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HEALTH CARE OUTCOMES, MALNUTRITION AND FOOD SECURITY IN SOUTHERN AFRICA DEVELOPMENT COMMUNITY: A QUANTILE REGRESSION APPROACH

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ABSTRACT

The study analyzed the linkages among food security, nutrition and health care outcomes within the SADC regional bloc for the period 1991 to 2016. The study employed panel OLS and quantile regression analysis and the latter provided more informative findings that would culminate in the development of effective policies to deal with problems of infant mortality. Specifically, the study showed that population growth and malnutrition have a positive and significant effect on infant mortality across the entire distribution. The effect of investment in fixed capital and economic development is significant at higher quantiles. There is a non-linear relationship between infant mortality and population growth. Food security has no effect on infant mortality rate across the entire distribution and these results are consistent with those found using panel OLS. Robust results using quantile regression show that the sensitivity of infant mortality to each variable remains the same, statistically, but the magnitude or effect increases in higher quantiles. The study showed potential parameter heterogeneity across countries with implications for estimating the wider effects of mortality for a policy shock that may have unequal effects across the distribution. Properly developed policies should have a differentiated approach in influencing the rate of infant mortality in member states.

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1. INTRODUCTION

The study examines the dynamic relationships among food security, malnutrition and health care outcomes in the context of the Southern Africa Development Community (SADC). The main focus is to show that nutrition is part of the complex process of reducing infant mortality rates within the region. This issue has been inadequately addressed in the context of the SADC region and despite the need for it to be integrated within all efforts being made to reduce child mortality. Malnutrition poses a serious public health problem and it is linked to high mortality and morbidity among children (Blössner and De Onis, 2005). Munyamahar (2017) showed that nearly 50% of children die due to malnutrition. Infant mortality rate (IMR) is the number of deaths per 1000 live births. IMR varies across the SADC member states and may be influenced by factors that could be country specific or general. The health care outcomes, like IMR, are driven by factors that can be economic, social and physical. Social determinants include poverty and food insecurity. It is a challenge for families to maintain a nutritious diet when

faced with food insecurity and poverty. This would adversely affect the chances of children surviving for longer periods (Hartline-Grafton, 2017).

Addressing food security and health challenges requires initiatives at country and regional levels if countries are to benefit from synergy. The failure by a member state to alleviate acute nutritional levels has potential to adversely affect health care outcomes at local level. This can, in turn, have spillover effects on countries within a regional grouping and hence a fall in regional metrics that measure performance. SADC is home to over 3.2 million undernourished people and this has implications on the health care outcomes. This level of undernourishment may rise in the absence of effective policy options. More so, past studies (Sultana and Kiani, 2011; Gebre, 2012; Zakari *et al*., 2014; Habyarimana, 2015) on food security at mainly at household level and are country specific which limits policy making at regional level. Poor policy making in one country has potential for spillover effects to neighboring countries. This study seeks to develop strategies to improve nutrition levels with the possibility of improving health care outcomes. This can be possible with a strong understanding of the connection between these variables. On the other hand, food security is an important prerequisite for improving nutrition levels and health care outcomes. Most importantly evidence, in the context of SADC, explaining the linkages among food insecurity, malnutrition and health care outcomes using advanced panel data techniques is scarce. Past studies have employed linear models which limit the scope and applicability of policy options they generate. This is because linear models generate estimated coefficients at conditional means for the entire sample and they fail to exploit information at different points of the distribution of sample. Knowledge of the behavior of a variable across the distribution is important where the connection between variables is non-linear. The food security-malnutrition and health nexus is complex and therefore from a policy maker's point of view the following questions are important: which factors explain the level of infant mortality rates in SADC? How is each quantile of health care outcomes affected by variables like food security and malnutrition levels?

The findings show that, according to panel OLS, infant mortality is driven by investment in fixed capital, population growth and malnutrition levels. Quantile regression analysis showed that population growth and malnutrition have a positive and significant effect on mortality across the distribution. The effect of investment in fixed capital and economic development is significant at higher quantiles. There is a non-linear relationship between infant mortality and population growth. Food security has no effect on infant mortality rate across the distribution and these results are consistent with findings using panel OLS. The robust results using quantile regression show that the sensitivity of infant mortality rate to each variable remains the same statistically but the magnitude or effect increases in higher quantiles. Thus the study showed potential parameter heterogeneity across countries.

The rest of the study is organized as follows: section 2 examines the levels of nutrition, infant mortality rates and food security in the context of the study. Section 3 provides a review of past studies to bring out their key results. Section 4 describes the data, presents and discusses the findings from this study. Section 6 provides conclusion and policy implications.

2. THE STUDY INTO CONTEXT

Food insecurity has been termed to be complex and multifaceted not only in Sub Saharan Africa (SSA) but also in the entire world. It is portrayed by high pockets of poverty among the disadvantaged groups, particularly those in the rural areas. On the other hand, food security is attained when, at all times, people have access to sufficient, safe and nutritious food to meet dietary needs and choices for a health and dynamic life. At macro level it means having adequate availability of food through increased production, improving import capacity, food stocks and attracting food aid. At micro level it refers to having access to food as necessitated by having adequate income and food producing assets. Therefore food security is explained by availability, accessibility, stability and nutrition (Kiome, 2009; Food and Agriculture Organization, 2013). Stability of supply and access to food are affected by weather variability, price fluctuations, political and economic factors. Food utilization is affected by food safety,

hygiene and manufacturing practices, diet quality and diversity. The physical and economic access to food is determined by availability of purchasing power, income levels, transport networks and market infrastructure. Food safety and security have a positive effect on reduction in food chain losses which increases in availability, stability and utilization. There is reduction in food borne illnesses with their associated social and economic implications and most importantly food security results in improved nutrition and health.

The development path for SSA and other regions of the world has been characterized by the food and nutrition related challenges. SSA has been struggling with food insecurity due to factors like distribution obstacles, global climate change, poor yields in agriculture and poor policy making. The international community has not managed to respond effectively to food insecurity thus worsening the situation. Efforts have been made to address these challenges through availing much funding to combat food and nutrition insecurity. Despite these efforts, the levels of undernourishment are still high in SSA region compared to other regions at the same level of development. Food and nutrition insecurity remain a challenge in most countries in SSA which has potential to worsen health care outcomes (FAO, 2014; Chivenge *et al*., 2015). The region is expected to face severe food shortages due to persistent droughts, floods, pests, economic down turns and internal conflicts. The production level for food stuffs has been on the rise, albeit it lagged behind the rate of population growth. Hilderink *et al.* (2012) argue that population and income growth are likely to result in a fourfold increase in total food demand by 2050. On the other hand some countries have managed to improve food security due to improved cereal production. Other countries have been relying on imports to improve food security while others have been relying on food aid. Some countries have suffered as a result of poor infrastructure and lack of funding to import food (FAO, 2015). Table 1 shows that the level of undernourished people has increased tremendously between 1992 and 2016. The increase in the undernourished has increased in all regions of SSA with the exception of West Africa which experienced a decline of 29.4%. Considering absolute figures, Southern Africa has the lowest population of the undernourished though the marginal increase is still worrisome considering the targets set in sustainable development goals (SDGs). The different performances at regional levels have been explained by differences at country level, climatic and drought conditions.

Table-1. Statistics for the undernourished (Millions).

Sub-region	Number of under-nourished		% Change
	1990 – 1992	2014-2016	
Eastern Africa	103.9	124.2	19.6
Middle Africa	24.2	58.9	143.7
Southern Africa	3.1	3.2	2.3
Western Africa	44.6	31.5	29.4
SSA	175.7	217.8	23.9

Source: FAO (2015).

The United Nations development agenda, beyond the year 2015, envisioned a world where there is sufficient, safe, affordable and nutritious food. Food security and reduction in malnutrition have been made important milestones. SDG number two seeks to end hunger by improving access to nutritious food by the poor, reduce all forms of malnutrition among children below 5 years of age and adults at all levels. It also seeks to improve agricultural productivity, improve farming incomes and access to resources that improve agricultural production. SDG two promotes cooperation at local, regional and international level with the aim to improving agricultural output. Furthermore SDG number three focuses on ensuring health lives at all levels. It seeks to reduce mortality rates at all levels and to ensure countries effectively manage health risks at local and global level. Burchi *et al.* (2011) showed that malnutrition results in adverse health care outcomes like poor health, morbidity, and mortality at all age groups.

The SDGs are compatible with the SADC Regional Indicative Strategic Development Plan (RISDP) which seeks to promote sustainable food security so as to attain continuous access to safe and adequate food by everyone in

the region to guarantee active and health lives. The RISDP seeks not only to improve availability but access to food with nutritional value. SADC aims to complement these efforts by increasing crop and livestock production, productivity and improving technology and access to resources. The RISDP acknowledges the link between nutritious food and health care outcomes (see SADC (2011)). SADC is composed of 15 member states that are mainly agro-based economies, hence the significance of agriculture in driving economic outcomes. There are, however, countries like Botswana and Angola that depend on mineral wealth. South Africa, Botswana, Mauritius, Namibia and Swaziland are considered as being middle income countries. Madagascar, Tanzania, Zambia, Mozambique and Malawi are classified as low income while Zimbabwe, Democratic Republic of Congo and Lesotho are still fragile. The main challenges for SADC member states include poor market development, overdependence on rain-fed agriculture, poor transport networks, low production, limited value addition, lack of inputs, pests, limited access to credit and low productivity. Thus attaining food security is key to attaining of the SDGs and the health care outcomes as set out in the RISDP.

3. EVIDENCE IN LITERATURE

The theory by Malthus in 1798 links population growth to resources. The theory argues that population growth happens exponentially according to the birth rate. Food production is said to grow arithmetically as increases take place at given points in time. The theory highlights the need to control population growth rates so that they will not outstrip available resources. This, once it happens, would take the economy into a crisis period. The theory shows that failure to deal with high birth rates among the poor may result in failed family support. In the context of this study, this would reduce nutrition levels and worsen mortality rates across different countries. High prevalence of diseases and poor living conditions will reduce the rate of population growth and reduce the majority to basic survival.

3.1. Empirical Evidence

The linkages between food security, malnutrition and health care outcomes have been investigated by several authors and results have been diverse. Links between these variables have been established with the aim to aid policy making. Hoddinott (2011) showed that policies affecting agriculture have implications on health care outcomes as well. Feedback loops have been identified as such any developments in agriculture in turn affect health care outcomes and malnutrition and vice versa. Such effects have been presumed to be both harmful and beneficial as such the pathways through which agriculture affects health care outcomes need to be established. Mabhaudhi *et al.* (2016) examines the linkages between water use, food and nutrition security in SSA. Their review developed an index for measuring the impact of water, food and nutrition and health relationship. The study showed that the region needs to establish an agro-biodiversity to handle the dietary quality and diversity issues. In view of a study by Wlokas (2008) it is also befitting to mention that food and nutrition security has been affected by climate change. The study shows that importance of improving access to quality food and having stable food supply. Access to quality food can be slowed down due to poor road networks and rising food prices. Edame *et al.* (2011) also argue that agricultural productivity has slowed down due to the ill effects of climate change. The study shows the need to develop policies that contribute to improved public health care to mitigate the effects of climate change. Food security can be improved by having a health and educated population, supporting policies that focus on inclusive growth, improving infrastructure and production conditions, providing quality institutions that guarantee stable incomes and incentivizing investment in agriculture (Hilderink *et al.*, 2012).

Seligman *et al.* (2010) showed that low income communities have less ability to absorb high food prices. They experience greater insecurity as food price rise such that they are forced to choose between food and other life necessities. They end up turning to cheaper and low nutrient processed foods with more fat, sugar and salt which cause them to risk suffering from diabetes and hypertension. On the other hand, Cook and Frank (2008) shows that

access to food is important in attaining optimal development and function in humans. Food insecurity poses a high risk to growth, health, cognitive and behavioral potential for the poor. The risk is even higher for children, even at low levels of poverty. Some studies show that food insecurity is high among human immunodeficiency virus (HIV) positive populations (Weiser *et al.*, 2011) it is associated with negative overall physical health summaries, negatively influences utilization of health care services (Weiser *et al.*, 2012) and it lowers immunity which increases vulnerability to diseases (Ivers *et al.*, 2009).

There is evidence on the relationship between population growth and infant mortality rates in both developing and developed nations. Mortality has been labelled as one of the barriers to population growth and economic development. Fabella (2008) showed that population growth robustly increases infant mortality rates five years later across all income categories. The impact of population growth on infant mortality differed among countries depending on the level of development. This relationship can be explained by the inadequacy of resources due to population increases, thus parents end up neglecting newly born babies. Again, Haines (1998) showed that higher birth rates, resulting in high population growth, lead to higher infant mortality since mothers will wean their children early and fail to take good care of them. On the other hand, Lehmijoki and Palokangas (2011) argued that a decline in mortality rates stimulates investment and generate income that will enhance population growth. More so, Azarnert (2006) argued that a fall in mortality rates lowers fertility and increases population growth.

Evidence, from Birchenall (2007) shows that improvements in economic conditions result in decline in mortality rates in developed nations. Economic development reduces mortality through differential effects on infectious diseases. Hanmer *et al.* (2003) argued that infant mortality rate reductions are not only explained by economic development as indicated by per capita income. Infant mortality rates also fall as explained by specific interventions like immunization. Amiri and Gerdtham (2013) showed that mortality and economic growth have bidirectional causality. Such causal effects are stronger in low income countries relative to high income countries. Such differences were explained by differences in infrastructure and human capital investment.

4. METHODOLOGY AND DATA

The study employs data for 12 SADC member states covering the period 1991 to 2016 to examine the linkages between food security, malnutrition and health care outcomes. All the data to be used was extracted from the World Development Indicators (WDI) data base (World Bank, 2017). The study employed two estimation techniques (panel data ordinary least squares (OLS) and quantile regression analysis to investigate the food security-health-malnutrition nexus in SADC (Verbeek, 2004). Panel unit root was employed to test stationarity of the series and the study used the methods by Levin, Lin & Chu tests and IM, Pesaran & Shin test. The panel OLS was used to identify factors that drive health care outcomes, as proxied by infant mortality rate in SADC and it was be specified as follows:

$$IMR_{it} = \beta_0 + \beta_1 DFD_{it} + \beta_2 POP_{it} + \beta_3 FS_{it} + \beta_4 Dev_{it} + \beta_5 GFCF + \varepsilon_{it} \quad (1)$$

Where:

β_0 is the a constant, β_i are vector of parameters to be estimated, ε_{it} is an error term. Fixed effects and random effects of the model were tested using the redundant fixed effects and Hausman tests respectively to select the best model to use. Table 2 provides variables that were employed in the analysis, definitions and expected signs. Expected signs are based on evidence from literature.

Quantile regression technique, developed by Koenker and Bassett (1978) was employed to trace the entire distribution of health care outcomes, conditional on a set of variables. This brings out informative findings by giving an overview of the distribution of countries at different levels of infant mortality rates. The study expected to find significant differences in the estimated slope parameters at different quantiles due to perceived

heterogeneity. Thus the dependent variable may not be identically distributed across countries. Again, the distribution of disturbances is non-normal due to outliers in the sample. This makes our estimators not to be robust and they portray long tail error situations which result in biased and inefficient estimators when using conditional mean estimators. In view of this, quantile regression is useful since it is robust to departures from normality and skewed tails.

The study employed the design matrix bootstrap method to get estimates of standard errors for the parameters (Buchinsky, 1998). This approach is good for relatively small samples and it is valid under different forms of heterogeneity. The method allowed the use of percentiles as suggested by Koenker and Hallock (2001). Estimations were done using nine quantiles (0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90). Quantile process coefficients are displayed in both tables and graphs at 95% confidence interval. The model is stated as:

$$Quant_{\theta}(y_{it}|x_{it}) = \beta_0 + \beta'_{\theta}x_{it} \qquad (2)$$

where $Quant_{\theta}(y_{it} \mid x_{it})$ is the θth conditional quantile of y_{it}, the dependent variable representing health care outcomes as measured by IMR, conditional on the vector of regressors x_{it} as represented by the country variables (DFD, POP, FS, GFCF, DEV). All variables have been defined in Table 2.

Table-2. Variables, Definitions and Expected Signs.

Variable	Measurement	Expected signs
IMR	The number of infants dying before reaching one year of age per 1000 live births	
FS	Food production index covers food crops that are considered edible and that contain nutrients. A measure of food security.	Negative
POP	Population growth (annual %)	Indeterminate
GFCF	Gross fixed capital formation as a % of GDP as a measure of physical capital	Negative
DFD	Depth of the food deficit - measured as kilocalories per person per day is used as a measure of malnutrition or undernourishment[1].	Positive
Dev	GDP per capita (current US$) – a measure of economic development	Negative

5. RESULTS AND DISCUSSION

5.1. Preliminary Analysis

The study employed methods by Levin, Lin & Chu (LLC) test and Im, Pesaran and Shin (IPS) to test for panel unit root. This was done to avoid reliance on spurious results when estimations are done with a non-stationary series. At 5% level of significance results Table 3 showed that all variables were stationary at levels using the LLC test except for measures for food security and economic development which were stationary after first differencing. The results using IPS showed that all variables were stationary after first differencing except for population growth and undernourishment variables that were stationary at levels. The LLC test performs well when the sample (N) lies between 10 and 250 and when T lies between 5 and 250. It is suitable for most macro panels (Levin *et al.*, 2002). The study relied on the findings provided by the LLC test.

[1] It indicates how many calories would be needed to lift the undernourished from their status, everything else being constant (Definition obtained from World Development Indicators, 2017).

Table-3. Panel Unit Root Tests.

Variable	Levels			
	Levin, Lin & Chu[2]		Im, Pesaran and Shin[3]	
	Levels	First Difference	Levels	First difference
FS	-0.857	-10.49***	-0.132	-12.02***
POP	-4.11***	-5.56***	-9.57***	-5.39***
GFCF	-1.71**	-14.59***	-1.045	-14.20***
Dev	-4.35	-9.99***	5.68	-11.12***
IMR	-4.06***	-2.87***	0.748	-2.79***
DFD	-6.69***	-4.35***	-4.458***	-6.67***

*** *significant at 1%; ** significant at 5%.*

The study tested for the presence of multicollinearity among the variables. Table 4 shows that all the correlation coefficients between any two set of variables was lower than 0.6 suggesting that there is no problem of multicollinearity in the data. Thus all variables could be incorporated in the same model.

Table-4. Correlation Matrix.

	IMR	D(FS)	DFD	POP	GFCF	D(DEV)
IMR	1					
D(FS)	0.070655	1				
DFD	0.429191	0.12169	1			
POP	0.378577	0.121704	0.569879	1		
GFCF	-0.14357	-0.00018	0.053155	0.042289	1	
D(DEV)	-0.25948	0.13741	-0.17175	-0.29078	0.124277	1

Source: Output from E-views.

The use of panel OLS in estimating the major determinants of infant mortality rate necessitated the need to choose between random and fixed effects model. Thus tests on redundant fixed effects were applied on fixed effects model while Hausman tests were applied to the random effects model. The null hypotheses were as follows: that fixed effects are redundant and that the random effects were uncorrelated with explanatory variables. Findings, Table 5, showed that fixed effects are not redundant and the random effects are correlated with explanatory variables. As a result the study employed the fixed effects specification for analysis. Using random effects model would give spurious results.

Table-5 (a). Redundant Fixed Effects Test.

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	132.747837	(11,282)	0.0000

Source: Output from E-views.

Table-5(b). Hausman Random Effects Test.

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	206.593982	6	0.0000

Source: Output from E-views.

[2] For the Levin, Lin & Chu test, the null hypothesis is a unit root (assumes common unit root process).

[3] For Im, Pesaran and Shin test, the null hypothesis is a unit root (assumes individual unit root process).

5.2. Regression Results

The study used equation 2 to obtain different values for θ to examine the effect of explanatory variables at the different points of the distribution of infant mortality rate (IMR). Table 6 present findings and Figure 1, in the appendix shows a plot of estimated coefficients against the different quantiles at 95% confidence interval. Estimates using panel OLS are presented in the same table to allow for comparisons. OLS shows that health care outcomes (represented by IMR) are explained by levels of undernourishment (positive effect), population growth rate (negative effect) and investment in fixed capital (negative effect). Food security and economic development are statistically insignificant though they carry the expected signs. The results using OLS were misleading as they explained the behavior of a variable at a particular point of the distribution. By focusing only on central tendency of the distribution, OLS fails to account for the different effects of explanatory variables for countries that have higher levels of mortality rates.

The quantile regression analysis was important in understanding the accurate behavior of explanatory variables. The effect of each variable is reflected by looking the size, sign and level of significance of each coefficient. The study shows that undernourishment (DFD) has a positive effect on health care outcomes (IMR) throughout the distribution. However, there is a large variation in the magnitude of the coefficient as we move from lower to higher quantiles. The size of the estimated coefficient is much larger at 80^{th} and 90^{th} quantiles showing that at higher quantiles undernourishment has a severe effect as it worsens the health care outcomes. Results do not show any signs of an upper constraint on the effect of undernourishment. These findings are consistent with previous studies (Blössner and De Onis, 2005; Munyamahar, 2017) which showed that undernourishment adversely affects health care outcomes.

Food security shows a change in signs as we move across the distribution. At lower quantiles it shows a negative influence on health care outcomes and the effect becomes positive at higher quantiles. However, the effect on health care outcomes remains insignificant throughout the distribution. This was potentially the same finding using panel OLS. One of the factors that could have weakened the impact of food security is worsening climate change (Wlokas, 2008; Edame *et al*., 2011). This result suggests that, within SADC, food security has potential to reduce the level of adverse health care outcomes (IMR) provided that correct steps are taken improve its effectiveness.

The study shows that the impact of population growth differs across the distribution. The variable is positive and statistically significant in all quantiles. The magnitude of the coefficient increases up to the 70^{th} quantile beyond which the coefficient becomes smaller. Countries with higher levels of IMR (poor health care outcomes) may be suffering from having limited resources to due to high population growth. This is consistent with previous studies (Haines, 1998; Fabella, 2008) which show a positive connection between the two variables. They are however faced with an upper cap beyond which population growth adversely affects the level of mortality among infants at a diminishing rate. In other words, population growth would result in low mortality which is consistent with previous results (Azarnert, 2006; Lehmijoki and Palokangas, 2011) that suggest a negative relationship between the two variables. These findings show the possibility of non-linearity on the relationship between population growth and health care outcomes.

Investment in fixed capital was not significant at lower quantiles. The variable became positively significant beyond the 60^{th} quantile and magnitude of coefficients increased as well. The impact of increased investment on mortality is likely to be higher for countries that are still restocking as they widen their capital base. Thus any increases in physical capital would result in the diversion of resources that could have been used to address the problems of high mortality. This shows the different dynamics in the manner in which different SADC member states allocate resources among competing alternatives.

The study shows that economic development (DEV) has no effect on mortality across the entire distribution. The variable was only significant at 80th quantile while the OLS analysis showed that the variable has no effect on mortality. This result shows how countries with high mortality rates would benefit from high levels of economic development. This is consistent with Birchenall (2007) who suggested that better economic conditions are associated with low mortality rate. The rate of economic growth is not the only factor explaining changes in mortality rates hence the low levels of importance at other quantiles. Economic development may have an indirect effect on mortality rates by working through other channels. Furthermore, the effect on growth, according to Amiri and Gerdtham (2013) is influenced by the different levels of investment in human capital and health infrastructure which may be possible in SADC member states. There are still huge disparities on the level of infrastructure and human capital development within the member states.

Table-6. Determinants of Infant Mortality Rate.

	OLS	10th Quant	20th Quant	30th Quant	40th Quant	50th Quant	60th Quant	70th Quant	80th Quant	90th Quant
D(FS)	-0.036	0.048	-0.060	0.059	-0.020	-0.065	0.071	0.396	0.186	0.141
DFD	0.051***	0.029	0.052**	0.065***	0.083***	0.082***	0.088***	0.09***	0.129***	0.202***
POP	-3.82***	11.60***	10.32***	11.88***	15.12***	17.45***	17.85***	18.06***	9.50***	5.6***
GFCF	-0.677***	0.10	0.19	0.16	-0.037	0.069	0.48	0.85*	2.09***	2.27***
D(DEV)	-0.001	0.001	0.002	0.001	0.007	0.002	-0.018	-0.025	-0.051***	-0.031
R^2	89.98									
F-test	158.84***									

**** significant at 1%; ** significant at 5%, * significant at 10%.*

6. CONCLUSION AND RECOMMENDATIONS

The study analyzed the linkages among food security, malnutrition and health care outcomes within the SADC regional bloc for the period 1991 to 2016. Health care outcomes have become a major concern among the member states in view of the need to meet the SDGs. The study employed quantile regression approach to explore the varying distribution of infant mortality rate across countries over time. The aim was to develop specific policy implications regarding factors affecting health care outcomes. The study showed that the location of infant mortality rate distribution matters considering the magnitude of the influence of variables (DFD, Dev, POP, GFCF) in the long term. There is clear heterogeneity in infant mortality rates for the different member states. The study provides evidence in support of policies that reduces malnutrition as the panacea for reducing infant mortality rate for SADC member states. Countries will benefit more from reductions in malnutrition when they are at higher quantiles of the infant mortality rate distribution. Policies are required that improve nutrient intake, absorption and utilization. At country level there is need to consider the type of malnutrition being experienced to allow for tailored policies across all age groups.

Again, countries at higher quantiles of the infant mortality rates will benefit from policies that effectively allocate resources between health care and other competing economic issues. This may be evidenced by resources devoted to health care related issues versus capital expenditure in budget allocations. The quest for growth in the capital base should not diminish the prospects of reducing mortality rates. Member states should take cognisance of the fact that their level of development matters in reducing mortality rates especially when they are at high quantiles. However, the level of development may not entirely address the high mortality debacle. More so, the study shows that the level of economic development slows down the effect of population growth at higher quantiles of mortality. Countries at high levels of development have potential to develop policies that support (social, economic, educational) women with high birth rates so that they continue to take good care of their infants. Consistent with the theory by Malthus, policies that guarantee rates of economic development that outstrip the rate of population growth may help improve health care outcomes. Appropriately developed policies should have a differentiated approach in influencing the rate of infant mortality in member states. Thus the existence of heterogeneity in countries' health care outcomes has implications for estimating the wider effects of mortality for a

policy shock that may have unequal effects across the distribution. Quantile regression analysis, therefore provides more informative findings than panel OLS which would culminate in the development of effective policies to deal with problems of infant mortality rate.

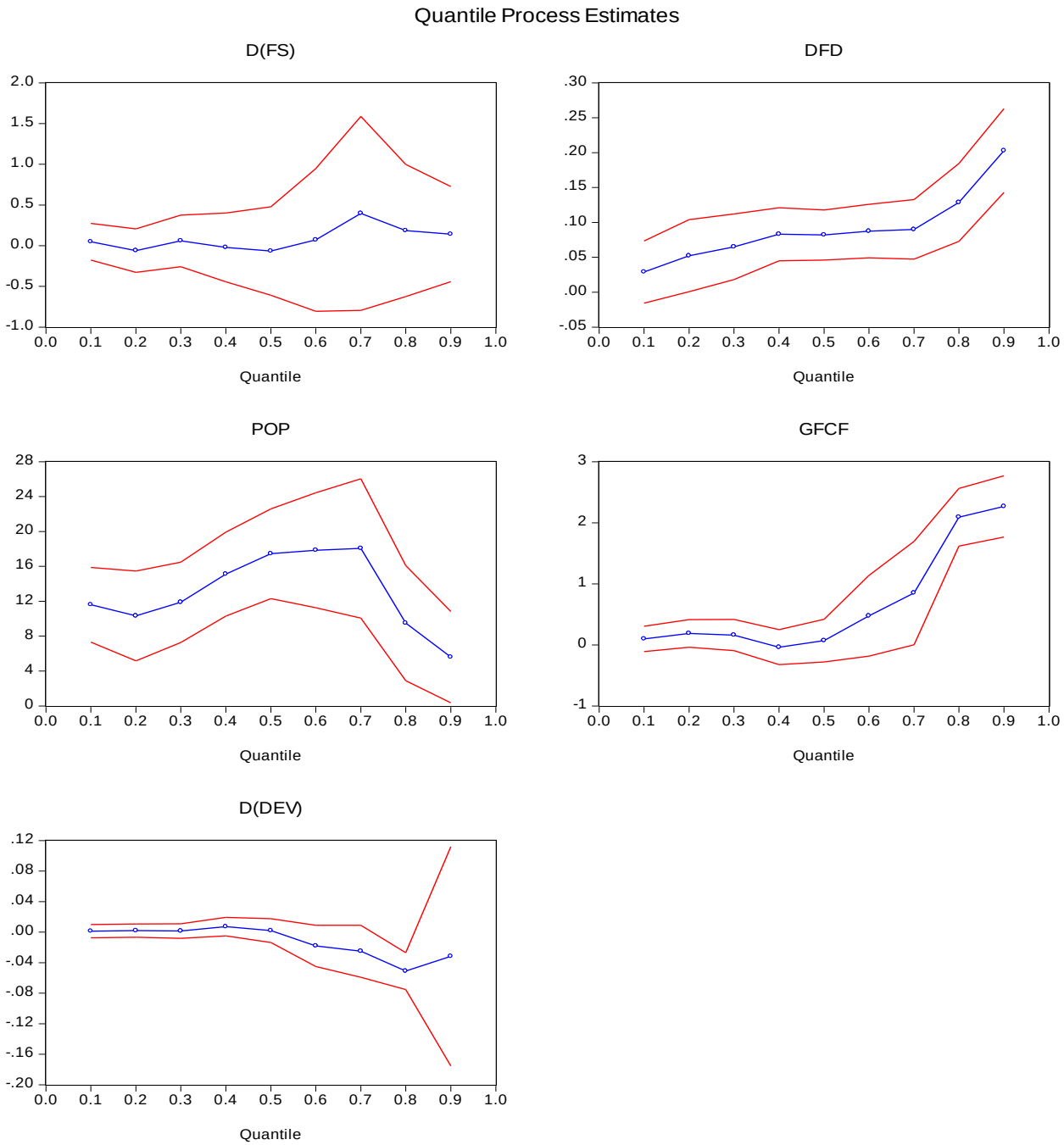

Figure-1. Plots for estimated coefficients against various quantiles.

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