3 (2007): 291-306.

David E. Bloom & David Canning & Jaypee Sevilla, "The Effect of Health on Economic Growth: Theory and Evidence," NBER Working Papers 8587, National Bureau of Economic Research, Inc., 2001.

Deon, Filmer, and Lant Pritchett. "The impact of public spending on health: does money matter?." Social Science& Medicine 49 (1999): 1309-13123.

Guerriere, DN, Wong AY, Croxford AR, Long VW, McKeever P, and Covte PC. "Costs and determinants of privately financed home-based health care in Ontario, Canada." Health Soc Care community 16, no. 2 (2008): 126-36.

Gupta, S., M. Verhoeven and E. Tiongson (2003), Public spending on health care and the poor, *Health Economics*, 12: 685-96.

H. Issa and B. Ouattara. "The Effect of Private and Public Health Expenditure on Infant Mortality Rates: does the level of development matters?" Economics Department, James Callaghan Building, University of Wales Swansea, Singleton, 2005.

http://www.unicef.org/esaro/7310_Gender_and_WASH.html

http://www.afrol.com/articles/23097

International Monetary Fund, "Health and Development." A compilation of articles from Finance and Development, Washington, DC, 2004.

Kaseje D. Health Care in Africa: Challenges, Opportunities and Energy model for improvement. (2006).

Khadaroo V. and Jaunky, A Health Care Expenditure and GDP: An African Perspective. *Applied Econometrics and International Development* Vol. 8-1. (2008).

Mahfuz, Kabir. "Determinants of Life Expectancy in Developing Countries." The journal of Developing Area 41, no. 2 (2008): 185-204.

Novignon et al.: “The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis.” Health Economics Review 2012 2:22.

Olanrewaju Olaniyan, Idowu Daniel Onisanwa and Abimbola Oyinlola. "Health Care Expenditures and GDP in *Sub-Saharan African* Countries": Evidence from Panel Data, Department of Economics, University of Ibadan, Ibadan, Nigeria, 2013.

Okunade, Albert A. "Analysis and Implications of the Determinants of Healthcare Expenditure in African Countries." Health Care Management Science 8, no. 4 (2005): 267-76.

Potrafke, Niklas, "The growth of Public expenditures in OECD countries: Do government ideology and electoral motive matter?," Journal of Health Economics. Elsevier, Vol. 29(6), pages 797-810, December. 2010.

Sonia, Bhalotra. "Spending to Save? State Health Expenditure and Infant Mortality in India." Discussion Paper Series IZA DEP, no. 2914 (2007).

U.-G. Gerdtham, J. Sogaard, F. Anderson, B. Jonsson, Econometric analysis of health expenditure: a cross-section study of the OECD countries, Journal of Health Economics, 11 (1992), pp. 63–84.

Ulrich Kohler, Frauke Kreuter, Data Analysis Using Stata, 2nd ed.,Stata Press,2009.

Xu, Ke, and Priyanka Saksena. “The determinants of health expenditure.” Geneva: World Health Organization, 2011. Print.

Zeynep Or. “Determinants of health outcomes in industrialized countries.”A Pooled, Cross-Country, Time-series Analysis, OECD Economic Studies, No. 30, (2000).