Economic Determinants of Public Health Care Expenditure in Zimbabwe

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Abstract: *The research sought to investigate the main determinants of public health care expenditure in Zimbabwe, with an understanding that health care financing is an important aspect of successful health systems. The research investigated the determinants of the public health care expenditure of Zimbabwe using yearly time series data for the period 1975-2005. The Engle-Granger cointegration technique was used to explain the main factors that affect public health care expenditure in Zimbabwe. The empirical results show that the key determinants in the explanation of the public health expenditure are real GDP per capita income, literacy rate, inflation and foreign health aid per capita while population and life expectancy were statistically insignificant.*

Key words: Public health care, Health expenditure

Introduction

Health is defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1946). Thus, it is an integral part of development and survival of people, which needs to be constantly improved. There is increasing recognition that improved health status contributes significantly to poverty reduction and economic growth (Carr, 2004; Lopez-Casasnovas *et al*. 2005). In a bid to reduce poverty and achieve economic growth, the Zimbabwean government made universal health a priority in 1986 through emphasising the development of government owned health services, largely financed by government tax revenues.

The issue of health care expenditure determinants has attracted a lot of interest, since the seminal work of Baumol (1967). Several studies have been done on determinants of health care. A wide array of factors has been taken into consideration, including the demographic composition of

the population, economic characteristics and performance, institutional background, and technological progress. Demographic characteristics and socio-economic factors have been identified as important determinants of health care expenditure.

However, income appears to be the prominent factor behind cross-country differentials in health care expenditure determinants. At the same time the magnitude of the estimated income elasticity, which is also of particular interest in this study, is key to ascertain whether health is a luxury good (income elasticity above one) or a necessity (income elasticity below one).

Financing of health services by the public sector not only increases utilization of health care services in developing countries but also increases health care accessibility by the poor. Besides increased utilization and accessibility of health services, the financing of health is a key element of the policy to promote broad based economic growth. The main asset of the poor is their labour and health services improve their productivity and earnings.(Bloom *et al,* 2004). Thus, poor health reduces a household's capacity to earn income and accumulate wealth by limiting work, raising medical expenses and reducing savings.(Sen, 1999).

Background of the Zimbabwean Health System

This section gives the developments that have taken place in the health sector in Zimbabwe during the period under study (1975-2005).

The Pre-Independence Era (1975-1980): Prior to independence, the health care system was characterized by major disparities. The government pursued a health policy which focused on the sustained servicing of the urban areas with the majority of the rural population having limited access to services (Zerai, 1993). In 1978, 44% of publicly funded health care services went to the urban-based sophisticated curative services in central hospitals (Government of Zimbabwe, 2007). Government expenditure on health was high among the whites with 80% of government health resources being channeled to the whites (Agere, 1986).

The Post Independence decade (1980-1989): When Zimbabwe attained independence in 1980; it inherited a social and economic system, which was skewed

heavily in favour of the minority Whites. The health status of Zimbabwe's population mirrored a glaringly unequal socio-economic structure, characterized by appropriately racial inequalities and significant inequalities between urban and rural populations. The government sought to address these imbalances and therefore took an active role in health sector. The health sector, like the education sector was given priority by the government. This commitment by the Zimbabwean government saw an increase in government health care expenditures in real terms.

The ESAP Era (1990-1995): In the 1990s, Zimbabwe embarked on a World Bank-inspired Economic Structural Adjustment Programme (ESAP) that was meant to usher in a new era of modernized, competitive and export led industrialization. There were massive cuts on social expenditures such as education and health. All these reforms were standard ingredients of liberalization and put special emphasis on reducing the government deficit, civil service reform and shedding of public enterprises. Government allocation to the health sector under ESAP fell from 2.6% of GDP in 1980 to about 2.2% by 1997. Since 1990, there has been a steady decline in real per capita spending on health.

Post ESAP Era: In health and nutrition, Zimbabwe had achieved by 1990 better indicators than many countries in Sub-Saharan Africa, narrowing inequalities between urban and rural areas, between gender and to some extent across income groups in health status and access to primary health care services (Loewenson, 2000). This resulted in the country ranking relatively high on human development for its GNP by the mid -1990s. However, combinations of financial austerity, inflation, an expanding population and illnesses related to HIV/AIDS have threatened these gains. Although the Zimbabwean government funded healthcare well during the early years of independence, programmes are now severely starved of funds. The improved health indicators achieved in the years following independence are now threatened by increasing demands on the health care sector, coupled with the dwindling financial resources.

Statement of the Problem: Health is at the centre of the Millennium Development Goals (MDGs). At the Millennium Summit in 2000, member states of the United

Nations, Zimbabwe included, reaffirmed their commitment to eradicate world poverty and improve the health and welfare of the poorest by 2015. The members committed themselves to increase government health expenditure to at least 15% of the total annual government budget by 2010. In this view, the public sector is the major source of health sector financing and provider of health-care services in Zimbabwe.

However, the volatility of Zimbabwe's public health expenditure leaves a lot to be desired in line with the country's commitment. The public health expenditure budget is not enough to meet health needs, the per capita budget has fallen since 1991 to a level where it does not even pay for prevention, clinics and districts hospital cost per capita (World Health Organisation, 1995). The level of government expenditure on health falls far below the agreed 15% by the member states of the United Nations. Thus the achievement of this noble idea requires the knowledge of what really determines public health care expenditures.

Materials and Methods

This section looks at the econometric methodology employed by the study to investigate the determinants of public health care expenditure in Zimbabwe.

Model Specification: The theoretical basis of the model is a simple linear relationship between public health care expenditure as dependent variable and independent variables, which include; real GDP per capita, literacy rate, life expectancy, population, foreign health aid per capita, inflation rate and two dummy variables (D_1VA and D_2VA). The hypothesised structural relationship for public health care expenditure per capita in Zimbabwe can be specified as follows:

$$Phce = f(Percap, Lr, Le, Fhaid, Popn, Inflat)$$

;

Where; *Phce* is public health care expenditure per capita; *Percap* is real gross domestic product per capita; *Lr* is literacy rate; *Le* is life expectancy; *Fhaid* is foreign health aid per capita; *Popn* is population and *Inflat* is inflation rate.

The econometric model used by Ariste and Carr (2001) forms the backbone of the methodology used in this research. Borrowing from Ariste and Carr (2001), the equation to be estimated is specified as follows:

$$InPhce = \beta_0 + \beta_1 InPercap + \beta_2 InLr + \beta_3 Le + \beta_4 InFhaid + \beta_5 InPopn + \beta_6 InInflat + \varepsilon_t$$

The expected signs from the regression equation to be estimated are as follows:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 > 0, \beta_6 < 0$$

Public Health Care Expenditure (PHCE): Public health care expenditure per capita is the dependent variable. Public health care expenditure in this research refers to expenditure incurred by government on health care services. Public health care expenditure per capita is calculated by dividing total public health care expenditure by the total population.

Real Gross Domestic Product per capita (PERCAP): GDP is defined as the market value of all final goods and services produced within an economy over an accounting period, typically a year or a quarter. Real gross domestic product per capita is calculated by dividing the real gross domestic product by the total population. Real gross domestic per capita in the study is used as a proxy of income.

Population (POPN): Spending decisions on health are not solely affected by the income level alone but also by the size of the recipients. Zimbabwe's population has been steadily increasing since her attainment of independence. This increase in population implies an increased responsibility of the government in as far as financing health care is concerned.

Life Expectancy (LE): Health status could be measured using three major indicators; infant mortality rate, under-5 mortality rate and life expectancy at birth. However, the researchers chose life expectancy to represent the health status of the Zimbabwean populace. Life expectancy at birth is the time (in years) that an individual is expected to live after birth.

Literacy Rate (LR): Literacy rate of a country represent the proportion of the total population aged 15 years and older who are able to read and write.

Foreign Health Aid per capita (FHAID): Foreign health aid is of particular interest in African countries because it represents a source of external financing of the health care systems. Foreign health aid is aid that is directly targeted towards the health sector that comes from foreign donors.

Inflation (INFLAT): Inflation as the general price increase levels by definition is introduced into the model to take into account the general increase in the health care prices. Inflation in this research is proxied by the consumer price index, which

is a measure of the overall cost of the goods and services bought by a typical consumer.

Error term: This variable is included to capture the impact of some of the explanatory variables that are not included in the model. It also captures the randomness of the data.

Interpretation and Discussion of Results

This section focuses on the empirical estimation, as well as the presentation and economic interpretation of the regression results. Estimation of the final equation is done against the background of several tests.

Interpretation of Estimation Results

Table 1:Preliminary Tests: Descriptive Statistics

	LPHCE	LPERCAP	LFHAID	LLR	LLE	LINFLAT	LPOPN
Mean	3.834692	7.573471	3.468548	3.480032	3.028875	3.400006	7.633645
Median	3.871201	7.599401	3.555348	3.487400	3.100040	3.077312	7.625500
Maximum	4.174387	7.731931	3.850148	3.843500	3.275380	6.555474	7.945200
Minimum	3.291042	7.319865	2.639057	3.091000	2.703870	2.104134	7.504200
Std Dev	0.228883	0.102348	0.298720	0.252474	0.183892	1.274625	0.086874
Observations	31	31	31	31	31	31	31

Table 1 shows descriptive statistics of the variables used in the research for the period 1975 to 2005. The data was converted into logarithms to reduce its variability and enable direct estimation of elasticities. We proceeded to test for correlation among the variables.

Multicollinearity Test: The correlation test was conducted using the correlation matrix. A correlation matrix Table 2 below depicts the results of our correlation tests.

Table 2: Correlation Matrix

	LPERCAP	LFHAID	LLR	LLE	LINF	LPOPN
LPERCAP	1					
LPFHAID	0.291069	1				
LLR	-0.171770	0.067051	1			
LLE	-0.100806	0.590241	0.095429	1		
LINFLAT	0.262583	-0.129916	-0.536558	-0.352463	1	
LPOPN	0.385381	0.292876	0.275459	0.029341	0.057751	1

The main diagonal entries indicate correlation of the variable with itself while entries off the main diagonal show pair-wise correlations that exist amongst explanatory variables. A correlation statistic greater than 0.8 shows that there is a high correlation between the two variables. However in the research, none of the variables is correlated as reflected by all coefficients less than 0.8 implying that there is no evidence of multicollinearity.

The Unit Root Test Results: The unit root tests were conducted by applying the Augmented Dickey-Fuller test to check for spurious correlation between variables in the regression equation.

Table 3: Augmented Dickey Fuller (ADF) Test Results in Levels.

Variable	t-ADF Statistic	Critical 1%	Critical 5%	Critical 10%	Conclusion
LPHCE	-0.189294	-3.6752	-2.9665	-2.6220	Non-stationary
LPERCAP	-0.423103	-3.6752	-2.9665	-2.6220	Non- stationary
LFHAID	-2.075662	-3.6752	-2.9665	-2.6220	Non-stationary
LLR	-1.170598	-3.6752	-2.9965	-2.6620	Non- stationary
LLE	-2.158300	-3.6752	-2.9965	-2.6620	Non- stationary
LINF	1.118008	-3.6752	-2.9965	-2.6620	Non-stationary
LPOPN	-1.815781	-3.6752	-2.9965	-2.6220	Non-stationary

ADF tests results in Table 3 led us to difference all variables to achieve stationarity and the results are shown in Table 4 below.

Table 4: Augmented Dickey Fuller (ADF) Test Results after First Differencing

Variable	t-ADF Statistic	Critical 1%	Critical 5%	Critical 10%	Conclusion
LPHCE	-2.799813	-3.6852	-2.9705	-2.6242***	I(1)
LPERCAP	-2.876499	-3.6852	-2.9705	-2.6242***	I(1)
LFHAID	-3.637537	-3.6852	-2.9705**	-2.6242	I(1)
LLR	-2.895525	-3.6852	-2.9705**	-2.6242	I(1)
LLE	-3.733956	-3.6852*	-2.9705	-2.6242	I(1)
LINF	-3.333621	-3.6852	-2.9705**	-2.6242	I(1)
LPOPN	-5.073705	-3.6852*	-2.9705	-2.6242	I(1)

*1% level of significance, **5% level of significance, ***10% level of significance

The results from ADF test after first differencing show that all the variables become stationary as shown in Table 4.Thus variables are integrated of order one I (1). Therefore, having established that all series are integrated of the same order, tests for cointegration are undertaken.

The Long Run Model (Cointegrating Regression): Ordinary Least Squares (OLS) of the data in levels was done for the period 1975 to 2005. The main reason for the regression of the data in levels was to get the fitted residuals to be used to formulate an error correction term to be used to formulate an error correction model (short-run model). The residuals from the estimation were tested for their order of integration as indicated by the cointegration test below.

Cointegration Tests

Engle-Granger Two-Step Test: Among a number of alternative methods of testing for the existence of cointegration, the Engle-Granger two-step has received a great deal of attention. Having established that the time series of all variables are integrated of order (1) cointegrating tests was explored using the Engle-Granger. Results of the cointegration test are presented in the following table:

Table 5: Unit Root Test for Residuals

t-ADF Statistic	Critical Values
-3.012853**	-3.6752 1%
	-2.9705 5%
	-2.6242 10%

** Indicates significance at 5%

It can be observed from the results in Table 5 that the null hypothesis of no cointegration is rejected at 1% level of significance. This is so because the ADF-t statistic is greater than the critical values in the given table. This confirms the presence of a stable long-run relationship among the series, thus suggesting the possibility of an error correction model (ECM), to represent the relationship between the independent and the dependent variable. The results indicate that the residuals are integrated of order zero, thus indicating that a long run relationship between public health care expenditure and its explanatory variables exists, thus justifying the formulation of an error correction model.

The Error Correction Model (ECM): The Engle-Granger residual test for the presence of cointegration was undertaken. Results

from the test as indicated by results in Table 5 revealed the existence of the long run behavior among the variables. The results are also in support of the hypothesis that a long run economic relationship exists among variables, implying that application of the error correction model would be efficient. To account for the relationships of the variables, both the short run and long run the error correction mechanism (ECM) was employed. The ECM relates the short run changes in the dependant variable (public health care expenditure per capita) to the short run changes in the explanatory variables, linking these with the changes to the long run effect through the feedback mechanism. Formulating the error correction model involved regressing the first differences of the dependant variable onto the values of the first differences of the explanatory variables plus the lagged value of the error correction term (ECM_{t-1} = error correction term lagged once) from the cointegrating equation as follows;

$$DLnPHCE = \beta_0 + \beta_1 DLnPERCAP + \beta_2 DLnLR + \beta_3 DLnLE + \beta_4 DLnFHAID + \beta_5 DLnPOPN + \beta_6 DLnINFLAT + ECM_{t-1} + \varepsilon_t$$

Table 6: **Error correction model results: Dependant Variable: DPHCE**

Variable	Coefficient	Std error	T-Statistic	Probability
C	0.058031	0.017590	3.299158	0.0036**
DLPERCAP	0.677519	0.229384	2.953648	0.0073*
DLFHAID	0.559426	0.131087	4.267601	0.0003*
DLLR	1.266528	0.600133	2.110410	0.0464**
DLINFLAT	-0.066008	0.039682	-1.663424	0.0104**
DLPOPN	0.137134	0.151494	0.905211	0.3752
DLLE	0.058322	0.133146	0.438030	0.6656
ECM_{t-1}	-0.460406	0.187123	-2.460451	0.0222**

Adjusted R-squared = 0.749891 F-statistic = 13.42136(0.0000)

DW=1.555009

D denotes the first difference operator

*, **, *** Indicate significance at 1%, 5% and 10% significant level respectively.

Diagnostic Analysis

The estimated model was tested for serial correlation, auto conditional heteroskedaciticity, normality and specification. The results are presented in the Table 7.

Table 7: **Diagnostics summary**

	F statistic	Probability
Specification error:		
Ramsey reset test	0.1522	0.7008
Serial correlation:		
Breusch-Godfrey Serial Correlation LM test	0.0471	0.9541
AR Cond Heteroscedasticity:		
ARCH LM Test	0.1867	0.6689
Normality:		
Jarque-Berra statistic	1.4938	0.4738

Diagnostic tests carried out reveal that the model passes the normality test and we can accept the hypothesis that our residuals are normally distributed, as proof for consistency and efficiency. The Ramsey Reset test has a *P* value of 0.70 and as such we accept the null hypothesis that there are no specification errors. ARCH LM test gives a *P* value of 0.67 indicating that there is no problem of autocorrelation in our model.

Discussion: After testing for cointegration all the variables were found to be cointegrated to per capita public health care expenditure. This implies that there exist a long-term equilibrium relationship between per capita public health care expenditure and its explanatory variables. Therefore the error correction term (residuals) is treated as the equilibrium error that attempts to correct errors or movement out of equilibrium. Thus, the error term can be used to link between the short run behavior of per capita public health care expenditure to its long run value.

Real GDP per capita was found to be positively related to public health expenditure and highly significant. This means that public health care expenditure in Zimbabwe will rise as the economy develops and becomes wealthier. This also means that real GDP growth exhibits a significant impact on public expenditure

growth on health. Thus, increased income leads to increased public expenditures. The coefficient of GDP per capita shows that elasticity of public health care expenditure of 0.67 is less than unity suggesting that health is not a luxury good in Zimbabwe.

Foreign health aid per capita is significant in explaining public expenditure on health care in Zimbabwe and positively related to public expenditure on health care. This means that foreign aid per capita received is of substantial importance to the level of health care expenditure. This reinforces the view that in countries like Zimbabwe where there are limited resources, increase in foreign aid is essential for higher allocation of resources among other things, to the health sector as well. Literacy rate was found to be positively related to public health care expenditure and significant at 10%. Thus, a 10% increase in the literacy rate tends to lead to a 12.6% increase in public health care expenditure.

Inflation rate, on the other hand, has a significant but negative influence on public health care expenditure. This means that public health care expenditure takes a downward spiral in an inflationary environment due the ever increasing in prices of health care services. Thus, inflation has a negative effect on public health care expenditures. Population was found to be statistically insignificant but positively related to public expenditure on health care. This means that, although population is positively related to the amount that the government spends on health care it does not influence the health care spending by the government. Life expectancy was found to be positively related to public health care expenditures but statistically insignificant in explaining public health care, meaning that life expectancy in Zimbabwe does not influence the amount of health care spending by the public sector.

The coefficient of the error-correction term (ECM_{t-1}) in the model is appropriately negatively signed. The estimated coefficient value of -0.46 of the error-correction mechanism suggests that the system corrects its previous period's disequilibrium from long run elasticity by 46 per cent a year. The strong significance of the ECM supports cointegration and suggests the existence of a long-run equilibrium relationship between public health care expenditure and the aforementioned variables, which greatly influence it.

Conclusion and Policy Inferences

Econometric estimates of the determinants of public health care expenditure for Zimbabwe suggest that public health care expenditures are largely explained by income (per capita GDP), foreign health aid per capita, literacy rate and the inflation rate. Moreover, the public expenditure on health care appears to be less sensitive to inflation rate changes. Since real GDP per capita is a significant variable in explaining the public health care expenditure in Zimbabwe, we expect that with an increase in real GDP per capita, expenditure on health would increase. Policy prescription should thus be directed towards mechanisms that encourage increase in GDP per capita (economic growth), since public health care expenditure expands as national income expands. Thus, economic growth is an important factor that can ensure delivery of adequate health services in Zimbabwe. Also policy makers in Zimbabwe should try to attract foreign aid. With increased foreign health aid most countries probably will able to keep their commitment to the health sector, which otherwise suffers from budget deficit in times of crisis. The significance of the literacy rate should also be considered since educated people demand more health services and facilities in the society.

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