Examining progress towards universal health coverage in Sub-Saharan Africa

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Date	31th of July 2021, Rotterdam
Word count	7333

Summary

Background: The goal of Universal Health Coverage (UHC) is to provide everyone with needed healthcare and protect them from financial hardship. This goal is included in the sustainable development goals (SDG's) of 2030 set by the United Nations (UN) (Johnston, 2016). In literature, protection against financial hardship is measured with two indicators: catastrophic spending and impoverishment. This research aims to better understand how protection against financial hardship due to healthcare expenses can be achieved. This study concludes with an advice on which prepayment scheme is most sensible for Sub Saharan Africa (SSA) countries to implement to improve UHC.

Methods: This study measures the incidence of catastrophic out-of-pocket healthcare spending at the 10% threshold and the incidence of impoverishment under the $1.90 poverty line in the Sub-Saharan Africa (SSA) region. In total, eleven countries with at least three data points each were included. The data points were all measured between 1999-2016. The data for the financial protection indicators is derived from the Health Equity Financial Protection Indicators (HEFPI) database. In addition, the Global Health Expenditure Database (GHED) is used to obtain data for the independent variables. All variables used were natural logarithmic transformed. With this data, a panel dataset is created, which enabled to use fixed-effect analysis to estimate the effects of several health insurance schemes and income inequality on both indicators of financial protection.

Results: All countries have to some degree implemented government schemes and voluntary health insurance (VHI) to cover health care expenses. However, in most countries, the primary funding source for the healthcare sector is out-of-pocket spending (OOP). OOP spending has a positive effect of catastrophic expenditure but a negative effect on financial impoverishment. Both prepayment schemes reduce the incidence of both financial protection indicators. The most considerable estimated reduction was found for the effect of government schemes on financial impoverishment. A 10% increase in the proportion of healthcare costs covered by government-run prepayment schemes reduces the proportion of the population being impoverished by 11.5%. Furthermore, better income equality primarily correlates with protecting the population against catastrophic healthcare expenses and, to a lesser extent against impoverishment.

Conclusions: If countries want to move towards UHC, more government intervention is the best way to reduce the incidence of financial impoverishment. To reduce the incidence of catastrophic spending, countries could better minimize income inequality.

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Chapter 1: Introduction

Health financing is, along with service coverage, one of the cornerstones of a functioning healthcare system. The World Health Organization (WHO) captures the interaction between health financing and service coverage in the concept of Universal Health Coverage (UHC). The WHO's definition of UHC is: "ensuring that all people have access to needed health services of sufficient quality to be effective while also ensuring that these services do not expose the user to financial hardship" (World Health Organization, 2015). This definition entails three dimensions: the proportion of the population covered, the proportion of the population financially protected, and the proportion of interventions provided (figure 1). In this study, the focus is only on the financial dimension of UHC because the affordability of healthcare services is essential for a well-functioning healthcare sector. Policymakers are aware of the importance of financial protection since the introduction of UHC (World Bank, 1993). Still, 808 million people incurred catastrophic health spending (Wagstaff, Flores, Hsu, et al., 2018). Furthermore, every year 150 million people face financial hardship from healthcare expenditure. Another 100 million people are pushed below the poverty line when they fall ill (Xu et al., 2007).

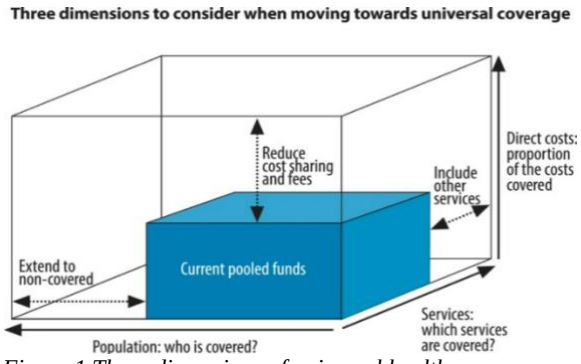

Figure 1 Three dimensions of universal health coverage. Source: WHO, 2021

In this study, catastrophic spending is defined as a household's Out Of Pocket (OOP) health expenses exceed a certain threshold. The event of a household being pushed below the poverty line due to healthcare expenses is called impoverishment.

The risk of impoverishment increases when people rely on OOP spending for health services, as is shown in multiple studies (Asian Development Bank, 2012; Salari et al., 2019a; Sirag & Mohamed Nor, 2021). To emphasize the importance of financial protection as part of UHC, the United Nations (UN) implemented it into the new sustainable development goals (SDG) for 2030. The SDG's comprise 17 goals, each representing a major development issue. SDG number three is dedicated to embody all sub-goals for good health and well-being. One of these subgoals, SDG 3.8.2, is destined solely for financial protection.

1.1 - The current status of Africa

As mentioned, 808 million worldwide incurred catastrophic healthcare expenditure. Seven hundred thirty-eight millions of these people live on three continents: Latin America, Asia, and Africa (figure 2). At least 10% of each of these continent's population spends more than 10% of their household income on healthcare services. However, as mentioned in two studies from Wagstaff et al., Africa is slower in terms of progress towards financial protection (2018; 2018). In Africa, between 2000 and 2010, the proportion of the population experiencing catastrophic expenditure grew by 2.7 per cent point, whereas Asia and Latin America showed rates of 2.4 and 1.4 per cent,

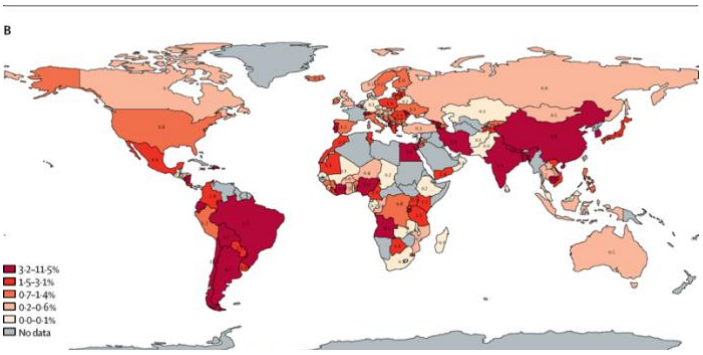

Figure 2 Incidence of catastrophic health spending at the 10%. Source Wagstaff, 2018

respectively. This growth implies that 48 million extra people are facing financial catastrophe due to healthcare expenditure.

1.2 - The need for financial protection

When people experience financial hardship due to the cost of healthcare services, they cannot spend money on other necessities such as food and education (Asante et al., 2020). That, consequently, can delay the progress towards other development goals, such as "quality education" and "zero hunger". Therefore, the relevance of financial risk protection as part of a well-working healthcare system comes from its role as a link to other dimensions of well-being (Saksena et al., 2014). Furthermore, in SSA countries, as much as 75% and on average 36% of the Current Health Expenditure (CHE) is paid for through OOP spending. Compared to the world average of 22%, it is clear that SSA can improve financial protection substantially. However, research already pointed out that reduced government health spending increased child, adult and maternal mortality, and a lower level of health spending from any type of insurance leads to a lower UHC score (Bokhari et al., 2006; Dieleman et al., 2018).

1.3 - The goal of this study

This study aims to answer which health financing scheme has the most considerable impact on progress towards financial protection. Furthermore, it is examined if a better distribution can prevent financial hardship due cost for healthcare services. Expected is that more OOP spending increases the incidence of financial catastrophe and impoverishment. Government schemes and voluntary health insurance, on the other hand, are expected to lower the incidence of both financial protection indicators. Moreover, a better distribution of income is anticipated to reduce the incidence of financial catastrophe and impoverishment due to healthcare spending. To answer those three sub-questions, three steps are taken. First, the trends for each indicator is plotted. Second, the correlation between the independent variables is tested. Third, with fixed-effect regression, the three health financing schemes' impact and income inequality are estimated. After discussing the results of the regressions, this research can conclude which prepayment scheme leads to the most progress in financial protection and if better income distribution can prevent financial hardship in SSA countries.

Chapter 2: Background

2.1 - Financial protection indicators

UHC embraces two main goals: financial protection and service coverage for everyone (Kawabata et al., 2002; World Health Organisation, 2004). Two indicators are frequently used for financial protection: catastrophic and impoverishing healthcare expenditure (Wagstaff, 2010). Both indicators will be used in this research.

2.1.1 - Catastrophic expenditure

The SDG 3.8.2 uses catastrophic spending 10% of the household income as an indicator for financial protection (Jussila, 2015). The incidence of catastrophic spending is calculated as follows. First, the total amount of healthcare expenses is deducted from the households prepayment income. If, as a consequence, these expenses exceed a certain predefined threshold, the household encounters financial catastrophe due to health expenses. In literature, two thresholds are widely used, namely 10% and 25% of a household budget. Because the 10% threshold is used in 41% of the studies on reducing catastrophic healthcare expenditure and the 10% is found to be a more appropriate threshold for low- and middle-

income countries (LMIC), regarding SSA countries, this study will use the 10% threshold (Wagstaff, Flores, Hsu, et al., 2018).

2.1.2 - Impoverishment

However, the drawback of using catastrophic expenditure as an indicator is that not only the countries' poor exceed the threshold. Therefore, catastrophic expenditure may give a misleading image of the effect of healthcare expenses on a household's financial situation. Therefore, a second widely used indicator in financial protection literature is used: impoverishment due to out-of-pocket spending (Wagstaff, Flores, Smitz, et al., 2018; Wagstaff & van Doorslaer, 2003). This is not an official SDG indicator but complements the catastrophic expenditure indicator by estimating how much the incidence of poverty is increased by households paying for healthcare out-of-pocket (Wagstaff, Flores, Smitz, et al., 2018). Therefore, this indicator can connect UHC to the first SDG goal; ending poverty in all forms. The concept of impoverishing expenditure is to visualize when a household's prepayment income is above a particular poverty line. Due to healthcare expenditure, the post-payment income is below the poverty. In SSA countries, a substantial part of the population is still struggling to live above the absolute poverty line, which lies at $1.90/day. Therefore, this will also be the poverty line used in this study.
To investigate how to make progress towards financial protection in SSA countries, it is essential to know what other studies have found on the effects of the independent variables used in this study.

2.2 - The role of OOP spending

OOP spending is defined as the direct payment for healthcare services by using the households income, borrow money, or sell assets. In half of the SSA countries, most health spending occurs out-of-pocket (McIntyre et al., 2018). In some countries, such as Nigeria, 70% of all health expenses are paid OOP. As OOP expenditure is the basis on which both financial protection indicators are calculated, reducing OOP spending is thought to improve financial protection. Therefore, the hypothesis is that OOP spending enhances the incidences of both financial protection indicators. Several studies already suggest that voluntary or social health insurance could reduce the amount of money paid directly to healthcare (Aryeetey et al., 2016a; Lu et al., 2010; Nnamuchi et al., 2019; Priyanka Saksena et al., 2011; Th Nguyen et al., 2011).

2.3 - The role of Government spending

In the Abuja declaration in 2001, governments in Africa committed themselves to spend at least 15% of their annual budget on health care services (Organisation of African Unity, 2001). However, in reality, the allocation of resources rarely exceeds 5% of GDP (Kaseje 2006:4). Even though the budget commitment is often not reached, one country in Africa has successfully implemented a national health insurance scheme (NHIS). Ghana implemented the NHIS in 2004 to improve financial protection and reduce the reliance on out-of-pocket payments. As Kusi et al. showed, implementing a government-run insurance scheme reduced the likelihood of catastrophic health expenditure by 4.2 times (2015). Apart from NHIS, removing user fees is another way for governments to reimburse healthcare costs. According to the WHO, eliminating user fees for some services already increased financial protection (WHO, 2010) (Witter et al., 2008). Examples of the effectiveness of this method are Côte d'Ivoire and Burkina Faso. In Burkina Faso and Côte d'Ivoire, the government reimbursed healthcare costs for children under 5. This reduced the incidence of catastrophic expenditure. Another advantage is that especially the poor are helped with this user fee exemption program (Konan et al., 2014; Mourtala et al., 2015). In light of what others have found, the

hypothesis is that a larger share of Current Healthcare Expenditure (CHE) paid by government schemes will improve financial protection and, more specifically, reduce impoverishment due to healthcare expenditure.

2.4 - The role of voluntary insurance

Voluntary health insurance (VHI) is, together with OOP spending, a way to privately pay for healthcare costs (Pettigrew & Mathauer, 2016). However, in the case of, VHI individuals or households protect themselves against sudden expenses through a prepayment scheme. Recent studies have shown that VHI lower OOP spending (Akazili et al., 2017; Erlangga Id et al., 2019). However, Pettigrew et al. also highlight that VHI can work regressively and is not favourable to UHC (2016). This is because VHI is often organized by companies and only affordable by the employees in the formal sector.
Consequently, this excludes the informal sector from the advantages of risk pooling. Apart from company-organized VHI, there are multiple other types of schemes. Those different types of schemes can, in general, be subdivided into two categories. VHI is provided by a large private health insurance agency or by a smaller community-based health insurance scheme (CBHI). The effect of CBHI is especially interesting because, in recent years, around 900 new schemes have been implemented in SSA (de Allegri et al., 2009). Although its popularity, the drawback of CHBI is that it has difficulties generating large risk pools. Although both types of schemes work differently, we use the indicator VHI for both for the sake of simplicity. The hypothesis is that a larger share of Current Healthcare Expenditure (CHE) paid by VHI primarily reduces catastrophic healthcare expenditure. And, to a lesser extent reduces the incidence of impoverishment.

2.5 - Income inequality

The goal of UHC is to make sure that everyone can use healthcare services without facing financial hardship. Therefore, it is essential to implement policies that contribute to achieve this goal. Typically, the first group facing financial hardship are the poor. This is because the wealthy have fewer assets to their exposal. Therefore, distribution is income more equally leads to less catastrophic healthcare expenditure, according to Wagstaff et al. (2018; 2018). They found a significant correlation between the Gini-index and the incidence of financial catastrophe due to healthcare expenditure. However, in another complementary study, Wagstaff et al. did not found a significance for the Gini-index on impoverishment (2018). This results in the following hypothesis: a lower Gini-index leads to less catastrophic healthcare expenditure.

Chapter 3: Research methods

In this chapter, first, the method for data collection will be explained. Second, the definitions per indicator are given. Then, at last, the theory for the statistical analysis is clarified.

3.1 - Data collection

For this study, the data from two databases are used: the Health Equity Financial Protection Indicators (HEFPI) database and the Global Health Expenditure Database (GHED). Both databases are publicly available on the World Bank and WHO websites.

3.1.1 - Dependent variables

The HEFPI database collects data for both financial protection indicators: catastrophic and impoverishing health expenditure and is based on 1846 surveys stretching multiple sources (World Bank, 2019). The dependent financial protection indicators used in this study are: the

proportion of the population spending >10% of the household budget on healthcare and the proportion of the population being pushed under the $1.90 poverty line due to healthcare expenses. The data clustered in the HEFPI database for the dependent variables originate from; Household Income and Expenditure Surveys (HIES) and Living Standards Measuring Studies (LSMS). These surveys are focused on obtaining data about income and consumption behaviour worldwide.

3.1.2 - Independent variables

The data from the GHED originates from two questionnaires: the Joint Health Accounts Questionnaire (JHAQ) and the Health Accounts Production Tool (HAPT). Both questionnaires are based on the International Classification for Health Accounts (ICHA) used in the System of Health Accounts (SHA) 2011 guideline ("A System of Health Accounts," 2011). All the surveys used to obtain data are conducted annually. The drawback of annual questionnaires is the risk of recall bias. For example, the last three months and the last 12 months are frequently used as recall periods. Those periods are probably too long to remember the costs for outpatient care and medicines (Wagstaff, 2010). Thirdly, the comprehensiveness of the surveys varies, which will lead to different estimates of OOP spending according to the survey used.

3.1.3 - Dataset assembly

The data of these databases are combined to assemble a database for eleven Sub-Saharan Africa (SSA)countries in a panel data format (appendix 1). The countries included in this study were selected based on the following criteria. Firstly, each country had to be in the (SSA) region geographically. Secondly, at least three observations had to be available for each country between 1999 and 2016 to create time trends.
Thirdly, of the three observations, one had to be in each of the following three time periods: 1999-2004, 2005-2010, 2011-2016 (Appendix 1). To analyse this data, the statistical program STATA version 16 was used.

3.2 - Indicators

First, the definition of both dependent is presented. Secondly, for each independent variable, the definition is explained.

3.2.1 - Definition of dependent indicators

Incidence of catastrophic health expenditure is defined as the proportion of the population whose health expenditure exceeds a percentage of a household's total consumption or income (Wagstaff, 2010). In line with the threshold of the SDG 3.8.2., this study uses 10% as a threshold for this indicator. Incidence of impoverishing health expenditure is defined as the proportion of the population whose gross income was above the poverty line. But, due to health expenses, the net income is below the poverty (Wagstaff, 2010). This study uses the $1.90 poverty line because all included countries were Low- and Middle-Income Countries (LMIC) (World Bank, 2021).
The catastrophic and impoverishing indicators rely on out-of-pocket spending (OOP). To calculate these two financial protection indicators, it is essential to define OOP spending. OOP spending includes payments at the point of use, cost-sharing and informal payments. On the other hand, it excludes payments by third-party payers.

3.2.2 - Definitions of independent indicators

The System of Health Accounts 2011 guideline defines the definitions for the independent variables. This guideline is established in a collaboration between the OECD, WHO and Eurostat. Except for the Gini coefficient, all independent variables are calculated as the share of current health expenditure (CHE).

- Household out-of-pocket spending as % of CHE:
  Households' out-of-pocket expenditure represents the amount of money a household has to pay for healthcare at the point of use. Crucial is that third-party payers are excluded. When loans, assets and savings are used to pay for healthcare at the point of use, it is still categorized as out-of-pocket spending ("A System of Health Accounts," 2011).

- Government schemes as % of CHE:
  The law of the country defines the characteristics of a government health financing scheme. Therefore, not all government schemes are entirely similar. Generally, the whole population or a specific group defined by law participates in this type of scheme. Fundraising can occur directly by requesting a mandatory fee or indirectly by earmarking taxes for the healthcare sector. In LMIC, foreign donor revenues may also contribute to government schemes. The most significant advantage of government schemes is their ability to create a large risk pool for their users. This potentially divides the cost of illness over all citizens included in the government scheme and, therefore, keeping healthcare services affordable ("A System of Health Accounts," 2011).

- Voluntary insurance scheme as % of CHE:
  In contrast to government schemes, VHI schemes have to be purchased, but this acquisition is not made compulsory by the government. Although the state can subsidize them, the insurance scheme usually is purchased from a (for-profit or non-profit) firm. The height of the premium depends on multiple factors, such as risk group, income, or size of the community. A unique form of VHI rising in popularity in SSA countries is community-based health insurance (CBHI). These schemes allow for the creation of small scale insurances for regions or towns. However, the result is that those schemes often face difficulties to attract enough enrolees for sufficient risk-pooling ("A System of Health Accounts," 2011).
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- Gini-index
  The Gini-index is a measure of the distribution of income across the population. It ranges from 0 (0%) to 1 (100%). At 0, the distribution of income is completely equal for each member of the population. At 1, there is complete inequality, and just one citizen earns all the country's income (Organisation International Labour, 2002). The Gini coefficient in the European Union (EU) is 0.31, compared to 0.43 in Sub-Saharan Africa (Statista, 2021).

3.3 - Statistical analysis

The statistical analysis in this study is conducted in five steps. First, the way the independent variables were chosen will be described. Second, in the statistical program STATA version 16, a panel dataset was created. Third, the correlation between the independent variables is tested. Fourth, the Hausman test was executed to determine if random- or fixed-effects was

the preferred regression model for the available data. Fifth, the coefficients for the effect of the independent variables on the financial protection indicators were estimated.

3.3.1 - Choice of independent variables

To choose the independent variables, graphs were computed for both the dependent and independent variables, illustrating the change of these variables over time in each country. In some countries, the trend of one of the independent variables is similar to or contradicts the trend of the dependent variables. This suggests that there might be some correlation between this particular dependent and independent variable. Furthermore, the articles of Wagstaff et al. and Pettigrew et al. were used to indicate which independent variables could be causative with the dependent variables (2016; 2018; 2018).

3.3.2 - Creation of a panel dataset

In the statistical program STATA version 16, panel data were created. In addition, dummy variables were created for i-1 countries and t-1 time period. The Gambia was chosen as the baseline country because it was the best-performing country on both the catastrophic and impoverishing health expenditure indicators if looked at the latest available data. The other countries, Burkina Faso, Côte d'Ivoire, Cameroon, Guinea, Mali, Mozambique, Nigeria, Senegal, Tanzania, Uganda, were included in the regression as country dummy variables. In addition, T1 (1999-2004) was used as baseline time-period, and T2 (2005-2010) and T3 (2011-2016) were included as time dummy variables. In total, the combination of three time-points and eleven countries resulted in a dataset with 33 observations. This small amount of data could reduce the power of the regression and, therefore the reliability of the estimated coefficients (Burmeister & Aitken, 2012). For this regression, the natural logarithmic values for the dependent and independent indicators were used. When both the dependent and independent variables are natural logarithmic transformed (ln), the coefficients can be interpreted as elasticities.

3.3.3 - Spearman's correlation test

Spearman's correlation test was performed for the chosen independent variables to quantify the correlation between variables. Using strongly correlating independent variables could lead to multicollinearity. If multicollinearity is present, the coefficient of the correlated coefficients cannot be precisely estimated.

3.3.4 - Hausman test

The Hausman test was conducted to determine if a fixed-effects model truly is more appropriate for estimating the effects of the independent variables on the financial protection indicators within countries. A significant result for the Hausman test pleads for using a fixed-effects model. A chi2 value of - 33.63 with four degrees of freedom resulted in a significant outcome for the Hausman test. Therefore, this study used fixed effects regression.

3.3.5 - Fixed effect regression

Fixed effects control for time and country invariant unobservable heterogeneity. In this study that is done by including dummies variables for the time periods and the countries. Each country has its coefficients for the country characteristics and the influence per time period on the dependent variable. Calculating the coefficient for the country characteristics and the influence of the time periods allow us to control for much of the potential omitted variable bias. Omitted variable bias means that an unobserved characteristic may affect an independent variable x and the dependent variable y simultaneously (Torres-Reyna, 2007). By controlling for this potential bias, fixed effects regression leads to a better estimation of the effect of the independent variables on the financial protection indicators (Wheelan, 2014).

However, fixed effects cannot control for unobserved time-variant heterogeneity within a specific country. Meaning that the situation in a country has changed within the observed study period (Collischon & Eberl, 2020). An example of this, is a financial crisis solely effecting a single country.
Furthermore, there is a possibility that the data is heteroskedastic. In that case, the error term distribution (u_{it}) is not constant and spreads when the value for x increases. In other words, the variance of the error term is dependent on the value of x. To adjust for this, a robustness check is implemented.
At last, when interpreting the results, it is essential to consider that fixed effects regression can indicate a partial correlation, not a causal effect, between the independent and dependent variables.

$$ln(y_{it}) = \beta 0 + \beta 1\ ln\left(\frac{OOP}{CHE}\right) + \beta 2\ ln\left(\frac{GS}{CHE}\right) + \beta 3\ ln\left(\frac{VHI}{CHE}\right) + \beta 4 ln(gini) + \gamma_i Country_i + \delta_t Time_t + u_{it}$$

- y represents the dependent variable's
- β is the coefficient for the corresponding independent variables
- $\frac{OOP}{CHE}$, $\frac{GS}{CHE}$, $\frac{VHI}{CHE}$ and Gini-index is the independent variable
- u is the error term.
- i represent the country id
- t represents the time id
- γ represents the coefficient for i-1 country dummies
- δ represent coefficients for the t-1 time dummies

Chapter 4: Results

The results will be presented in the following order. Firstly, a visual inspection of the graphs for the dependent and independent variables will take place. Secondly, the correlation between the independent variables will be presented. At last, the coefficients of the regression analysis will be explained.

4.1 - Trends of variables

In figure 3, the trends for the dependent and independent variables over a period of seventeen years are presented. Each country has its own trend per variable. For the dependent variables, a downward sloping line is preferred. This indicates improvement in that financial protection indicator. Although only three data points were available for each dependent variable, there is a trend visible for some countries. Cote d'Ivoire is the only country performing better for both dependent variables. When solely focusing on the trends for catastrophic payments, it is clear that Burkina Faso and The Gambia made some progress. The Gambia already had the lowest catastrophic payment levels of all included countries.
When looking at the share of the population being impoverished by healthcare expenses, again, the Gambia improved over time, almost eliminating impoverishment due to health expenditure. All other countries did not show a clear trend over time. Per independent variable, the most striking changes will be discussed below.

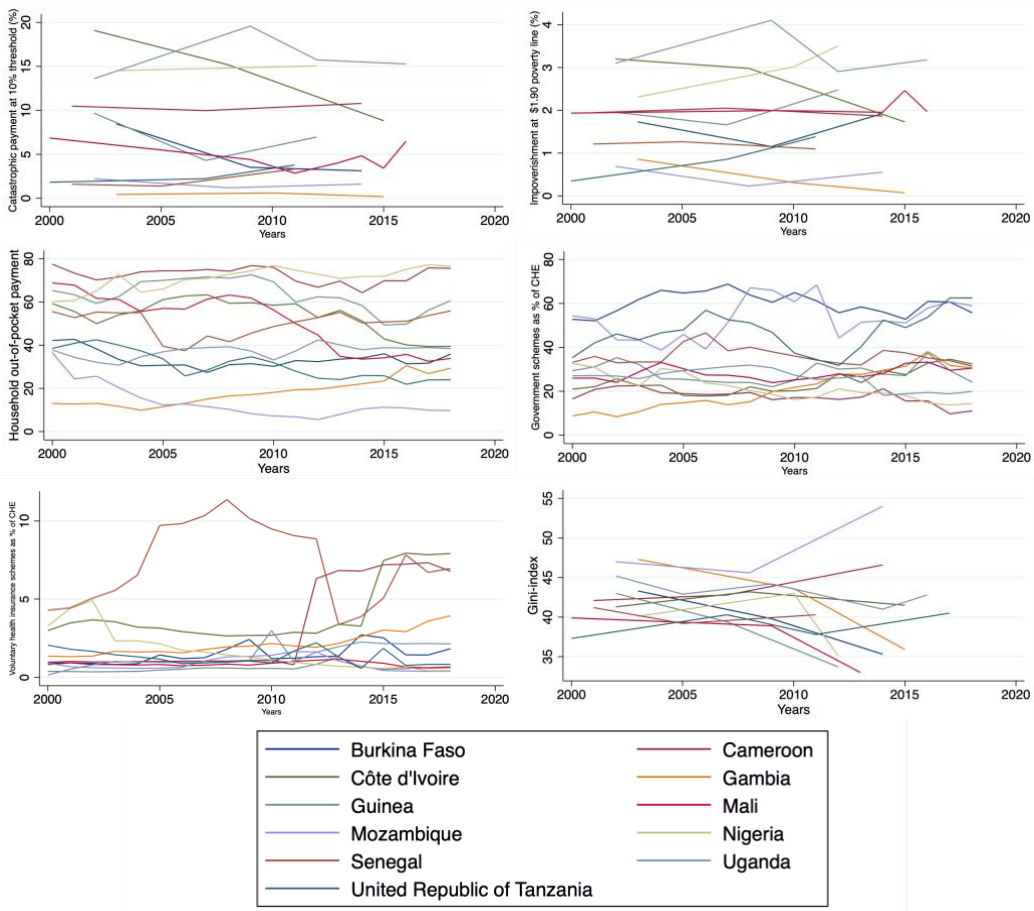

Figure 3: Graphs representing the trends of the dependent and independent variables.

4.1.1 - Household out-of-pocket spending

When looking at household out-of-pocket spending changes, four countries present a clear trend. First, Mali decreases out-of-pocket spending from approximately 70% to 35%. Second, Côte d'Ivoire shows a similar trend, lowering OOP spending from 60% to 40%, and Mozambique lowered OOP expenditures from 38% to 10%. Despite this good progress in those three countries, one country, however, showed an opposite trend. Nigeria increased OOP spending quite dramatically from 60% to 78%.

4.1.2 - Government schemes

In some countries, the proportion of current health expenditure covert by government schemes has grown over 17 years. For example, in Tanzania in 2000, 38% of current health expenditure was covert by government schemes. This proportion has been rising to 60%. Côte d'Ivoire and the Gambia showed rising trends for government schemes as well, growing from 20% to 35% and 10% to 30%, respectively. Nigeria showed a substantial drop in the presence of government schemes, decreasing from 35% to 15%.

4.1.3 - Voluntary insurance schemes

The share of VHI on current health expenditure is far less substantial than household out-of-pocket expenses or government schemes. However, in three countries, the share of VHI has grown considerably. These countries are Côte d'Ivoire (3% to 8%), Gambia (1% to 4%) and Cameroon (1% to 6%).

4.1.4 - Gini-index

In respect to the other independent variables, less data is available for the Gini-index. To be more precise, three data points for each country could be obtained. However, these data points were corresponding with the available data for the dependent variables. Therefore the Gini-index could still be used in the regression. However, due to the low amount of available data for each country, only a non-fluent trend could be plotted. When aware of this drawback, it can be seen that five countries have improved and two countries worsened.

Table 1: variation in Gini-index between the first and last measurement

	First data point	Last data point
The Gambia	47.3	35.9
Burkina Faso	43.3	35.3
Guinea	43	33.7
Nigeria	40.1	35.1
Mali	39.9	33
Mozambique	47	54
Cameroon	42.1	46.6

4.2 - Spearman's correlation test

This study subsequently looked at the correlation between each independent variable using Spearman's correlation test (table1). As little correlation as possible is preferred (close to zero). In this case, only the government and OOP spending are significantly correlated. This might be because, in most countries, the sum of the shares for OOP spending and government schemes account for almost all the current healthcare spending. However, it cannot be stated that the share of government schemes and voluntary insurance combined is the substitute of the share of OOP. Because, in some countries included in this study, direct foreign contributions represent 75% of current health expenditure. Due to the lack of data for direct foreign contributions for multiple countries, this indicator still could not be included.

*Table 2: Spearman's correlation test. P-values are denoted with *. *p<.05.*

Variables	(1)	(2)	(3)	(4)
(1) ln_OOP	1.000			
(2) ln_GOV	-0.545*	1.000		
(3) ln_vol	-0.007	-0.058	1.000	
(4) ln_gini	-0.253	-0.095	-0.147	1.000

Spearman rho = -0.147

4.3 - Results fixed-effects analyses

The results of the fixed effect analyses are presented in table 3. In the table, both the results for the catastrophic and impoverishing spending indicators are shown. The table can be split into two sections. Firstly, the coefficients of the independent variables are presented. Secondly, the effects of the time periods and countries are shown. The first period (1999-2004) is used as the reference period and The Gambia as reference country. All variables are natural log-transformed; therefore, the coefficients can be interpreted as elasticities.

*Table 3: all variables are ln transformed to be able to interpret the coefficients as elasticities. Standard deviations are in parentheses. P values are denoted with *: *p<.1, **p<.05, ***p<0.01. The number of observations for every variable is 33.*

VARIABLES	(1) Catastrophic spending 10% (ln)	(2) Impoverishment $1.90 (ln)
Out-of-pocket spending (ln)	0.235	-0.510
	(0.278)	(0.420)
Government schemes (ln)	-0.0856	-1.155**
	(0.331)	(0.416)
Voluntary health insurance (ln)	-0.208*	-0.363**
	(0.0999)	(0.164)
Gini-coefficient (ln)	1.987**	0.849
	(0.920)	(1.075)
T2 (2005-2010)	-0.118	0.0160
	(0.144)	(0.162)
T3 (2011-2016)	0.133	0.162
	(0.206)	(0.238)
Burkina Faso	2.522***	3.370***
	(0.726)	(0.767)
Côte d'Ivoire	3.502***	3.330***
	(0.655)	(0.682)
Cameroon	2.887***	2.676***
	(0.638)	(0.752)
Guinea	2.488***	2.750***
	(0.722)	(0.830)
Mali	2.427***	2.688***
	(0.608)	(0.691)
Mozambique	1.110*	1.098
	(0.621)	(0.808)
Nigeria	3.361***	3.015***
	(0.639)	(0.787)
Senegal	1.803**	3.243***
	(0.718)	(0.747)
Tanzania	1.910***	2.094**
	(0.650)	(0.724)
Uganda	3.422***	2.953***
	(0.548)	(0.575)
Constant	-8.665**	0.606
	(3.828)	(4.514)
Observations	33	33
R-squared	0.954	0.904

In case of OOP spending, positive coefficients are expected. In theory, a rise in direct out-of-pocket expenditure would result in more catastrophic and impoverishing spending(Xu et al., 2007). However, the effect of OOP expenditure is statistically irrelevant because the standard error (presented in parentheses) is of a similar size as the coefficients. If the coefficient were significant, the effect of OOP spending on impoverishment would be that a 1% rise of OOP spending would lower the share of the impoverished population by 0.51%. For catastrophic expenditures, the expected effect for the coefficient is presented. 1% higher OOP spending would result in 0.235% more people facing catastrophic healthcare costs at the 10% level.

When looking at the coefficients of government schemes on catastrophic health expenditure, it can be noticed that the standard error is 3.9 times greater than the coefficient. Therefore, no meaningful conclusions can be drawn for the effect of government spending on catastrophic expenditure. However, if the estimation were significant, a 1% increase in the share of government schemes would lead to a 0.086% reduction of catastrophic spending. Thus, the effect of increasing the percentage of government schemes to pay for healthcare expenses is very modest. The estimation for the impact of government schemes on impoverishment is more promising.

Furthermore, the elasticity of government schemes on impoverishment is 1.155. This can be interpreted as each per cent increase in expenditure on health care through government schemes at the expense of other schemes will reduce impoverishment by 1.155%. Together with a standard error of 0.416, this coefficient is significant at the 5% level. Thus, if a country wants to reduce impoverishment, it is effective to increase healthcare expenditure covered by government schemes.

VHI is the only independent variable that provides significant results for both indicators of financial protection. Although, the coefficient for catastrophic spending is only significant at the 10% level. Furthermore, both indicators show a negative coefficient, implying that more VHI leads better financial protection. The effect of VHI on catastrophic spending is even larger than effect government schemes, -0.208 and -0.086, respectively. Thus, an increase of the share of VHI would offer 2.4 times better protection against catastrophic spending compared to government schemes. However, Mathauer et al., commissioned by the WHO, pleads against the further implementation of VHI as a prepayment scheme to improve UHC (2018). The main reason for this is that primarily the better of can afford VHI. Secondly, a more substantial presence of VHI could hamper the implementation of compulsory government schemes that can offer protection for the whole population.

When interpreting the coefficients of the Gini-index, a positive coefficient is preferred. The reason for this is that a higher Gini index means that there is more income inequality. Alvarez & El-Sayed found that the Gini-index was positively correlated with increased borrowing behaviour and selling of assets to pay for healthcare services (Alvarez & El-Sayed, 2017). Furthermore, they found that a higher Gini-index was positively correlated with ineffective insurance schemes. In their conclusion, Alvarez & El-Sayed proposed that better distribution of income would increase the uptake and effectiveness of health insurance schemes and, as a consequence, improve the health of the population (Alvarez & El-Sayed, 2017). As expected, the coefficient indicating the effect of the Gini-index on catastrophic spending is positive and significant. If the Gini-index is reduced by 1%, as a consequence, the proportion of the population facing catastrophic health expenditure reduces by 1.987%. The effect of the Gini-index on the share of the population facing impoverishment is less dramatic (0.849); however, this coefficient is not statistically significant. Thus, better income distribution primarily reduces the incidence of catastrophic healthcare expenses, and to a lesser extent, prevents impoverishment due to healthcare spending.

At last, the coefficients generated for the time and country dummies are presented. The first thing that can be noticed is that the estimations for the two time period dummies are all insignificant. Furthermore, because the best-performing country (The Gambia) is chosen as the reference country, it is expected that all coefficients for the country-dummies are positive. A positive would mean that that country is performing worse on the financial protection indicators. Compared to The Gambia, Côte d'Ivoire the is worst performing country on both financial protection indicators. To a lesser extent, almost all other countries perform significantly worse than The Gambia on both financial protection indicators. However, only the coefficient for the effect of being in Mozambique is non-significant for the impoverishment indicator. This is probably attributed to the slight difference between The Gambia and Mozambique over time.

Chapter 5: Discussion and conclusion

5.1 – Discussion

The main finding of this research is that government schemes appear to be more effective to reduce impoverishment. Furthermore, better income equality suggests to be more effective to reduce catastrophic healthcare expenses.

The result for the influence of government schemes on impoverishing healthcare expenses is in line with the published literature (Aryeetey et al., 2016b; P. Saksena et al., 2006; Th Nguyen et al., 2011). They investigated the influence of a National Health Insurance Scheme (NHIS) in Ghana and Kenya. Both Aryeetey et al. and Th Nguyen et al. found that these NHIS's significantly reduced the incidence of poverty due to health expenditure (2016b; 2011). In this research, the estimated elasticity showed (-1.155) matched with the conclusion of those studies. Therefore, this study was as well able to conclude that governments schemes protected against impoverishing healthcare expenditure.

In contrast, government schemes do not significantly influence the incidence of catastrophic expenditure according to the estimated coefficient (-0.08). This outcome is not in line with the results from Saksena et al. (2006). They found that the NHIS in Kenya reduced catastrophic health expenditure significantly. Côte d'Ivoire and Burkina Faso are two countries that implemented a government scheme in the form of a user fee exclusion program (Konan et al., 2014; Mourtala et al., 2015). These programs are used to ensure accessible healthcare service for children under five years of age and are according to Konan et al. reducing poverty (2014). Other countries included in this study have not implemented government-run prepayment schemes and did not show meaningful improvements in financial protection against healthcare expenses.

Furthermore, the estimated influence of the Gini-index on the proportion of the population facing catastrophic healthcare expenditure was in line with the presented results from Wagstaff et al. (2018). A reduction of the Gini-index by one per cent is estimated to reduce catastrophic healthcare expenditure by 1.987 per cent. Therefore, according to the presented results, better income equality is the most effective way to reduce catastrophic healthcare expenditure. Furthermore, although not significant, the effect of income inequality on impoverishing is still worth mentioning. Apart from the impact of government schemes, the Gini-index had the second largest effect on impoverishing health expenditure.

Another interesting result for the regression is the effect of OOP expenditure on the financial protection indicators. According to the estimated coefficients, more OOP spending would reduce the incidence of impoverishment, which could be interpreted as if primarily the more prosperous part of the population uses OOP spending to pay for healthcare services. These results are not in line with Salari's (2019b) results, which indicate that primarily the poor are negatively affected by OOP expenditure. On the other hand, the incidence of financial catastrophe is still positively affected by OOP spending. This estimation aligns with what others have found (Akazili et al., 2017; Xu et al., 2007). In other words, according to the regressed coefficients in this study, OOP spending might result in less impoverished citizens but simultaneously pushes an increasingly large share of the population in a position in which they have to pay a catastrophic amount of money for healthcare services. Placing citizens in a situation where they face financial hardship is not one of the values UHC tries to accomplish.

In case of VHI, the results align with the expectations based on literature by Bonfrer et al. (2018). They found that a heavily subsidized VHI scheme reduced reliance on OOP expenditure as a form to pay for healthcare services. In this study, a 10 % increase of VHI as

a proportion of CHE reduced financial catastrophe and impoverishment due to health expenditure by 2.1% and 3.6%, respectively. However, Mathauer and Kutzin wrote a policy recommendation for the WHO, in which they advised against further implementation of VHI schemes (2018). There are three main reasons for this. First, the uptake of VHI is primarily present among the wealthier part of the population (Preker et al., 2006). This segregation of the population able to afford the benefits of prepayment schemes and leads to unequal access to healthcare services.
Second, if doctors get higher if they help insured patients instead of uninsured, this could lead to longer waiting times or higher informal payment to access healthcare for the uninsured.
Third, higher uptake of VHI could hamper implementing a social health insurance scheme accessible for everyone. The reason is that people enrolled in VHI schemes that cover sufficient medical services will not additionally enrol in another insurance scheme. This reduces the potential size of the risk pool for a social health insurance scheme (Mathauer & Kutzin, 2018).

5.2 - Limitations

This study has some limitations. Firstly, the dataset for the financial protection indicators was limited. In total, just 33 observations were available. This limited the power of the regression. Preferably, data for both financial protection indicators are every year collected in all SSA countries. However, this will be challenging because producing household surveys is a time-consuming process. Secondly, the data for the independent variable indicators came from various surveys. Therefore, one cannot guarantee that the heterogeneity of these surveys is absent. Thirdly, this study only focuses on one dimension of UHC and does not provide a link between financial protection and service coverage. Therefore, it could be possible that some countries focused on providing more service rather than financial protection. Finally, this study only focussed on 11 SSA countries, although the SSA region consists of 46 countries. However, these 35 countries had to be excluded due to a lack of data for the dependent indicators.

5.3 - Conclusion

After discussing the results and comparing them to what others have found, this study can draw multiple conclusions. First, it could be concluded that increasing the share of government schemes to finance the total amount of healthcare expenditure is more effective than VHI in reducing the incidence of impoverishment. However, voluntary health insurance, on the other hand, is more effective in reducing the incidence of catastrophic expenditure. Nevertheless, supported with the recommendations by Mathauer and Kutzin, it is advisable for countries to implement government schemes, rather than a VHI scheme to improve financial protection.
Although it is more effective in reducing impoverishment, implementing a government scheme will be a challenge for most SSA countries. To do so, governments have to raise sufficient funds to cover all the services that are offered. In general, funds are raised by collecting taxes. However, due to a substantial informal sector in SSA countries, this will be difficult.
Second, improving income equality reduces the incidence of catastrophic healthcare expenditure. A suggestion for improving income equality is to implement a progressive taxation scheme. Additionally, such a progressive taxation scheme could be able to generate revenue to finance the government-run healthcare scheme. In that way, a progressive taxation scheme could form a solution for reducing the incidence of both indicators of financial protection, contributing to progress towards UHC.

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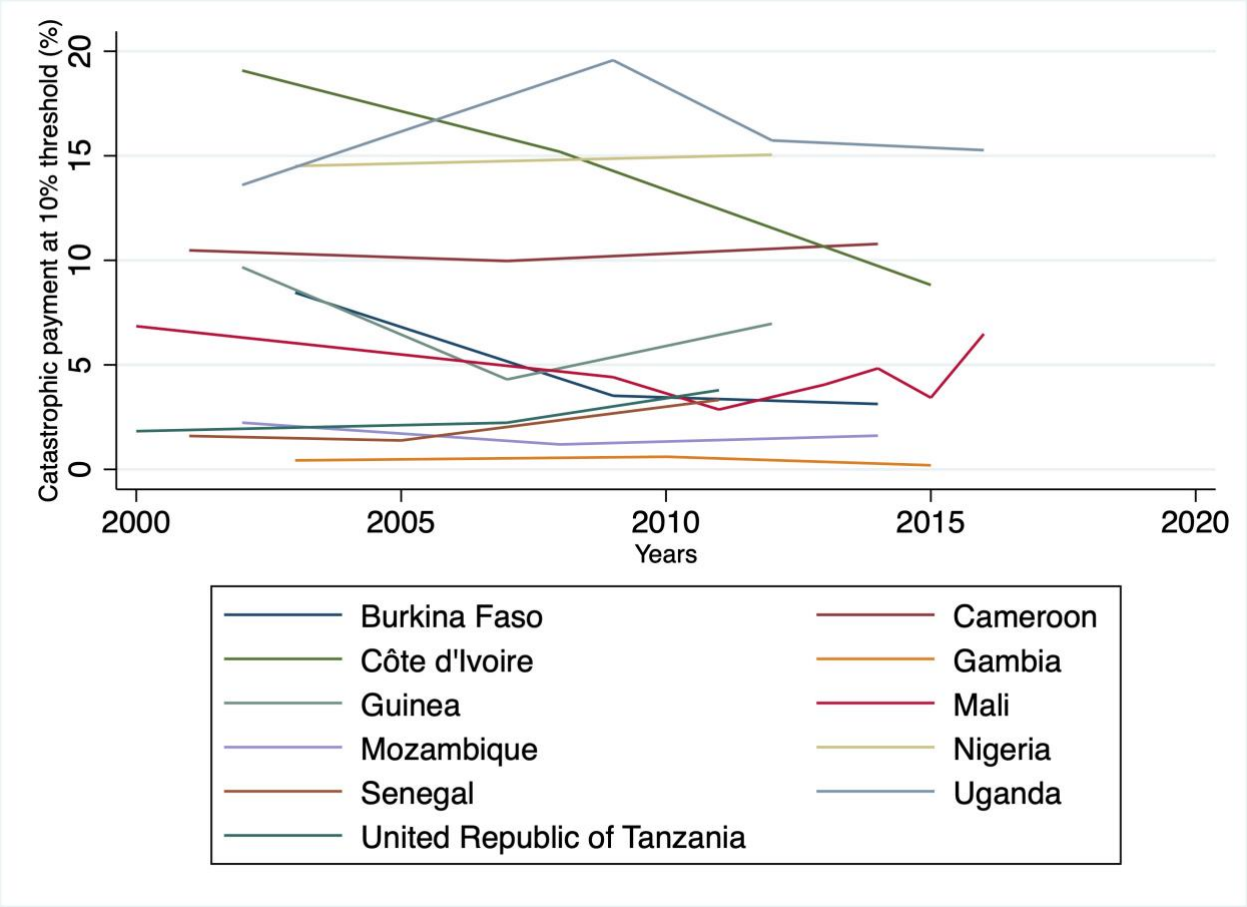
Appendices

Appendix 1

Table 4: Included countries and corresponding years with available data

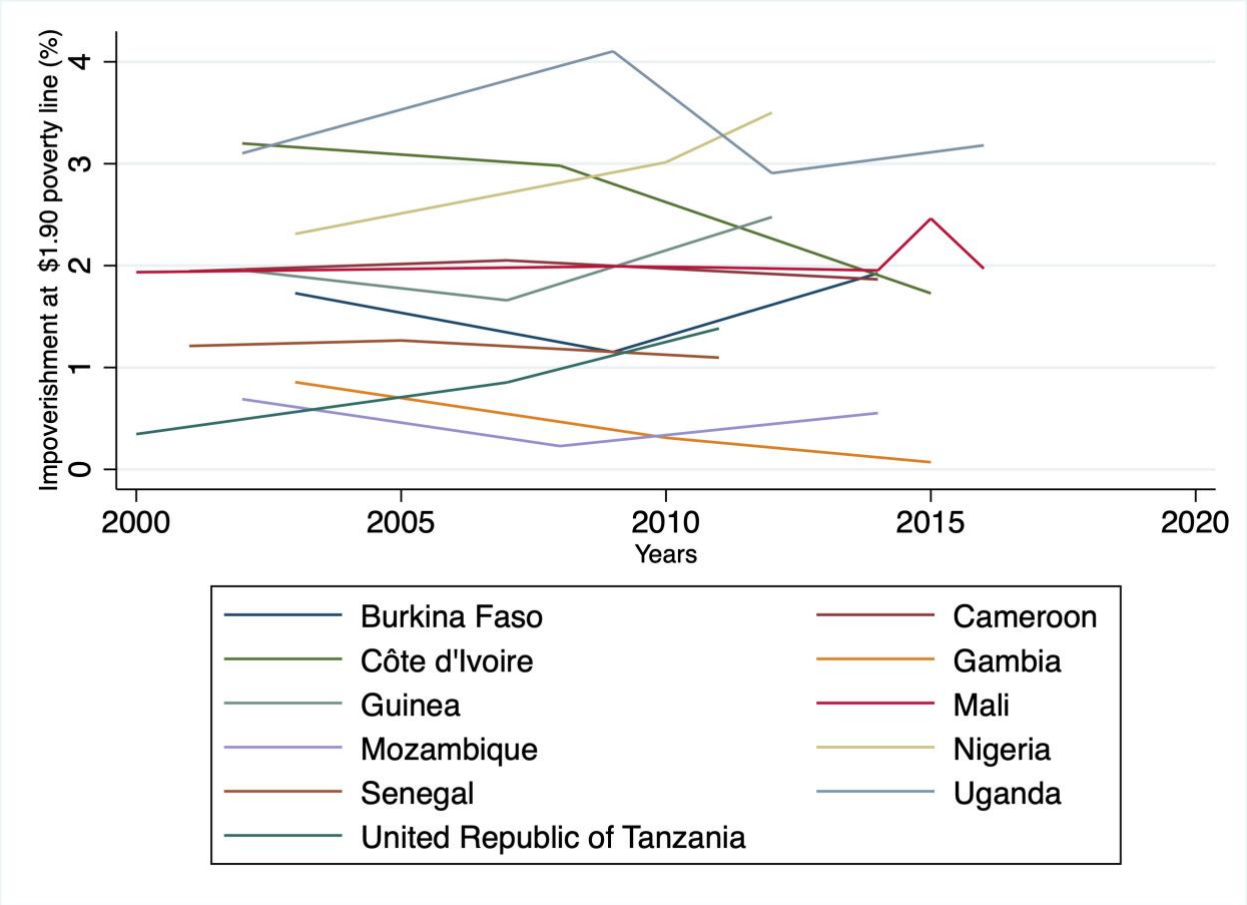
Country	Indicators	
	Catastrophic expenditure (10%)	Impoverishing expenditure ($1.90)
Burkino Faso	2003, 2009, 2014	2003, 2009, 2014
Cameroon	2001, 2007, 2014	1996, 2001, 2007, 2014
Cote d'Ivoire	2002, 2008, 2015	1998, 2002, 2008, 2015
The Gambia	2003, 2010, 2015	2003, 2010, 2015
Guinea	2002, 2007, 2012	2002, 2007, 2012
Mali	2000, 2009, 2011, 2013, 2014, 2015, 2016	2000, 2009, 2011, 2013, 2014, 2015, 2016
Mozambique	2002, 2008, 2014	2002, 2008, 2014
Nigeria	2003, 2010, 2012	2003, 2010, 2012
Senegal	2001, 2005, 2011	2001, 2005, 2011
Tanzania	2000, 2007, 2011	2000, 2007, 2011
Uganda	2002, 2009, 2012, 2016	2002, 2009, 2012, 2016

Appendix 2



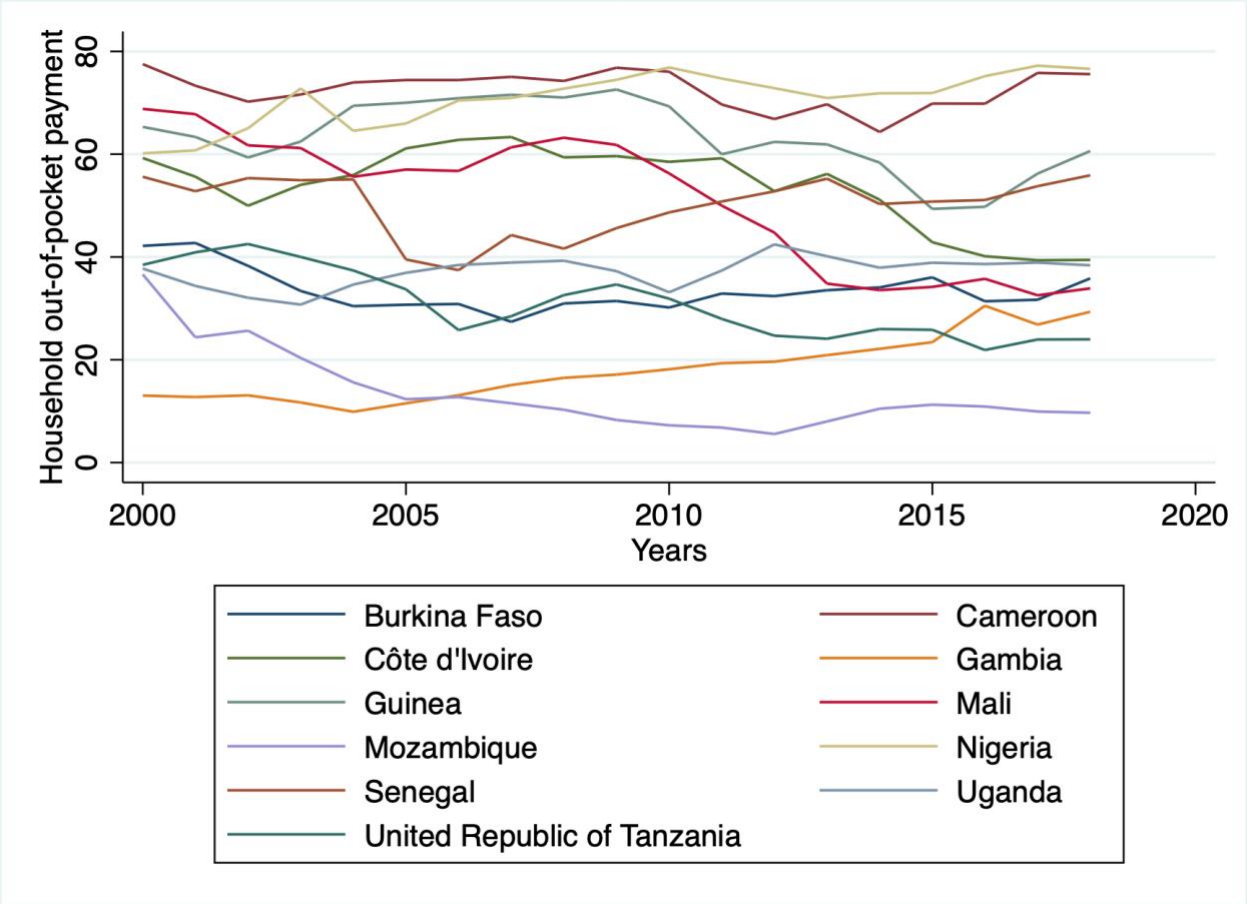
Graph 2: Catastrophic payment at 10% threshold as % of population

Appendix 3



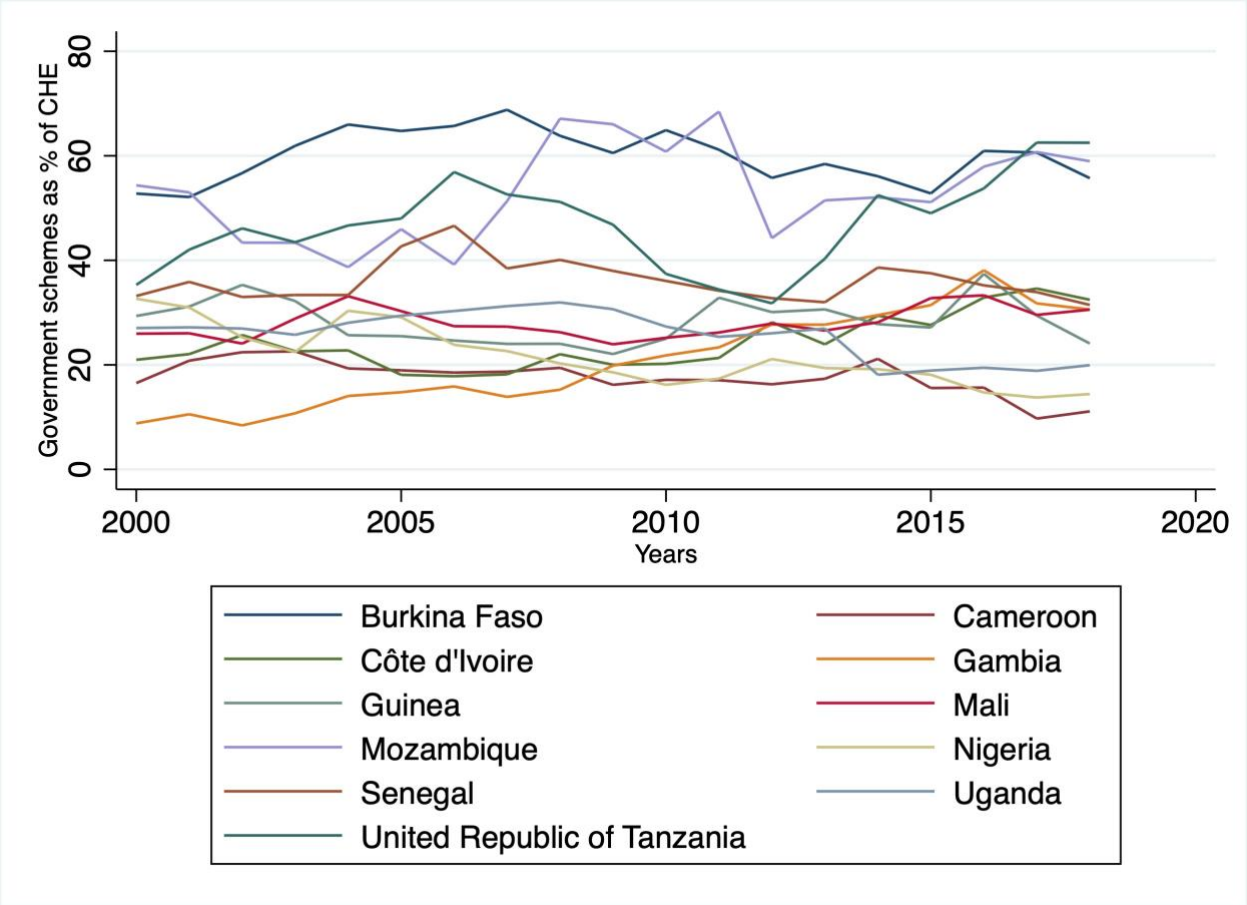
Graph 3: Impoverishment at $1.90 poverty line as % of population

Appendix 4



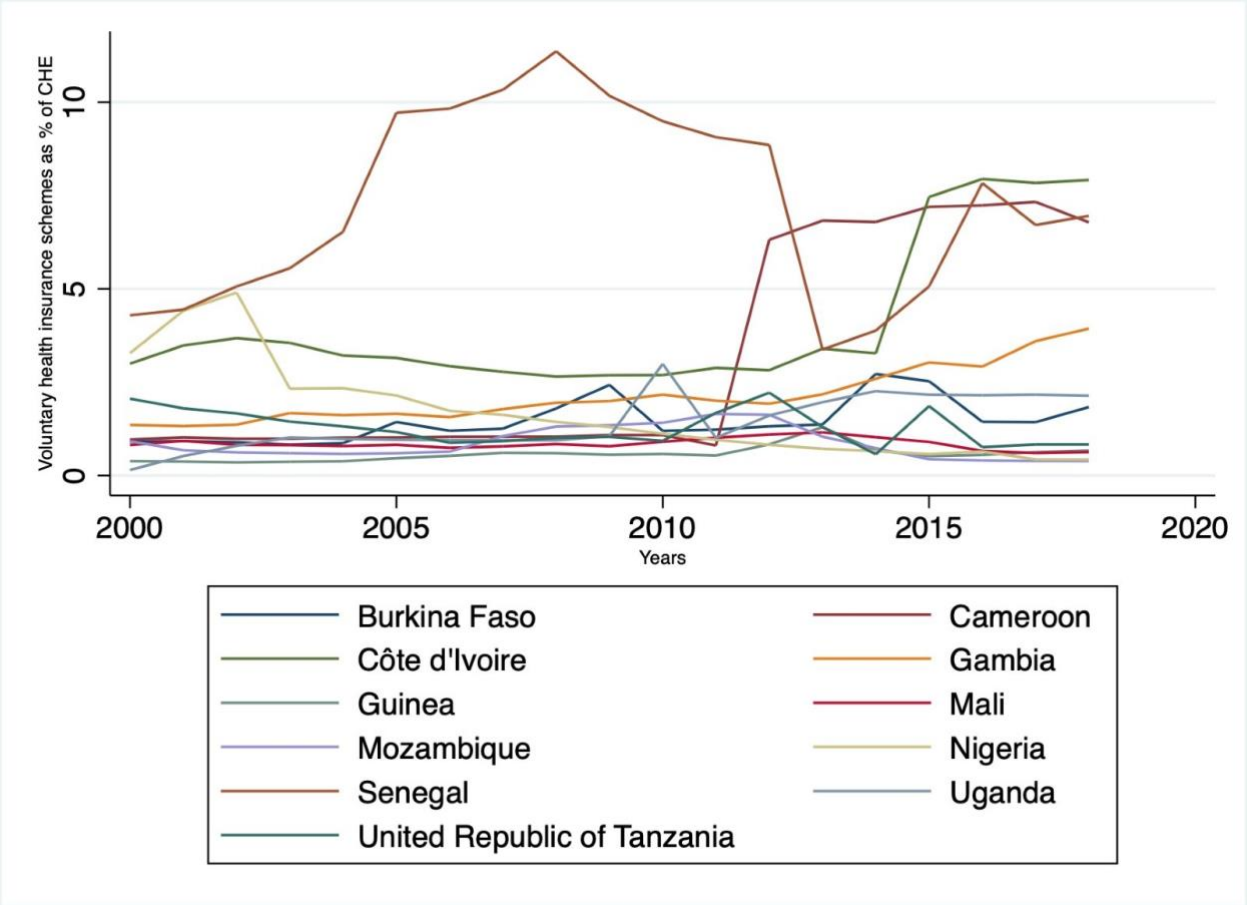
Graph 4: Household out-of-pocket payment as % of CHE

Appendix 5



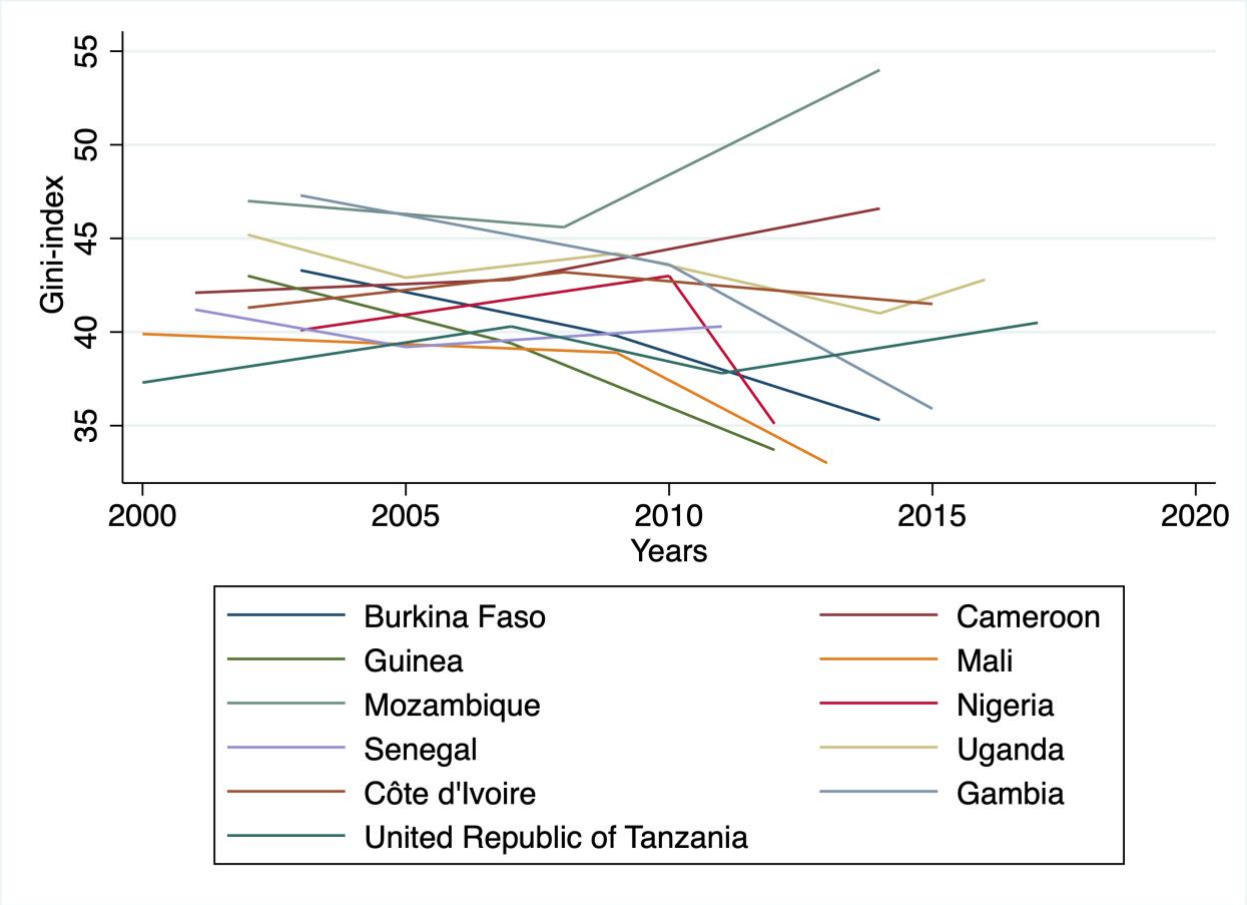
Graph 5: Government schemes as % of CHE

Appendix 6



Graph 6: Voluntary health insurance as % of CHE

Appendix 7



Graph 7: Gini-index as estimated by the World Bank