



Review Article

Macroeconomic Effects of HIV/AIDS: Protocol for a Systematic Review

Danjuma Maijama^{1,2,*}, Shamzaeffa Samsudin², Shazida Jan Mohd Khan²

¹School of General Studies, Abubakar Tatari Ali Polytechnic, Wuntin Dada Bauchi, Nigeria

²School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia, UUM Sintok, Kedah Malaysia

Email address:

danjumarabiuu@gmail.com (D. Maijama'a), shamzaeffa@uum.edu.my (S. Samsudin), sjmohd@uum.edu.my (S. J. M. Khan)

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Abstract: Since its appearance over three decades ago, HIV/AIDS has become global pandemic and remain the most shocking disease humankind has ever faced. It causes more death than any other disease in sub-Saharan Africa (SSA) and worldwide, it is the fourth killer disease. The epidemic now is a major threat to macroeconomic growth and development, infecting people at their most productive age (15-49 years), and imposing hardship on households, communities, firms and eventually national economies. Considering the widely spread HIV/AIDS prevalence rate in SSA, a number of studies investigated the macroeconomic consequences of the epidemic, focusing mainly on per capita GDP or GDP growth rate as a measure of economic performance, with comparatively no or little research on GDP per person employ. In addition to dearth of research on the effect of health expenditure in reversing the epidemic, previous studies have failed to take the lag effect of the HIV/AIDS in to consideration in their estimation process. The association between HIV/AIDS and the macroeconomy is complex, with several studies reporting mix and conflicting results. This review aims to systematically synthesised research evidence on the effects of the epidemic on aggregate labour productivity, and assess whether health expenditure is effective in reversing the HIV/AIDS.

Keywords: HIV/AIDS, Macroeconomy, GDP Per Capita, Health Expenditure

1. Introduction

Since its appearance over three decades ago, HIV/AIDS has become not only pandemic on a global scale but also remains the most shocking disease humankind has ever faced. It causes more death than any other disease in the sub-Saharan Africa (SSA), however, the fourth killer disease worldwide (Joint United Nations Programme on HIV/AIDS [UNAIDS], & World Health Organization [WHO], 2001; UNAIDS 2007; WHO 2008). The epidemic is not only on health issue, but also a major threat to macroeconomic growth and development. HIV infects people at their most productive age (15-49 years) (WHO, 1995; UNAIDS, 2006), imposing heavy burdens on families, communities and ultimately economies (Kambou, Devarajan & Over, 1992; McDonald & Roberts, 2006). The number of people living with HIV/AIDS worldwide has considerably increased over the past three decades. The

prevalence rate estimates of the HIV epidemic rises from 18.0 million persons in 1994 to 30.0 million in 2001 (WHO, 1995; UNAIDS, 2006). Recent epidemiological data estimated that about 75 million persons worldwide have become HIV positive and 36 to 42 million people had died due to HIV/AIDS related illnesses (UNAIDS, 2013).

In the sub-Saharan Africa, the HIV/AIDS epidemic is widely spread and continues to infect people. The rate of infection has cut across all sexes as well as ethnic and religious groups. In fact, HIV/AIDS spare no one from its devastating effects which is being felt not only by those infected, but also by relatives and governments in terms of care and treatment (UNAIDS, 2009). In the sub-Saharan region, the prevalence rate among the highly vulnerable age cohort (15-49 years) increased from 20.9 million (5.8%) in 2001 to over 28.0 million people in 2013 (WHO, 2014). Specifically, in 2007 the estimated prevalence rate was

greater than 28 percent in the heavily infected South African countries such as Lesotho, Botswana, Namibia, South Africa and Swaziland among others. In the East African countries, the heavily infected countries include: Mozambique, Zambia and Zimbabwe among others (UNAIDS, 2013). Sub-Saharan Africa contains approximately about 12 percent of global population (World Bank, 2011) yet, it accounts for two-third of all HIV/AIDS infected persons as well as 3/4 (75%) of all global AIDS related deaths (UNAIDS, 2013).

The varied channels of transmission mechanism make the association among HIV/AIDS and macroeconomic indicators complex (Haacker, 2011). In Africa, the HIV/AIDS epidemic has destabilized the family structures and general social cohesion (Schneider & Moodie, 2002). At the household's level, the direct and indirect costs of the epidemic increases with severity of illness and eventual death. This imposes heavy burden on family's income which results to harsh living standard (Naidu & Harris, 2005; McDonald & Roberts, 2006). The epidemic also contributes to the termination of children's education which forces them in to the labour market in order to support their family (McDonald & Roberts, 2006). Given the effects of the epidemic, labour productivity will decline as sick and worried workers become physically and mentally weak, hence less productive. Also, the productivity of uninfected labour could be adversely affected as the rates of HIV/AIDS infection among colleagues, relatives or friends increases (Cuddington, 1993). Even with surplus labour, replacing the lost workers with less skilled and experienced ones could not possibly offset the productivity lost (Coulibaly, 2003). Certain consensus indicates that the HIV/AIDS epidemic could reduce aggregate labour productivity which in turn will reduce output, competitiveness, individual and government income, and subsequently lower the growth of national economies (Dixon, McDonald & Roberts, 2002). However, the effect on per capita income seems to be indeterminate owing to two opposing factors. On one hand, reduction in labour force due to AIDS related mortality rate could increase per capita income. On the other hand, reduction in domestic savings due to HIV/AIDS spendings will reduce capital formation and investment which in turn will lead to decline in per capita income, hence dwindling economic growth (Coulibaly, 1993; Bonnel, 2000).

As the HIV/AIDS prevalence rate rises in sub-Saharan Africa (UNAIDS, 2013), it is essential to investigate the effects which the epidemic might have on the macroeconomic performance in the region. A number of researches have investigated the macroeconomic consequences of the epidemic. Collectively, these studies focuses mainly on GDP per capita or GDP growth rate as a measure of economic performance with comparatively no or little research on GDP per person employed which measured labour productivity that shows the contribution of individual worker in the economy (World Bank, 2014). In addition, there is dearth of research on the effect of health expenditure in reversing the epidemic (Lovasz & Schipp, 2009). However,

previous studies have failed to take the lag effect (i. e. time from infection to manifestation of the effects) (Kanki et al., 1999), into consideration in their estimations. Initial quantitative investigations of the effects of HIV/AIDS on the macroeconomy were compromised by lack of adequate and appropriate data; hence more or less simulations and calibrated growth models were utilized to estimate the economic consequences of the epidemic (McDonald & Roberts, 2006). This according to (Haacker, 2011), explained the mix and conflicting results reached by certain studies (Arndt & Lewis, 2000; Bloom & Mahal, 1997; Cuddington & Hancock, 1994; Lovasz & Schipp, 2009; World Bank, 2000).

Given that reduction in labour productivity and increased health care spendings are among the effects of the HIV/AIDS epidemic at the most primitive level (Cuddington, 1993). Therefore, there is obviously a need, taking the incubation period in to consideration to investigate the consequences of the HIV/AIDS epidemic on the macroeconomy. Hence, the focus should be on GDP per person employ (labour productivity) as well as examination of the effect of health expenditure on HIV/AIDS epidemic. Unlike in medical research, there is dearth of systematic review in health economics. Specifically, to our understanding there has been no systematic review of the macroeconomic effects of HIV/AIDS. This necessitate the need for such methodological rigorous review in order to synthesized research evidence on the relationship between the HIV/AIDS epidemic and the macroeconomy.

2. Objective

This review aims to investigate the macroeconomic effects of HIV/AIDS in sub-Saharan Africa. Specifically, the review will (1) examine the effects of the epidemic on GDP per person employ (i. e., labour productivity) and (2) assess the impact of health expenditure in reducing the HIV/AIDS in the region.

3. Method/Design

This review is in accordance with the PRISMA-P guidelines for systematic review protocols (Moher et al., 2015). The results will also be presented in line with the PRISMA guidelines for reporting systematic review and meta-analysis (Moher, Liberati, Tetzlaff & Altman, 2009). The review is not registered with the PROSPERO since it is not meant for a controlled health care intervention. The controlled health care intervention is meant to prevent, diagnose, treat or monitor health related conditions, for which there is a clinically health related outcome.

4. Search Strategy

Searching for articles will be done electronically, because of ease in accessibility and fastness. The following bibliographic databases: Emerald, Science Direct, and Wiley online library

have the potential to cover literature on health economics will be searched to identify relevant studies. Also, the lists of those retrieved full-text articles that met the inclusion criteria will be scanned manually to identify additional studies. On the other hand, databases of the following policy organizations: UNAIDS, WHO and World Bank will as well searched for identification of relevant 'grey literature'. The policy organizations have a higher potential to cover relevant grey literature on HIV/AIDS epidemiological data and prevalence rates. Moreover, such important aspects of the grey literature being commissioned by the policy organizations not issued as academic papers. Only published materials in English, the common language understood by the authors will be searched for the review, without any restrictions on the date of publication. In order to identify as many relevant studies as possible from the databases, our search process will include use of the following key terms: macroeconomic effects of HIV/AIDS, HIV/AIDS and economic growth, HIV/AIDS and labour productivity, health expenditure and HIV/AIDS, HIV/AIDS spending and HIV/AIDS, access to treatment and HIV/AIDS as well as HIV/AIDS and households. The review will basically focus on empirical studies, because we intent to build the conceptual framework based on empirical evidence rather than theoretical views. The word 'empirical' will however be added to the keywords in limiting the search to empirical works. The databases will be assessed online through the e-journals in Sultanah Bahiyah Library, University Utara Malaysia (UUM). Some articles that could not be accessed freely will be requested from the interlibrary loan via the UUM library. The structure of the search process is as follows:

1. Retrieve studies on macroeconomic effect of HIV/AIDS or HIV/AIDS and growth in SSA.
2. Retrieve studies on HIV/AIDS and households or labour productivity in SSA.
3. Retrieve studies on the effect of health expenditure or HIV/AIDS spending on HIV/AIDS in SSA.
4. Retrieve other studies that clearly stated either empirical or econometric analysis.
5. Joint 1, 2, 3 and 4 together.
6. Retrieve studies other than 1, 2, 3 and 4
7. Exclude 6 from 5.

4.1. Eligibility Criteria

Based on its nature, HIV/AIDS is now a very broad issue attracting research from various disciplines hence, the review will be limited by excluding studies that either focus mainly on mode of transmission of the disease, prevention strategies, vulnerability and high risk groups, stigmatization or information. In addition, studies that focused on other economic aspects of health but not relevant in achieving the review's objectives will be excluded. The exclusion will provide a sense of direction and precision in identifying relevant studies for the review. However, the inclusion includes studies that examined the effects of HIV/AIDS on macroeconomy, economic consequences of the HIV/AIDS, effect of HIV/AIDS on households, effect of health expenditure or HIV/AIDS spending in reducing the

HIV/AIDS, impact of access to treatment or health facilities on the HIV/AIDS and the impact of HIV/AIDS on labour productivity, firms, or any sector of the economy.

4.2. Study Selection and Screening

The results searched from each database will be exported to Endnote reference manager (version X4), and it will then merged in order to identify and delete duplicate studies. Screening for eligibility will be done in two stages (see Figure 1). First, two reviewers (DM and SS) will independently screen the titles and abstracts retrieved in order to ascertain the relevancy of each article against the pre-defined inclusion/exclusion criteria. On an inclusion/exclusion form, each reviewer will indicate whether title/abstract is relevant to the review objectives. After which, the full-text of all studies identified as relevant will be retrieved for second screening to exclude those articles that might be found inappropriate for the synthesis. The rationale for the exclusion will be documented. Then, all eligible articles will be subjected to quality assessment. Discussion will be use to resolve disagreements throughout the review. However where consensus is not reached, a third independent author (SJKM) will be call upon to determine eligibility.

4.3. Data Extraction

Two reviewers [DM and SS] will independently extract data from each eligible study using a pre-made data extraction sheet. A second reviewer will checked the extracted data against the retrieved original text to ensure accuracy. Any discrepancy will be resolved by the reviewers through discussion. The extracted data will include the following: study authors and year of publication, name of the journal, objective(s) of the study, country/region on which the study is conducted and period covered, data source, data completeness, sample representation, description of the data, type(s) of techniques of analysis, model assumption, specification of the model, variables used, statistical significance of the results, estimation bias and objectivity of the discussion. Additionally, a brief summary of each study's findings will be documented together with the main conclusions drawn and recommendations where available.

4.4. Study Quality Assessment

The methodological quality of all the selected studies will be assessed to determine their validity and reliability in supporting the review (Sanderson, Tatt & Higgins, 2007). The assessment will be conducted independently by two reviewers using modified Canadian Council on Learning, quality assessment rubric and scoring criteria (Canadian Council on Learning, 2006). This quality assessment rubric and scoring criteria is developed to assist in assessing the quality of empirical studies (see Table 1 for the rubric and the scoring criteria). The following three major criteria consisting of sub-criteria will be use to assess the study quality. The data quality has source of data, completeness of data use, adequate sample representation and description of the data as

sub-criterion while the model quality has type of techniques of analysis, assumptions of the model, specification of the model and variables choose as sub-criterion. On the other hand, the result quality consists of significance of the results, estimation bias and objectivity of the discussion as sub-criterion. Based on the rubric and the scoring criteria, each criterion can attain a score of 1 (poor), 2 (fair), and 3 (good). When a score for a criterion is between 2 levels (1 & 2 or 2 & 3) then the lower score should be chosen.

Altogether, there are eleven criteria which allow each study to have a total score of between 11 and 33 points. Studies that have scored more than or equal to 28 are judged to be of good quality, between 22 and 27 are classified as fair while below 22 are of poor quality. Good quality studies will provide convincing evidence for the review, fair quality ones, even though not up to the former ones will also be considered. However, evidence from poor quality studies will not be considered. Discussion will also be used to resolve any disagreement, and if consensus failed to be reached, a third reviewer will make the final decision.

5. Data Synthesis

We anticipated that the study designs and outcomes of the included studies will be heterogeneous; hence it will be unlikely to allow a meta-analysis to be conducted. Consequently, our evidence synthesis will be organized and presented descriptively. However, if the synthesized evidence warrants meta-analysis, then the outcomes of each study will be presented in accordance with the meta-analysis of observational studies in epidemiology (MOOSE) guide lines (Stroup et al., 2000). Studies will be categorised based on their domains/types: micro or macro study, country specific, regional or global or particular sector of an economy. The synthesis will be conducted by the leading author and will be independently reviewed by the co-authors. Consensus will also be use to resolved any discrepancy.

6. Discussion

To the best of our understanding, there are no published systematic reviews that have either specifically assessed the association between HIV/AIDS and aggregate labour productivity or the effect of health expenditure in reversing the epidemic. This protocol describes a proposed systematic review to address this gap. The aim is to systematically find empirical evidence on the association between HIV/AIDS and aggregate labour productivity, and whether health expenditure is effective in combating the epidemic. The summary of the available empirical evidence would provide information on the output lost due to HIV/AIDS as well as the effectiveness of health spending as a measure in controlling the epidemic. This study may also inform policy makers about the epidemic's effects on their economies and budget. This is essential in order to ensure the availability of adequate resources in combating the disease. Also, we hoped to identify gaps in the review that may form the basis

for further studies of the various aspects of economic consequences of the HIV/AIDS epidemic. This being the pioneer systematic review of the association between HIV/AIDS, aggregate labour productivity and health expenditure, will serve as reference and motivation to health economists, therefore it is timely.

Abbreviation

AIDS: acquired immunodeficiency syndrome; GDP: gross domestic product; HIV: human immunodeficiency virus; MOOSE: meta-analysis of observational studies in epidemiology; SSA: sub-Saharan Africa; UNAIDS: Joint United Nation Program on HIV/AIDS; UUM: University Utara Malaysia; WHO: world health organization; X4: fourteen.

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Appendix A

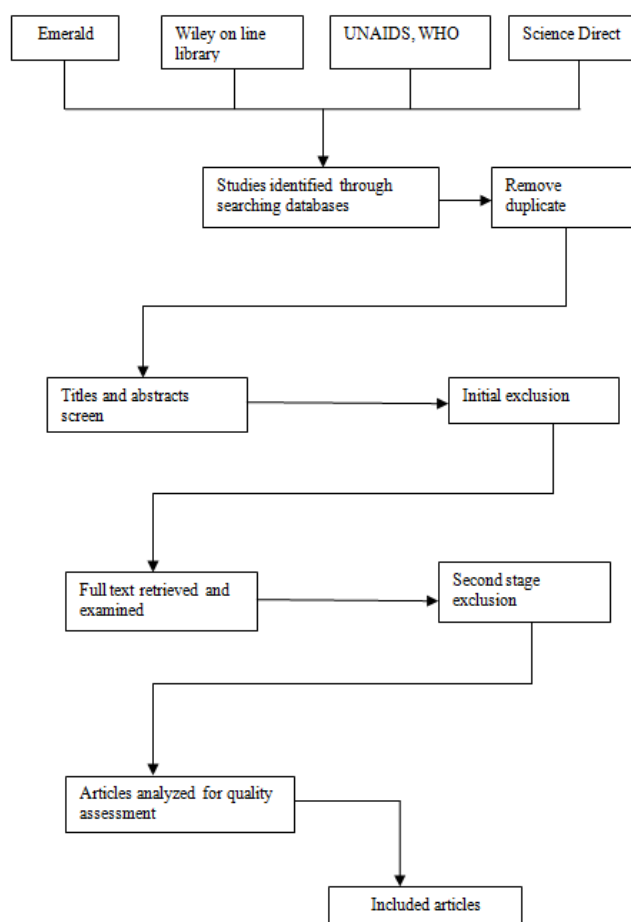


Figure 1. Flow diagram of database searches, study selection and exclusion.

Appendix B

Table 1. Canadian Council on Learning, quality assessment rubric and scoring criteria.

Quality dimensions	Score 1 criteria	Score 2 criteria	Score 3 criteria
<i>Quality of Data</i>			
Data source	Study either does not discuss sources, population, sampling or respondents.	Data sources either external or surveys are not explicitly documented.	Data sources are well documented.
Data completeness	A considerable amount of data is missing which could affect the reliability of the results of the study.	Missing data is mention. Though the missing data is not discussed, but is believed not to hamper the results of the study.	No any missing data.
Representative sample	Sample size is poor and not sufficient to truly represent the population of interest.	Sample size is satisfactory for the statistical analyses and there is reasonable generalization of results.	Sample size is sufficient for all statistical analyses and there is substantial generalization of results.
Data description	Variables used in the study are not described.	The variables used are described but not explicitly description.	The variables used in the study are explicitly discussed.
<i>Quality of Model</i>			
Type of analysis	The study relies only on descriptive analysis without employing any of the econometric methods.	Only econometric methods are use in the study to estimate the results.	The study uses a mixture of quantitative techniques and any other acceptable type of analysis to improve the results.
Model assumptions	Assumptions made are irrational and without any explanation.	Assumptions made are irrelevant to the study, non intuitive and not explicitly discussed.	Assumptions are rational, and used in other relevant studies. Also, the assumptions are essential for the study and are justify by reasonable explanations.
Model specification	The specification is not familiar or poor or without explanation. The chosen specification is not in-line with the problem with regard to the type of data used.	The specification is familiar in relevant studies. The specification is in-line with the type of data used.	The validity of the functional form of the model specified is tested by the researcher. The specification is justified by reference to reliable and related sources. The specification excellently matches the type of the data used in the study.

Table 1. Continuous.

Quality dimensions	Score 1 criteria	Score 2 criteria	Score 3 criteria
Choice of variables	Many of the important variables are not included in the model specified. Proxy variable(s) are not good representation of the underlined factors.	Many of the important variables are included in the model specified. Proxy variable(s) if used are good representation of the underlined factors.	All important variables of interest are included in the model. Proxy variable(s) if used are significantly good representation of the underlined factors.
<i>Quality of Results</i>			
Statistical significance	Information on the estimates that capture statistical significance is not reported. Statistical significance of the results is not discussed.	Information on the estimates that capture statistical significance is reported, but the study failed to discuss the Statistical significance of the results	Information on the estimates that capture statistical significance is clearly reported. Statistical significance of the result is discussed.
Estimation bias	The study produces bias results.	Though the result is biased, but the direction of the effect is reliable.	The study's results are not biased.
Objectivity of the discussion	The study objectively discusses the results, but implications and inferences are made beyond the estimated results, or the discussion considerably exaggerates the results.	The discussion to some extent exaggerates the estimated results.	The study objectively discusses the results and implications as well as inferences are made base on the estimated results.

Source: Canadian Council on Learning (2006).

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