Political economy of health in the Southern African Development Community (SADC) region: The effect of political instability on health outcomes and expenditure.

By

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Submitted for the degree of Master of Commerce in Economics

(By dissertation only)

In the

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Acknowledgements

Firstly, I would like to thank my supervisor Dr. Djiby Thiam for his support and patience during the course of this work. I also would like to thank the committee that approved the research proposal for this work (Professor Anthony Black and Associate Professors Tony Leiman and Eftychia Nikolaidou). I am grateful for the questions raised, suggestions made and the insights provided during my defense. This dissertation would not have been possible without the unwavering financial and emotional support of my mother Mrs J. Gombe who would drive 300km to come and babysit if I needed to work. To my sisters who kept egging me on: Ruvimbo Tagwira, Tatenda Shoko, Emma Proctor, Jessicah Zulu-Shawa, Flora Kurasha, Ida Achiume-Shiaka, Chipo Hamukoma, Carol Dayo Obure, Munyaradzi Mataruse-Matsaira and Nolwazi Ncube.

This dissertation is dedicated to my daughter, Amari Ruvarashe Gombe. May this work inspire you to always reach for what you want in life and not let any adversities get in your way. You kept me going every day because I do not want to teach you to give up. Thank you for being patient with me when I needed to study and could not play with you. I love you.

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Abstract

This dissertation studies the effect of political stability on health outcomes and expenditure in the SADC region. The health outcomes under investigation are life expectancy at birth, maternal mortality ratio, infant mortality rate and HIV incidence. Health expenditure is captured as the percentage of total government expenditure that is allocated to public health. The study conducts a literature review on previous studies that examine these relationships, conduct exploratory data analysis and conduct empirical estimations using two measures of political stability: International Country Risk Guide's Political Risk Services index and the World Bank's World Development Indicator index. Additionally, further investigation is made into the effect that a country's level of democracy has on health outcomes and public health expenditure. The empirical estimations involve a panel dataset containing 11 SADC countries over a 20 year period from 1996 to 2015. The results confirm the statistical and economic significance of political stability on all the health outcomes under investigation and on public health expenditure when controlling for heteroscedasticity and autocorrelation.

Holding all else constant, a one point increase in the political stability variable is associated with an increase of 0.19% for life expectancy, a decrease of 1.39% in maternal mortality, a decrease of 2.01% in infant mortality, an increase in HIV incidence of 3.48% and an increase in public health expenditure of 2.03%, when using the International Country Risk Guide's Political Risk Services index (ICRG). Political instability in the SADC region is characterized by destruction of social infrastructure including hospitals and roads in Angola and the Democratic Republic of Congo and lack of resources for adequate healthcare in countries such as Zimbabwe, Zambia and Malawi. Both mechanisms result in poor health outcomes in a given country in the region. Subsequently, countries like South Africa receiving refugees from politically unstable countries in the region also suffer from an overload on their health system which means resources allocated to the health sector are no longer adequate to meet the increased demand. When using the World Bank's World Development Indicators (WB), holding all else constant, infant mortality decreases by 0.27% and HIV incidence increases by 0.40% when political stability increases by one point. The policy recommendation is to ensure strategic governance is in place to ensure that the health sector is not affected by political instability.

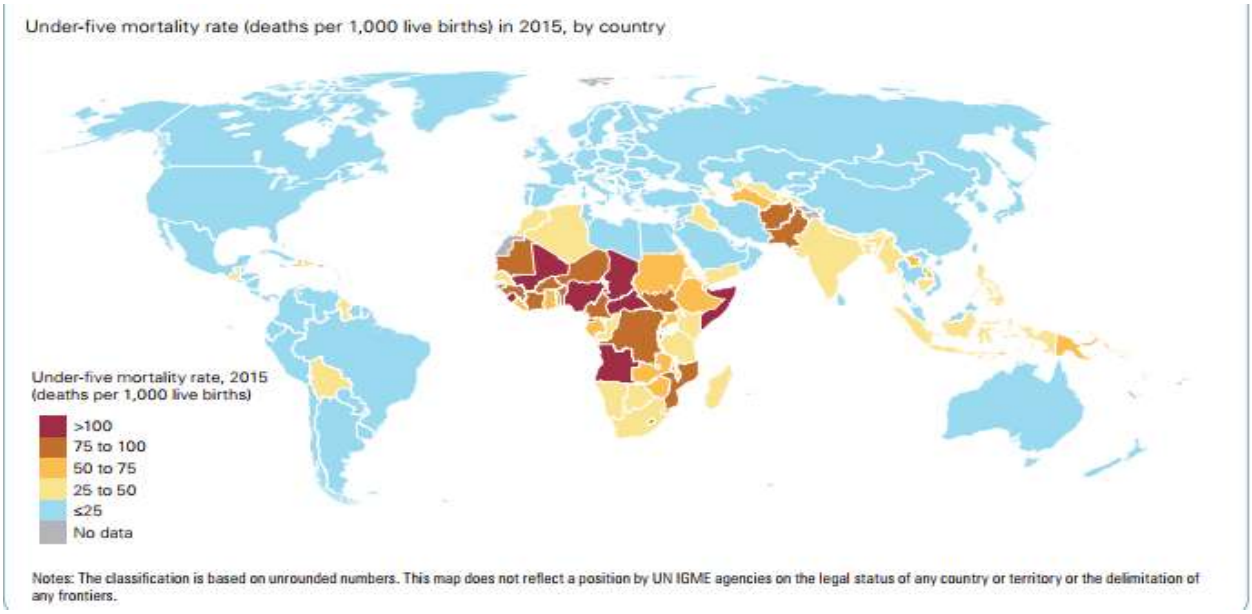
Chapter 1: Introduction

1.1 Motivation

Since the independence of African countries began in the 1960s, many African regions have experienced political instability in the form of political alternation, ethnic conflicts, tribalism, wars, coup d'états and subsequent economic crises. The Encyclopedia defines political instability in three ways. The first approach defines it as the propensity for regime or government change. The second focuses on the incidence of political upheaval or violence in a community, such as assassinations, demonstrations, etc. The third approach focuses on instability in policies rather than instability in regimes (i.e., the degree to which fundamental policies of, for instance, land or property rights are subject to frequent changes).

These crises have an impact on the economic outcomes of these countries and their associated health systems. The 1990s saw the introduction of democratic regimes across Africa, but the region still has the lowest rates of access to safe water and the highest rates of infant and under-five mortality in the world (WHO 2015; World Bank 2014).

Figure 1.1 World Map depicting Under-five mortality rates by country



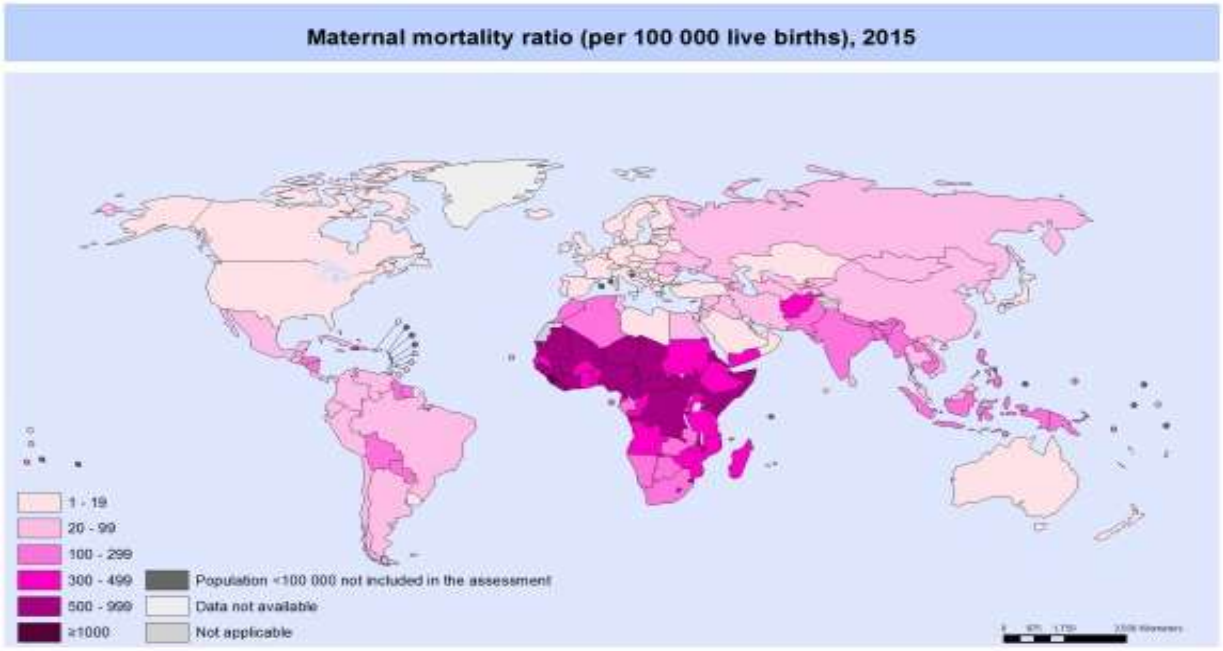
Source: WHO, 2015

The map above shows that Africa has the highest under-five mortality rates with a significant portion having mortality rates of above 50 per 1 000 live births.

Health is an intrinsic human right as well as a central input to poverty reduction and socio-economic development. In many developing countries, though cost-effective interventions are designed to control major diseases, inefficiency observed in the health sector combined with income poverty and political fragility hamper many of the poor's efforts to access basic health services. Therefore, the high burden of preventable diseases in poor communities calls for strategic planning of investments across health and health-related sectors to improve the lives of poor people and promote sustainable and inclusive development. Many academics have expressed concern that economic downturn adversely affects public health as a result of job losses (Ruhm, 2004 and 2006, Dupas and Robinson, 2012). This not only creates additional social problems such as mental health problems, due to stress and anxiety that arise from unemployment, but also adoption of less healthy lifestyles that involve the consumption of less food than the required daily intake or cheap food with little nutritional value (Bhattacharya et al., 2003; Maccini and Yang, 2009).

However, an interesting but not fully explored relationship is that between public health and political instability. War torn countries experience deaths and poor health conditions due to active violence that kills people and destroys infrastructure. Of the 15 countries with the highest neonatal mortality rates in the world, all but Lesotho have been plagued by chronic civil conflict and political instability (Wise et al, 2015). Of the nine countries which account for the highest absolute numbers of neonatal deaths in the world, four (Nigeria, Pakistan, the Democratic Republic of Congo and Angola) are similarly characterised by political instability and governance. Estimates show that countries experiencing chronic conflict or political instability account for approximately 42% of all neonatal deaths worldwide (UNICEF, 2014). For example, with a still-birth rate of 39 per 1000 births, Zimbabwe is comparable to Afghanistan (36) and South Sudan (39), countries that are war torn.

Figure 1.2 World Map depicting maternal mortality ratios by country



Source: WHO, 2015

The map above shows that Africa has the highest maternal mortality ratios with a significant portion having mortality rates of above 300 per 100 000 live births. Zimbabwe's maternal mortality ratio is comparable to that of Angola and Congo- Brazzaville (World Bank, 2015) despite the presence of wars in the latter countries. Despite considerable improvements in reproductive and newborn health throughout the world, relatively poor outcomes persist in areas plagued by conflict or political instability.

However, most of the analyses between socio-political disorder, economic decline and mortality have taken place in the developed countries. Despite the disruption to civility in developing countries associated with political disorder, similar studies have not been extensively pursued in these regions (Ityavyar 1989, Pedersen 2002). Efforts to address adverse health outcomes in politically unstable areas should adapt recommended intervention protocols that target a better governance structure. This shall induce long-term stability and socio-economic development, which should help to pull people out of poverty and marginalization.

The Southern African Development Community (SADC) is an interesting region to investigate due to its diversity in the age of the democracies, the common multi-ethnic societies and

diversity of political instability cases in the region. My familiarity with the region and its health statistics in comparison to countries with civil conflict also motivated the choice.

1.2 Research questions

The main question to be answered in this study is whether a political system does affect performances of the health sector. The SADC region is used as an example to answer this question. Specifically this thesis attempts to answer the following questions.

1. What is the effect of political instability on health outcomes (life expectancy, maternal and child mortality and HIV incidence)?
2. What is the effect of political instability on public health expenditure?

1.3 Hypotheses to be tested

1. Political instability negatively affects health outcomes
2. Political instability reduces public health expenditure

1.4 Structure of the thesis

This thesis is structured in four chapters, beyond the general introduction and the final conclusion. Chapter 2 gives the socio-political context of the SADC region. Chapter 3 looks at the literature describing politics in the SADC region. It also assesses the mechanisms by which political stability (instability) affects the health system. This includes a conceptual framework that links the performances observed in the health systems with key political and socio-economic features in the SADC region. Chapter 4 provides the methodology for the investigation of the extent to which performance of the health system is affected by the political stability. The theoretical model is tested using a panel regression that combines data from different sources in the region. Chapter 5 presents the results and provides a discussion. Chapter 6 concludes the thesis.

Chapter 2: The SADC region

2.1 Context

The Southern African Development Community (SADC) is a Regional Economic Community (REC) comprising 16 Member States; Angola, Botswana, Comoros, Democratic Republic of Congo (formerly Zaire), Eswatini (formerly Swaziland), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia and Zimbabwe. SADC was established in 1992 with a commitment to regional integration and poverty eradication within Southern Africa through economic development and ensuring peace and security.

This study looks at 11 of the 16 countries for 20 years, for the period 1996 to 2015, when all SADC countries were independent of colonial rule. The sample selection is largely motivated by the availability of data not only on political stability, but also on other socio-economic variables of interest such as democracy, economic growth, female literacy, etc. The data limitations restrict our sample selection and exclude Lesotho, Mauritius, Seychelles and Eswatini where there was missing data for most variables and there was no International Country Risk Guide - Political Risk Services (ICRG) data on political stability. This study exclusively makes use of annualized time series secondary data.

Table 2.1 SADC countries under analysis and key socio-economic indicators*

Country	Population (million)	Real GDP per capita	% of Rural population	Life expectancy (yrs)	Rate of HIV prevalence	WB polstab	ICRG polstab
Angola	28.81	4101.47	56	52.67	2.2	unstable	unstable
Botswana	2.25	6360.14	43	64.49	22.2	stable	stable
Congo, D.R.	78.74	456.05	58	59.02	0.8	unstable	unstable
Madagascar	20.70	401.84	65	65.48	0.4	unstable	unstable
Malawi	14.39	371.99	84	63.8	9.1	unstable	stable
Mozambique	28.83	529.24	68	55.37	10.5	stable	unstable
Namibia	2.48	4673.57	53	64.92	13.3	stable	stable
South Africa	55.91	5718.24	35	57.44	19.2	stable	stable
Tanzania	55.57	878.98	68	65.49	4.7	unstable	unstable
Zambia	16.59	1304.88	59	60.79	12.9	stable	stable
Zimbabwe	16.15	924.14	68	59.16	14.7	unstable	unstable

*Source: World Development Indicators *2015 figures*

2.1.1 Politics

In the SADC region, voting patterns are not purely determined by the policies of the candidates, other factors like ethnicity, coercion and allegiance to liberation parties determine voting behaviour. These other factors have contributed to political instability in the region. Former liberation parties like Tanzania's Chama Cha Mapinduzi (CCM, English: Party of the Revolution), Mozambique Liberation Front (FRELIMO), the Movement for the Liberation of Angola (MPLA), the South West African People's Organisation (SWAPO) in Namibia and the Zimbabwe African National Union – Patriotic Front (ZANU-PF) are among ruling parties that freed their countries from white minority rule and are not very tolerant of any form of political opposition (Chiroro, 2006). Officially, the parties may support multi-party systems and democracy, but their treatment of political opponents has been less than supportive. This is usually a cause for political clashes and radical policy changes resulting in political instability.

In terms of governance, colonial powers were democratic in their own countries but did not afford the same governance structures to their colonies. It is argued that the lack of democracy in African states during colonialism meant that the African revolutionaries sought support from the Chinese and Russian socialist and communist states post-independence (Bauer and Taylor, 2005 p.3). This meant that the newly independent African countries adopted the principles of communism and socialism from their supporters. The premise is that the principles on which socialist and communist states are founded require one party dictatorship to ensure successful implementation of socialist and communist policies, hence the resultant form of governance that is seen in most SADC countries where government criticism is not tolerated. In 2015, Amnesty International reported crackdowns or restrictions on political protests in Angola, Swaziland, Zambia and Zimbabwe, successfully suppressing freedoms of expression and assembly (Amnesty International, 2015). Botswana however, is typically cited as one of the most democratic countries in Africa, with a history of peace and stability and democratic elections since its independence in 1966 (Bauer and Taylor, 2005).

Within the region, there are some countries that are democratic but these countries have their own sources of political instability. Malawi became a multiparty democracy in 1994 after the autocratic rule of Kamuzu Banda belonging to the Malawi Congress Party (MCP) since 1964 (Bauer and Taylor, 2005 p.12). The country however slipped back into autocracy after 2008 during President Bingu wa Mutharika's second term with intolerance of criticism of the

government and corruption increasing. Democracy was however restored after his death in April, 2012. Zambia gained independence in 1964 and declared a one party system in 1972 where President Kenneth Kaunda ruled unchallenged until the riots and protests and subsequently a failed coup in 1990. The country moved to a multi-party system in 1991. There was another failed coup in 1997 and just before the 2001 elections; there were political protests in response to proposed changes to the constitution for presidents to have more than two terms (Bauer and Taylor, 2005 p. 13).

South Africa however, has always encouraged a multiparty democracy since its independence and its constitution has always supported this. The country however suffers from economic and social ills that stem from the apartheid era such that they have one of the highest inequality gaps in the world with a Gini coefficient of 0.69 (World Bank, 2014). These socio-economic problems and discontent result in periodic strikes and protests for better service delivery with the worst having been the Marikana incident in 2012. In addition to this, South African government officials including the former President have faced charges of corruption and misuse of public funds. Finance ministers were also known to lose their jobs if they criticized the former President's use of public funds further aggravating political instability (Karodia and Soni, 2016). According to the Transparency International Corruption Perception Index (2016), the failure to improve corruption perception indices by SADC countries like South Africa, Tanzania and the DRC, demonstrates how electoral democracy is challenged in African countries because of corruption.

Another product of colonialism that affects politics is the premise of inferiority and backwardness of the local Africans that colonisers employed to justify systematic segregation of the natives. This resulted in close ethnic bonds among those who spoke the same language or lived in the same geographic area. For example, ethnicity was used as an apartheid weapon in Namibia and South Africa, through the "homeland" policy. The ethnic structure was used to ensure subordinate participation by Africans, ethnic consciousness was the tool of apartheid oppression (Young, 2002). African societies are often characterised by persistent deep-rooted and identity-related conflicts. These conflicts are fueled by a combination of identity based factors and wider perceptions of economic and social injustice regarding the distribution of economic, social and political resources within the country (Harris and Reilly, 1998). When it comes to politics, the perception is that the winning candidate will convey benefits to his home area or to people from the same ethnic group once they are in power (Oyovbaire, 1974). In the eyes of the public, the

electoral outcome can take on a winner-take-all quality, and defeat is seen as unacceptable. The election campaign itself may be accompanied by physical violence and intimidation, raising the stakes for everyone. The possibility that competitive elections may lead to violent ethnic confrontation also emerged as a justification for single party or military regimes.

The Angolan national liberation movement split into three mutually hostile movements: The People's Movement for the Liberation of Angola (MPLA), National Union for the Total Independence of Angola (UNITA), and the National Liberation Front of Angola (FNLA). The movements were demarcated both by different ethnic and racial bases, and by the distinct mission attachments of their leadership (Ndumbe and Cole, 2005). One of the most important reasons for the civil war that lasted 27 years in the country after independence was the reluctance of the dominant liberation movements to share power within a multi-ethnic society. Mozambique had a similar situation with FRELIMO and RENAMO creating civil unrest in Mozambique. Other examples in the region include Zimbabwe's ZANU-PF and PF ZAPU. The two political parties were separated on ethnic terms. In 1987, there was a civil war between the Ndebele in Matebeleland (ZAPU) and the Shona (ZANU). Following this, the two political parties signed the Unity Accord to merge under ZANU- PF and establish a one party state (Chiroro, 2005). The Democratic Republic of Congo (formerly Zaire) is one of the most ethnically diverse countries in the world, which has led to conflict for resources and power. Poor public service provision and control of mineral rich areas by rebels, certain ethnic groups, political powers or foreign institutions has resulted in poverty in the region and fuels violence and conflict behaviour (Karbo and Mutisi, 2012).

An important characteristic to note about the SADC region is the political interconnectedness among the countries. The liberation movements in Angola, Mozambique, Zimbabwe, Namibia, and South Africa had to resort to armed struggle to attain independence (Bauer and Taylor, 2005 p.7). These struggles for independence fostered interconnectedness among the states of the region. Many of those fighting for independence in their own countries spent time in exile in neighboring countries like Angola, Mozambique, and Zambia, which had gained their independence first. These countries became havens and training grounds in the 1970s and 1980s for liberation movements that were attempting to end minority rule in South West Africa (Namibia), Rhodesia (Zimbabwe), and South Africa (ibid.). This relationship has continued post-independence with the agreement among SADC countries that they will assist each other in preserving political independence which suggests that political or social instability in a SADC

country would directly impact the other SADC countries (SADC, 2010). A case in point was the second Congo war of 1998 – 2002 where Zimbabwe, Angola and Namibia sent troops to fight the Rwandan and Ugandan rebels that had entered the DRC. In addition to the economic effects on the countries that were actively involved in the war, other countries in the region also experienced stagnation in their economies (Koyame and Clark, 2002).

2.2 Health in the region

2.2.1 The HIV/ AIDS pandemic

An analysis of health in the SADC region would be incomplete if it did not include the HIV/AIDS pandemic because Southern Africa is the worst affected region in the world (WHO, 2015). In 2007, Southern Africa recorded the highest prevalence of HIV and AIDS with at least one-third of all HIV infected people globally and yet the region had less than 2% of the global population (Halperin et al, 2007). Attributed to this were high levels of multiple and concurrent sexual partnerships by men and women, coupled with insufficient consistent and correct condom use. In addition, low levels of male circumcision were identified as key drivers of the epidemic in the sub-region (ibid.). Infection rates among adults in South Africa, Swaziland, Botswana and western Kenya ranged from 20% to at least 30%, which was much higher than anywhere else in the world, outside of Africa (UNAIDS, 2006). However, the low levels of male circumcision do not explain why HIV has spread so much more extensively in Southern Africa than in India or in Europe, where circumcision is similarly uncommon.

In addition, Demographic Health Surveys and other studies suggest that, on average, African men typically do not have more sexual partners than men elsewhere (Wellings et. al, 2006). A comparative study of sexual behaviour, conducted by the World Health Organization (WHO) in the 1990s, found that men in Thailand and Rio de Janeiro, Brazil were more likely to report five or more casual sexual partners in the previous year than were men in Tanzania, Kenya, Lesotho, or Zambia. And very few women in any of these countries reported five or more partners a year (Carael 1995 and Halperin, 2004). Men and women in Africa report roughly similar, if not fewer, numbers of lifetime partners than do heterosexuals in many Western countries.

This leads to the notion that more than socio-economic determinants of HIV are the only factors at play. Nattrass (2008) talks about the political economics of antiretroviral treatment in

developing countries. Despite the current best efforts of the international community in mobilising for HIV treatment, commitment on the part of national governments to negotiate with pharmaceutical companies over patented antiretroviral drug prices, their policy towards compulsory licensing, and the approach they adopt to delivering ART are the key determinants of the trajectory of the HIV epidemic. The economics of antiretroviral (ARV) drug delivery in developing countries is a political-economy discussion of access to treatment. For nearly 10 years, the South African government's response to the HIV epidemic was described as denialist, which was estimated to have resulted in the deaths of 330,000 people because lifesaving antiretroviral therapy was not provided (Chigwedere et al., 2008).

2.2.2 Trends in the health outcomes

The trends in life expectancy are increasing over time. Countries such as Madagascar, Mozambique and Angola have been experiencing a steady increase in life expectancy over time while those that were hardest hit by the AIDS pandemic saw a decrease in life expectancy between 2000 and 2005. In that time, countries like Zimbabwe, South Africa and Swaziland rolled out Anti-Retroviral Treatment (ART) to all HIV positive patients and the life expectancy started to improve. The pandemic affected maternal mortality as well as infant mortality but the trends in those two outcomes are steadily decreasing over time for all countries. The HIV incidence for all countries is also falling at an exponential rate.

Figure 2.1 Trends in Life expectancy

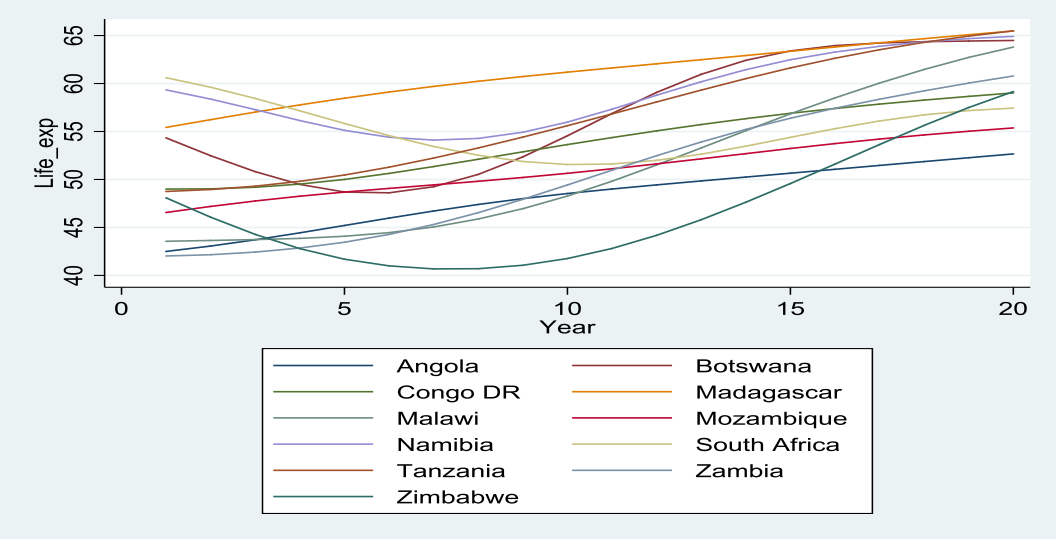


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Figure 2.2 Trends in Maternal mortality ratio

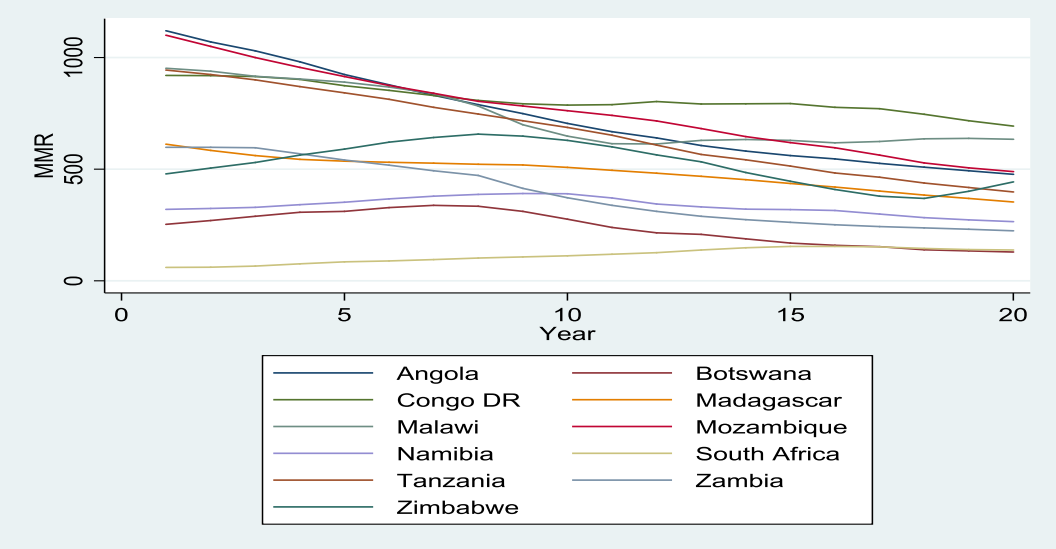

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Figure 2.3 Trends in Infant mortality rate

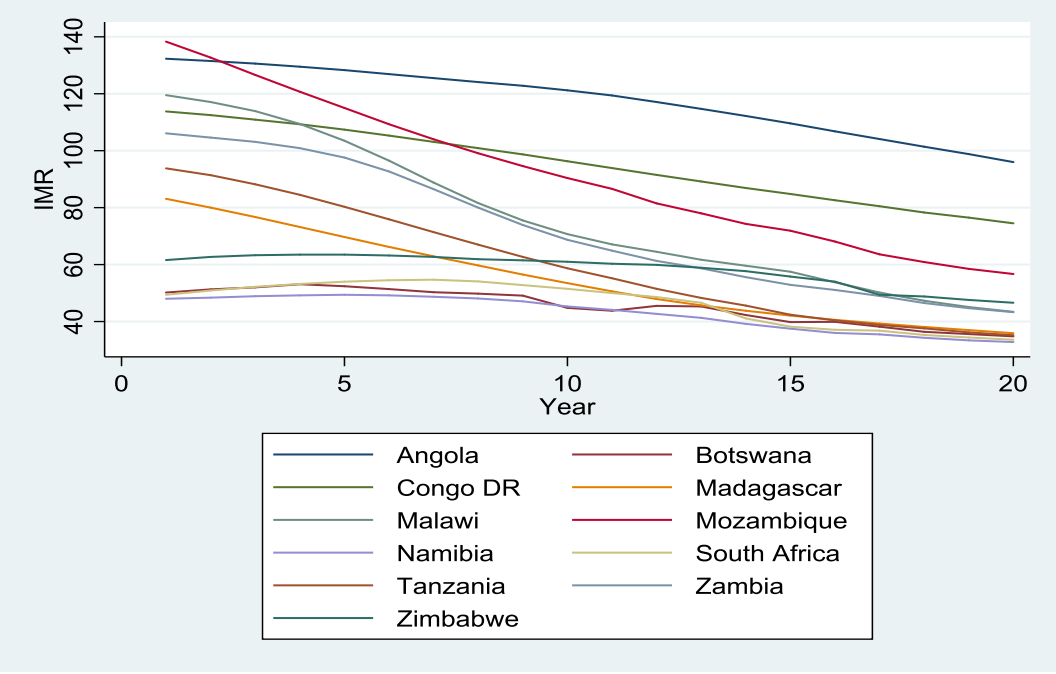

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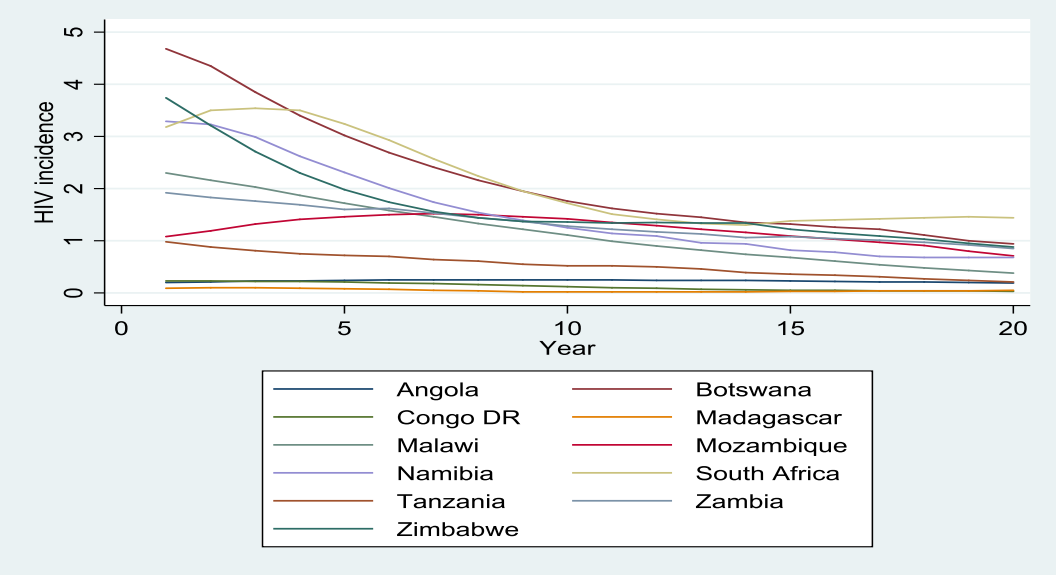
Figure 2.4 Trends in HIV incidence



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Chapter 3: Literature Review

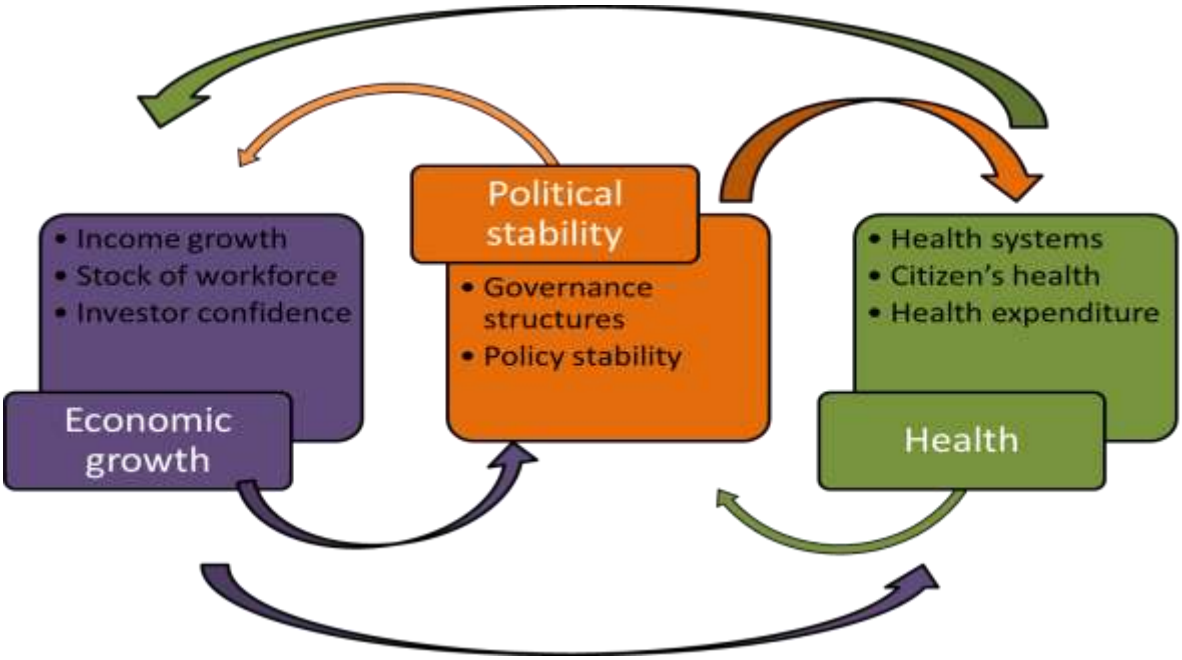
3.1 Measures of political stability used in the literature

To examine how political stability influences policy choices and public health outcomes, the starting point is measuring political stability. Reliability of the measurement of political stability remains a key issue in any empirical study. A reliable measure must be able to quantify the frequency and the depth of political stability and be comparable over time and across countries. The literature uses measures such as the Polity IV (Radu, 2015), World Bank World Governance Indicators (Makuta and O'Hare, 2015; Farag et al, 2013), the International Country Risk Guide's Political Risk Services (PRS) indicator (further on referred to as ICRG), the Major Episodes of Political Violence (MEPV) and Conflict Regions 1946-2015 database and the State Fragility Index (SFI) from the Centre of Systemic Peace. The World Bank World Governance Indicators index (further on referred to as WB) is a composite measure as it is based on several other indexes from multiple sources including the Economist Intelligence Unit, the World Economic Forum, and the International Country Risk Guide Political Risk Services, among others (Kaufmann and Kraay, 2006). The construction of a composite index reduces the bias of any one index that comprises the weighted average. The underlying indices reflect the likelihood of a disorderly transfer of government power, armed conflict, violent demonstrations, social unrest, international tensions, terrorism, as well as ethnic, religious or regional conflicts. Alesina and Perotti (1996) construct an index of political stability based on multivariate principal component analysis (PCA) based on the number of political assassinations, political arrests and attempted assassinations, coups, guerilla actions and the share of GDP that is spent on military spending. A similar methodology was used by Ndokang (2015).

3.2 How political stability affects health

The role of institutions is central to this discussion. The effect that political stability has on institutions affects the resultant economic and health outcomes. Figure 3.1 shows the hypothesized linkages between health and political stability and the economic growth intermediate steps. The diagram shows the complexity of the relationship and the feedback within the system where political stability can directly influence health and economic growth but both effects can result in political stability.

Figure 3.1 Hypothesised linkages between health and political stability



3.2.1 Political instability and economic growth

Early work on political instability simply assumed that stability has instrumental economic value but this was never tested (Goldsmith, 1987). Rather, causes of political stability were mapped and stability was never used to predict economic performance, let alone health outcomes. Researchers believe stability to be a necessary condition for growth and prosperity because people are encouraged to invest and trade when they are confident in the future. Few things seem more likely to undermine business and consumer confidence than the prospect of political unrest and sudden changes in the political economy (ibid.). Early studies of growth, find that the number of revolutions and coups has a great effect on investment, which in turn influences growth (Levine and Renelt, 1992). Many authors have worked on the impact of a political crisis (Radu, 2015, Tabassam et. al., 2016, Aisen and Veiga, 2010) in a state with almost the same conclusion: political instability adversely affects the economy of a state and the proposed adverse effects are diverse in manner. Economic growth and political stability are interconnected. On one hand, the uncertainty associated with an unstable political environment may reduce investment and the rate of economic development. On the other hand, poor economic performance may lead to government collapse and socio-political unrest. Posner (1997) refines this and finds that the level of income rather than income equality results in

political stability. Aisen (2011) finds that higher degrees of political instability are associated with lower growth rates of GDP per capita. Regarding the mechanisms, they find that political instability adversely affects growth by lowering the rates of productivity growth and, to a less extent, physical and human capital accumulation.

Other studies have also found effects of political instability on inflation (Edwards, 1994). With regards to private investment, Alesina and Perotti (1996) show that socio-political instability generates an uncertain political-economic environment, which raises the risks of investment thus reducing the level of investment (foreign and domestic). An example here is the financial crisis in South Africa as a result of cabinet shifts. After six reshuffles of Jacob Zuma's Cabinet including three finance ministers in 5 days in 2015, the economy deteriorated (Karodia and Soni, 2016). The Rand has been volatile since, falling to R16 against the USD, a reaction to political developments. The country's bonds have also been downgraded to junk status resulting in capital flight (ibid.).

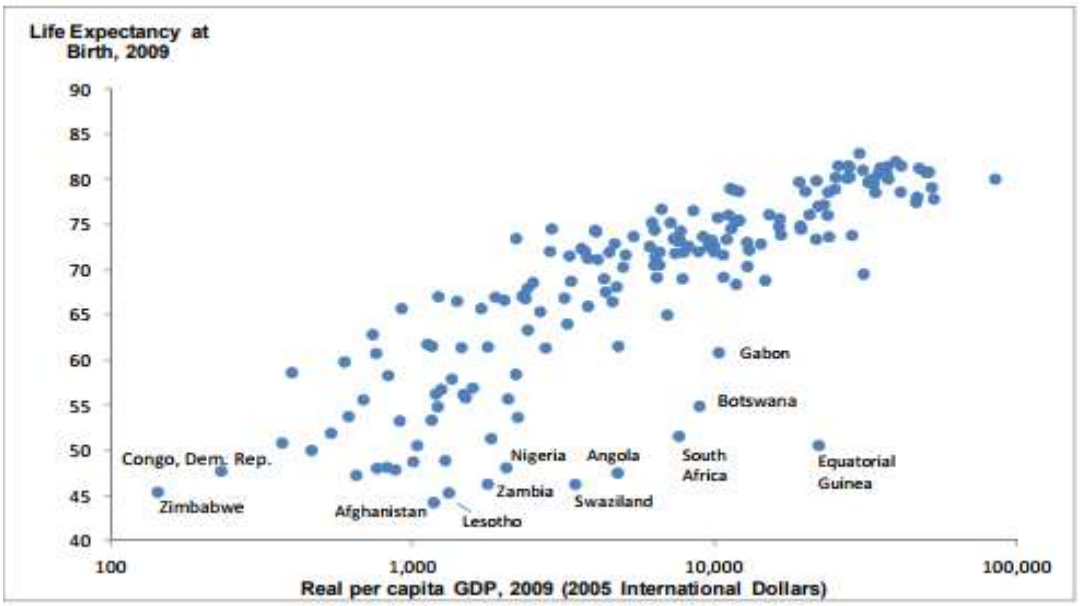
Political instability also leads to higher inflation as shown in Aisen and Veiga (2006). The channels of transmission at work to explain inflation in their paper, similarly affect economic growth - political instability shortens the horizons of governments which disrupts long term economic policies that are conducive to better economic performance. Holt and Turner (1966) sum up the political basis for economic development as follows: war, revolution, and other destabilizing events obviously disrupt economic activities in the short term, but, Olson argues, they also set the stage for more rapid growth in the medium term. Over the long term, however, Olson asserts that political stability can be economically dysfunctional and cause growth to decelerate (Olson, 1982).

3.2.2 Economic growth and health

A global empirical study showed that governance, education and private sector and trade were found to be the most important macro factors associated with maternal mortality (Sajedinejad et. al., 2015). Employment and labor structure, economic policy and debt, agriculture and food production, private sector infrastructure investment, and health finance were also some other critical factors that explained about 65% of the variability in maternal mortality between different countries. These economic factors affect effect growth and apparently health as well.

Studies highlight a unidirectional causality that exists between healthcare expenditures and GDP (Hansen and King 1994; Blomqvist and Carter 1997; Gerdtham and Loethgren 2000; Herwartz and Theilen 2003). Studies in OECD countries show that GDP per capita is the most important determinant of healthcare expenditure and that healthcare expenditure increases proportionally more than per capita income (income elasticity above unity). Such findings may help to understand variation in health expenditures encountered between different regions of the world. Income is related to health in, at least three ways: through the gross national income of a country, the income of individuals, and the income inequalities within nations (Marmot, 2002). This would suggest that a redistribution of income will improve health and therefore its outcomes. Economic growth implies better food and housing, access to safe water and sanitation, less strenuous working conditions and fewer people living under destitute conditions (Bloom and Canning, 2000). Figure 3.2 shows the positive relationship between life expectancy at birth and real GDP per capita, a one-year improvement in a population's life expectancy contributes to an increase of 4% in output (Bloom et. al., 2004). This supports the notion that income improves lifestyles therefore reducing citizens' propensity to protest (political instability).

Figure 3.2 Income and Life Expectancy Across Countries



Adapted from Weil, 2013 Data *Source: World Bank*

Interestingly, we observe a few SADC countries that are outliers. The DRC and Zimbabwe lie above the line of best fit meaning that life expectancy in those two countries is higher than the average country with the same income. Lesotho, Angola, Zambia, South Africa and Botswana

fall below the line meaning that their life expectancy at birth is lower than the average country with the same income level. This alludes to the presence of other factors affecting life expectancy beyond income. For example, South Africa and Botswana have high rates of HIV. Gbesemente and Gerdtham (1992) noted that countries in Africa, unlike OECD countries have an income elasticity of healthcare expenditure of unit. This means that a unit increase in income in OECD nations results in an increase in health expenditure of more than 1 unit in OECD nations and by 1 unit in African states. This study helps to explain the differences in the effect of income on life expectancy, the same income level does not necessarily translate to the same expenditure on health in African countries as in OECD countries. This study, among other African studies (Okunade, 2005; Murthy and Okunade, 2009; Gbesemente and Gerdtham, 1992) also revealed that countries receiving more foreign aid, invest more in healthcare. The positive correlation between foreign aid and per capita healthcare expenditure is of particular interest. It reinforces the view that in countries with limited resources, increased foreign aid is essential for higher allocation of resources to the health sector and provision of other public goods. In addition to these determinants of health expenditure, health personnel per capita and internal conflicts also explain variations in health expenditure in Africa (Okunade, 2005). Foreign aid flow is determined by the political and institutional stability of a country. Deviations from stability could result in a loss of aid that would have been beneficial to the economy including the health system.

3.3 Political instability and health

3.3.1 Effects of political instability on the health system

There are different channels through which political instability affects public service delivery in general and health outcomes in particular. Channels range from a fall in income due to high unemployment that emerges from crisis to non-respect of rule of laws that secures returns to economic investment. The empirical evidence shows that many of the cities that experience civil disorders have low and inefficient health service outlooks (Somali-Swedish Action Group for Health Research and Development, 2014 and Cocks, 1999). More generally, one expects political instability to not only influence political decisions, but also economic as well as social dimensions. Some previous studies account for productivity losses that are associated with political instability (Dupas and Robinson, 2012). This loss in productivity, in turn, reduces the tax revenue that would have been collected and allocated to the health system had productivity not fallen.

Political instability creates a threat to existing institutions by enhancing the level of uncertainty that surrounds public and private investments as well as the risks that are associated with long-term government decisions. During periods of political instability, ministry staff turnover is high and this results in the lack of stability in decision-making processes, especially in the developing world, where the structures of the current institutions provide little accountability for a coherent governance structure. The effects on government decisions are discussed further in the next section on public financing.

If the legitimacy of the government is undermined, then the government's capacity to formulate policy is reduced and they may fail to implement any long term plans. Uncertainty within the government can lead to patronage payments and corruption within the system in order for each individual to ensure they have a livelihood even after they leave power. Equally, some citizens could receive transfers to reward them for the support for the government rather than these funds being used for economic development. All these effects negatively affect health outcomes by affecting different parts of the public health system. Other effects that can be felt during this period are reduced domestic savings and investments, capital and donor funding flight and property destruction. NGO involvement in a country and the level of donor funding are largely dependent on political stability. Crisis nations receive emergency humanitarian assistance and economic/infrastructural recovery states get recovery phase assistance. Southern African nations have offices of donor agencies that implement and fund on-going projects and their continued work depends on political stability and a demonstrated commitment of local governments to ensure fiduciary stewardship. Countries like Zimbabwe and the DRC saw NGOs flee from them at the height of political unrest which disrupted programs in HIV/AIDS or Reproductive Maternal Neonatal and Child Health (RMNCH) which are currently the highest recipients of aid in countries like Zimbabwe (MOHCC, 2016).

Beyond governments, political risks affect local citizens as well as international communities. Human events such as war and civil disruption directly affect health conditions in a country. For instance, increases in military spending may also compete with health care priorities (crowding out) such that there is a consistently smaller budget allocation for healthcare investments. If instability includes physical destruction of infrastructure like roads and public health infrastructure (hospitals, clinics, ambulances etc.) then access to healthcare will be negatively

impacted. Any refugees that result from this situation will increase the burden of need for healthcare in a nation where resources for healthcare will be dwindling (Ityavyar et al, 1989).

A health crisis that is associated with political instability leads to a number of discrepancies, which might all negatively affect economic performance. War and civil disruption are usually proven to force both relocation and displacement of people (Ityavyar et al. 1989). This, in turn, places an increasing burden on the health services at the destination points. When the political systems are not strong enough to resolve these dynamics, this situation might lead to disease epidemics. In conflict zones, political violence might cause disruption and, as a result, a complete cut-off of services and assistance for the people left behind or the displaced persons. These effects have the potential for a downward spiral into chaos and possibly state of emergency. The ripple effect of the political scenario described above may be reduction in human capital due to deaths or brain drain. Studies show that many medical professionals (including doctors, nurses, pharmacists and lab technicians) have moved from politically unstable countries to the ones where their lives are not at risk (Squires et. al., 2016; Awases et. al., 2003; Bloom and Standing, 2001; Bundred and Levitt, 2000; Ndlovu et al., 2001; Bakamanume, 1998; WHO, 1997). This has the effect of reducing the stock of health service providers in situations where they are needed most.

Ityavyar et al (1989) investigated the impact of incessant violence and conflict on health in Africa. The authors concluded that African states would have better health policies had they not experienced internal violence or political conflict. An additional driver of health-related investments is income. As an example, Bakamanume (1998) tracked the effect of political instability on healthcare in Uganda and he found that the greatest effects of political instability were seen in the trajectory of the HIV/AIDS pandemic. The southern region with no conflict saw declining rates of HIV infection when the northern region in crisis saw increasing rates of HIV (Bakamanume, 1996 and 1997). Ndokang et. al. (2015) discussed the adverse effects that political instability in the Central African Republic had on health in Cameroon validating the effects of political instability across borders as well.

3.3.2 Mechanisms of transmission between political stability and health

The next question to be answered is: What are the mechanisms by which ruling political parties determine public policy, including health policy, which in turn influences health outcomes? The

main mechanisms of transmission seem to be via the effect of political instability on economic growth and income, then the effect of income on health expenditure and therefore the final effect on health outcomes. The main channels through which political stability affects health outcomes are: (1) the effects of political stability on institutions and governance, which in turn influence health services delivery, and (2), the effects of political stability on GDP and growth, which in turn influence health-related investments.

3.3.2.1 Effect on institutions and governance

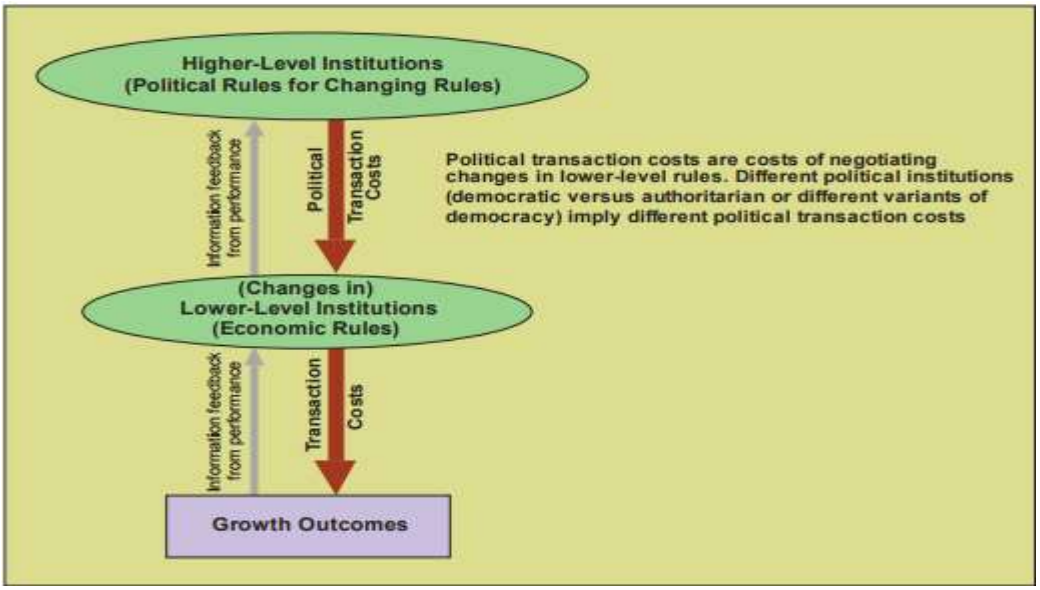
Mismanagement, corruption and lack of clear policies to chart ways forward result in poor health outcomes. Policies, institutions, and processes at the micro and macro levels are inherently connected. Navarro et. al. (2006) find that cumulative years of pro-redistributive governance are statistically correlated with policies promoting full employment, highly regulated labour markets, and public health expenditure. Holmberg and Rothstein (2011) find that quality of governance is positively associated with higher levels of life expectancy and lower levels of mortality rates for children and mothers. Therefore, this assessment will need to incorporate micro-macro linkages, these being the linkages between issues that influence livelihoods and economic recovery at the individual, household, and community level (the micro level) and those issues that relate to the economy, policy framework, and systems of governance at provincial, national and, where relevant, regional levels (the macro level).

Corruption is one form of poor governance that affects countries and is rampant in politically unstable countries. It is defined as the use of public office for private gains (Bardhan, 1997). The main forms of corruption are bribes received by public officials, embezzlement by public officials of resources they are entrusted to administer, fraud in the form of manipulating information to further public officials' personal goals, extortion, and favoritism (Andvig and Fjeldstad, 2001). Large bribes paid to influence policy formulation and major contract awards tailored to favour private interests and those favours bought from bureaucrats and judicial officials involved in implementing existing policies in their daily interaction with the citizens of the country are the major forms that affect the economy and health outcomes. Given that corrupt behavior of public officials affects the cost and incentive structures faced by the firms and households, an explanation is given for how that affects the performance of an economy and health outcomes in this case. In 2006, the leading international anti-corruption organization, Transparency International, published a special report about the devastating effects that corruption has on

people's access to health care and on health in general. The report documented lack of access to treatment due to corrupt practices. Corruption in this case took the form of drug pilfering for sale on the black market, health service provider absenteeism as they seek profitable opportunities outside of their jobs and stolen equipment for sale. Malfunctioning equipment in the public sector sometimes does not get replaced so that the health service providers can refer patients to their private practice where they offer the service privately for a profit. In some cases, low levels of treatment efforts are observed in some public health institutions and patients are referred to practitioners' private practices for better care (World Bank, 2010: 2).

Fragmentation of government structures adds to the bureaucracy involved in making decisions and any delays or inefficiencies in the processes could be political in nature. Public sector organizations and public officials at various levels of government are key players in the policy process. Civil servants and political appointees are deeply involved in policy formulation, regulatory agencies are delegated wide-ranging discretionary powers, and street-level bureaucrats crucially influence policy outputs and shape the public image of the government (Bach and Maggetti, 2017). Political instability results in uncertainties of government positions and policies alike which adversely affect policy implementation and institution credibility.

Figure 3.3 Mechanism of how policy decisions are made



Source: Adapted from Khan (2010)

Khan (2010) argues that higher-level formal institutions like the president or minister's office are 'political' institutions which define the rules for changing rules, and these rules define the 'political' transaction costs of organizing changes in lower-level institutions. It should always be possible to suggest an introduction of growth-enhancing/health improving institutions because the additional output should enable losers to be compensated directly or indirectly, if the political transaction costs of negotiating the compensations are low. But if political institutions are inefficient or have divergent ideologies and political transaction costs are too high, the cost of introducing policy/programmatic interventions in lower-level institutions may preclude a rapid change to greater efficiency. In order to effect changes, political transaction costs need to be reduced. This can be done by other institutions namely; informal institutions through lobbying or NGOs who bring financing for interventions and can bypass the bureaucracy. Political instability could lead to the absence of other institutions like NGOs who flee the risk or weakness of existing public institutions. This can however limit the extent to which political transaction costs can be reduced. Good governance lowers transaction costs in the economy since citizens and companies will be able to predict the outcomes of their interactions with government authorities (North, 1990).

In addition to the transaction costs involved in policy making which affects public health expenditure and programming, the study examines the other effects of poor governance on health outcomes. When people earn a stable income, they have the ability to save for the future, including adequate provision of public goods like healthcare and education for those with children. This results in the brain drain of key personnel like doctors and nurses in institutions that provide public health services. This reduces the labour force and poor health outcomes can arise from institutions being understaffed and the few that are present being demotivated.

The same phenomenon applies to the linkage between political stability and health via the income route. Institutions and government policies provide the incentives for individuals and firms in an economy. For instance, Kaufmann (2003) finds that the slowing of economic growth rates of countries is not related only to the macroeconomic situation of certain countries, but also to the stagnation or the lowering of governance indicators such as the quality of the institutional structure, independence of the judiciary, level of corruption and the ease of doing business. Similarly, Roll and Talbott (2003) conclude that about 80% of differences in GNI per capita between different countries, can be explained by factors such as property rights, political rights, governance expenses, voice and accountability. Negative effects of institutions come

from excessive bureaucracy, informal economy, trade barriers, etc. The same transaction costs that prevent progress in effecting interventions for health improvement apply to the situation where economic development is not fostered. However, it is important to highlight that, per capita income does not directly determine the production of health output rather, it permits a high level of expenditure for health purposes whether by the individual or by the government.

An example is when health care is said to be free but due to economic hardships, is not. Some services require an administration fee to be paid before accessing health services. This blocks access to healthcare for those who cannot afford to pay the administration fee. This can be the result of instances where the government is expending resources for free healthcare but corruption erodes this endowment and patients are then asked to pay for services. If the resources intended for healthcare have been pilfered, then poor governance has fostered poor health outcomes.

Another example is the case where the government declares free health services in order to buy political support but they cannot afford this. This would not be sustainable and would result in a) health service provider morale falling if the implications of lack of government funds are that their wages do not come on time or at all or b) the service provider charging for services in order to recoup costs or c) the service provider ceasing to offer services due to lack of resources. All three scenarios result in poor/ no health services being offered and therefore poor health outcomes.

3.3.3 Political instability and public financing

Economic literature has long recognized the influence of political process on efficiency in the provision of public goods (Deacon 2009). For instance, some empirical studies carried out in the OECD countries have shown the extent to which electoral motives influence public health expenditures (Potrafke, 2010). In a bid to garner votes, politicians invest in sectors such as health that affect all citizens and are usually under provided for and therefore provide a gap that can be filled. Potrafke continues to classify health as an important and special good whose expenditure decisions differ from other social goods. This is said to be the reason its provision depends on the type of governance structure and is higher in election years (Potrafke, 2011). Samuelson (1954) provided the optimal conditions for the provision of public goods. Provision of public services is driven by a number of factors such as, the magnitude of the tax system, the

political and social regimes, the anticipated free-riding behaviors, reliability of institutions, etc. Health service delivery, acknowledged as one particular form of public service, is driven by the above-mentioned factors but also by the political systems that influence public finance. Whether under democratic or autocratic regimes, the provision of health services is deeply rooted into the political actions and incentive mechanisms taken by national governments.

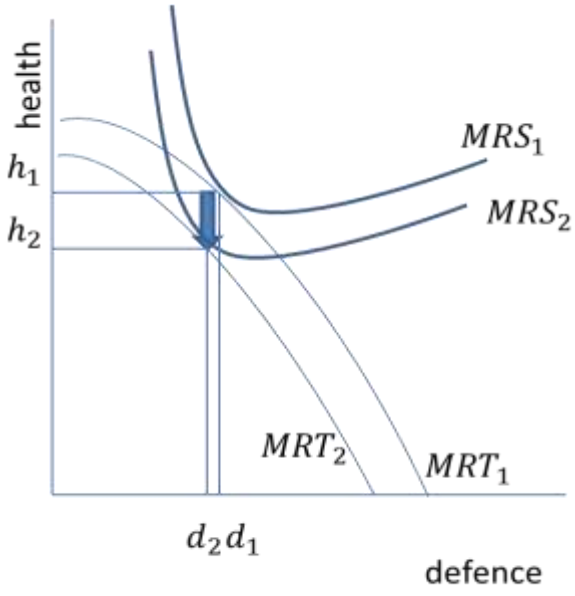
North (1990) said that "Third World countries are poor because the institutional constraints define a set of payoffs to political/economic activity, which do not encourage productive activity". As a result, countries experience a decrease in public expenditures that could have improved health and other key socio-economic conditions due to weaknesses in institutions that result in increased incentives to use public funds for less productive activities. The supply of public goods reaches its efficiency when the marginal rate of substitution (MRS) in consumption of the different consumers remains equal to the marginal rate of transformation (MRT). The marginal rate of substitution is the rate at which a consumer can give up some amount of one good in exchange for another good while maintaining the same level of utility while the marginal rate of transformation is the rate at which one good must be sacrificed in order to produce a single extra unit (or marginal unit) of another good, assuming that both goods require the same scarce inputs. The optimality condition assumes not only that the market is under perfect competition, but also that individuals are able to share and monitor the costs that are associated with the provision of the public goods.

Political instability affects both the MRS and MRT curves associated with public good provision. If the instability involves the military for example, then investment in defence crowds out other government investments e.g health expenditure. Citizens face different choices when a country is unstable to when it is not. They may choose to give up more health care in order to get security from the deployment of armed forces. However, if the crisis is bloody then they may need more forces and more health facilities. From the government's perspective, they may choose to protect their position by getting more armed forces that do not necessarily benefit the population. In this case, the opportunity costs of healthcare expenditure increase and the intrinsic value of an extra unit of military increases, changing both the marginal rate of substitution and the marginal rate of transformation curves. An additional component to consider is the lack of imperfect information in this scenario where opportunity costs and intrinsic values cannot be fully observed by all the stakeholders. An alternative scenario is that costs do not change but the budget decreases due to increased misuse of public funds for officials to enrich

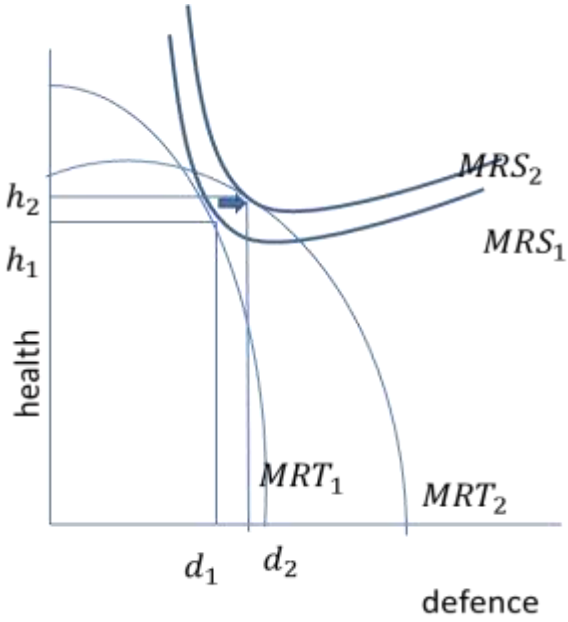
themselves amidst turmoil. The externalities arising from the different scenarios are also difficult to quantify and include in the model to determine optimal quantities. Figure 3.4 shows the different scenarios that could arise and their effects on health provision assuming that health and defence are the only two public goods provided.

Figure 3.4 Effect of political instability on public health provision

Scenario A - Budget decrease as a result of misuse of public funds



Scenario B – Increased opportunity costs of not investing in defence



Author's own construction

Figure 3.4 Scenario A shows a budget decrease that results in a parallel inward shift of the MRT curve. The equilibrium that results from this shift is a small decrease in defence and bigger decrease in health. This results from the rate of transformation that already exists where the curve is steep – in order to provide an additional unit of defence, a lot of healthcare has to be foregone. Scenario B shows a change in opportunity costs of providing defence, changing the slope of the MRT curve which results in an increase in both goods provided.

Lindahl (1919) showed that simultaneous bargaining allows individuals to determine the level of public good provisions as well as the distribution of the costs between them. The equilibrium that arises from the bargaining corresponds to the Pareto optimal outcome. However when imperfect information (caused by political instability) is assumed under public good provision,

there is a distortion between Samuelson (1954) optimum (social efficiency is maximized when the marginal costs are set equal to the sum of the marginal rates of substitution) `and the policy preference. Thus inefficiency can lead to either under provision or overprovision of public goods. Policy preference is assumed to be the outcome of heterogeneity observed between individuals (Persson and Svensson 1989; Aghion and Bolton 1990, Millner et. al. 2014). When political regimes are introduced in the analysis, heterogeneity emerges from the differences observed between characteristics of the voters. Therefore one expects, as argued by the economic theory, that public good provisions under democratic societies would be efficient in a society with identical voters (for example, the same ethnic group). Tiebout (1956) shows that the influence of heterogeneity could be overcome when people organize themselves into communities. The underlying assumption for membership creation is to send a signal that reveals the group's sensitivity towards existing public policies. This is however difficult in our case where diverse ethnicity is at the core of politics in the region.

3.3.2.1 The effect of democracy

Firstly, studies have shown that low-income democracies are at least as conflict/instability-prone as low-income non-democracies due to the prevalence of socio-economic strife in low-income countries (Herge and Nome, 2010). In a follow-up study, Hegre finds that when you control for GDP and other socio-economic conditions, democracies and non-democracies are just as likely to plunge into conflict (Hegre, 2014). Therefore democracies and non-democracies in low income countries are just as likely to plunge into political turmoil, which lends the discussion to focus only on the public provision choices of the different regimes.

The link between political regimes and public good (health) provision has an intuitive explanation. In a dictatorship (democracy of a few/ the elite), where political influence is concentrated among a few, a rational government leader spends the public budget mainly on transfers targeted to politically influential groups. This can be classified as spending on an exclusive good that only a few benefit from. Alternative spending on a nonexclusive public good is deemed unprofitable because much of a public good's benefit would spill over to non-influential outsiders. In a democracy, where control of the government requires satisfying a large fraction of the population, direct transfers are unattractive because of the large size of the group whose support must be won dilutes the benefit each member receives. Spending heavily on the public good makes sense in this case, due to the economies of scale inherent in supplying a

public good to a larger population. Authoritarian regimes tend to suppress political competition and have an interest in preventing human development. This is done because improved health, education, and economic security mobilise citizens to advocate for greater participation and more resources. However, the same conditions could secure a dictator's position if the citizens have nothing to complain about.

The provision of public goods under different regime sets has been investigated, both theoretically as well as empirically. The underlying rationale behind the questioning of political dynamics in health service delivery stems from the fact that voters can influence political decisions. In a democratic society, one expects voters to have more influence over public policy, than in an autocratic society. Acemoglu et. al. (2005) have provided the role of institutions in the provision of public goods. Additional studies have argued that dictatorships provide fewer public goods than democracies (McGuire and Olson, 1996; Niskanen, 1997). For example, Besley and Kudamatsu, (2006) argue that democracies provide more public health than autocracies and therefore health outcomes would be better in democratic countries than in autocratic ones.

Arguments put forth for why democracy provides better public health than autocracies stems from its public provision servicing. It is usually expected from democratic societies to promote internal instruments that favour redistribution of income and assure that the poor receive at least basic healthcare services (Mobarak et. al., 2011). The assumption that a democracy is where the interests of the masses are represented in government assumes that public good provision caters for these masses. The opposite being an autocratic government that only caters for the elite/their supporters who form the minority. The repression of media and political opposition that typically characterizes autocracy is said to stifle public debate that could force a government to be accountable for the level of public good provision. This would result in a government that provides less than optimal public health but will never be openly criticized for it (Besley and Kudamatsu, 2006). Without elections, opposition parties, and uncensored public criticism, ruling groups do not suffer political consequences from their failure to prevent health crises. Democratic governments, by nature of being accountable and looking out for the masses, will pick skilled professionals to run ministries and public offices and the assumption following this is that their staff is more competent than those in autocratic public offices (Besley and Kudamatsu, 2006). Therefore, more competent staff deliver better services than those that are appointed based on positions of influence and not credentials (ibid.).

There is however no consensus on the differences in public good provision and the type of government. Deacon (2009) found that democracies provide higher levels of public goods but Mulligan and Tsui (2006) argue that public policies have nothing to do with the level of political competition (interpreted as the degree of democracy). Mulligan et al. (2004) expected to find that democracy affects policies that redistribute / economically favor the political leadership / enhance efficiency but instead they found that democracy correlated with policies that limit competition for public office. This means that the type of government did not affect choice of public good provision, rather policies designed to keep them in power. Therefore, political competitiveness may have little to no effect on a wide range of economic and social policies, like the mix of taxes, or spending on social security. Instead, competitiveness is reflected by policies like military spending, torture, and execution, which more directly serve to protect the incumbent leader's position.

Political instability arises from popular uprising against a government that needs to attend to a socio-economic or political problem. These problems can take the form of poor economic growth, poor health systems, trade sanctions, income inequality, ethnic inequality and tribal differences to name a few. In an unstable democracy, the failure of public policies to resolve socio-economic problems results in political unrest which, in turn, will pave the way for a military or hostile takeover and the establishment of an authoritarian system (Pourgerami, 1988).

The next Chapter will conduct empirical studies on the data to determine whether or not political stability determines health investments and outcomes in the SADC region.

Chapter 4: Methodology

4.1 Demand for health capital: a simplified Grossman model

Health outcomes can be seen as outcomes of a health production function. The health production function used in this paper is based on Grossman's (1972) model of the demand for health. In this model, health is demanded for two purposes: consumption and investment. Health as an investment commodity is an important form of human capital. The core assumption of the model is that an individual inherits an initial stock of health capital that depreciates over time but can be increased through investment. Such gross investment is a function of a household's health seeking behaviour that includes factors such as diet, frequency in physical activities, time spent in recreation amenities and quality of housing. An investment in health increases stock of health, which improves health outcomes such as longer life expectancy and reduced maternal and infant mortality (Grossman, 1972). This investment can be undertaken by both the individual and the national government. Therefore the study adapts the original Grossman's model to socio-economic characteristics of the SADC region and includes, among the determinants of health, factors such as political stability, public health expenditure and the percentage of the population that lives in rural areas.

Therefore the first specification of the means of our outcome is modeled by the following health production function in which a country's health outcomes (H) depend on political stability (PS), GDP per capita (Y), public health expenditure per capita (PHE), a measure of a country's democracy level $(Polity)$ and a vector of other socioeconomic indicators (SE).

$$H = h(PS, Y, PHE, Polity, SE) \quad (1)$$

4.2 Model specification

Let H_{kit} be the health outcome k for country i at time t, we proceed to build a regression equation with the socio-economic covariates as control explanatory variables resulting in equation 2 below of the general estimation:

$$H_{kit} = \beta_0 + \beta_1 PS_{kit} + \beta_2 \ln(Y_{kit}) + \beta_3 \ln(PHE_{kit}) + \beta_4 Polity_{kit} + \gamma SE_{kit} + a_i + \tau_t + \varepsilon_{kit} \quad (2)$$

Where SE is a set of the socio-economic control variables (drawing from the literature, this includes the education, military spending, inflation, HIV incidence and the percentage of the population living in rural areas (inequality)), and $Polity$ is the democracy variable, a_i the difference between countries which is constant over time, τ_t the time specific random effect, and ε_{it} is the regression residual.

The fixed effects specification of the model is shown below:

$$H_{kit} = \beta_0 + \beta_1 PS_{kit} + \beta_2 \ln(Y_{kit}) + \beta_3 \ln(PHE_{kit}) + \beta_4 Polity_{kit} + \gamma SE_{kit} + a_i + \varepsilon_{it} \quad (3)$$

a_i (the unobserved time-invariant country effect) $\sim N(0, \sigma_a^2)$ and ε_{it} (the random error term) $\sim N(0, \sigma_\varepsilon^2)$.

The fixed effects model requires a specification of a correlation structure so we estimate the correlation structure from the data. The structure revealed by the data as shown in Tables A1 to A4 in the appendix show an autoregressive structure with values that are closer in time having a higher correlation than those further apart. Therefore an autoregressive correlation structure will be used to estimate the fixed effects.

Equations (2) and (3) regress the health-related outcome (life expectancy at birth, maternal mortality ratio and infant mortality rates and HIV incidence) over key socio-economic and political variables. Equations (4) and (5) are the specifications of the random and fixed effect models respectively that investigate the determinants of public health expenditure,

$$PHE_{kit} = \beta_0 + \beta_1 PS_{kit} + \beta_2 \ln(Y_{kit}) + \beta_3 Inflation_{kit} + \beta_4 Polity_{kit} + \gamma SE_{kit} + a_i + \tau_t + \varepsilon_{kit} \quad (4)$$

$$PHE_{kit} = \beta_0 + \beta_1 PS_{kit} + \beta_2 \ln(Y_{kit}) + \beta_3 Inflation_{kit} + \beta_4 Polity_{kit} + \gamma SE_{kit} + a_i + \varepsilon_{it} \quad (5)$$

In the estimation of what influences of government health expenditure as a percentage of total government expenditurePHE_{sit}, the analysis uses the dynamic theory of public spending where policy choices are made by a legislature consisting of representatives elected by

geographically-defined legislatures (Battaglini and Coate, 2008). The value of a public good is stochastic and it reflects shocks such as wars or natural disasters. The variables under investigation as potential determinants of public health expenditure, include political stability, democracy and inflation which erodes the value of any money that had previously been raised for public expenditure.

Both the random and fixed effects models will be run five times for each of the four health dependent variables and for the public health spending variable that comprise PHE_{sit} *using the explanatory variables listed in section 4.3.* However, depending on the dependent variable, some explanatory variables may not be significant or contribute to the variability in the response variable. The most explanatory parsimonious models will be built and interpreted.

A comparison of each pair of the fixed effect and random effect models is done using the Hausman test. This is done in order to determine the cross specification of each dependent variable. The Hausman specification tests the hypothesis that:

H_0: *There is no correlation between the errors and the regressor variables (use RE model)*

H_1: *There is correlation between the errors and the regressor variables (use FE model)*

The Hausman specification tests show that the most fixed effects models were favoured over the random effects model with p-values< 0.10 therefore we reject H_0 and use the fixed effects model.

Besley and Kudamatsu, (2006) use a fixed effects panel study to investigate the relationship between health and democracy, while controlling for various factors. Farag et. al. (2013) use the same in order to estimate the effect of health expenditure on health outcomes. Ruhm (2004) and (2006) also suggests the use of a panel study rather than time series when investigating linkages between the economy and health outcomes as this provides more robust outcomes. Therefore, the next step is to build a panel study rather than conduct time series analyses.

The main advantage of the fixed effects model is that it only uses within-subject variation, despite the fact that this can lead to lack of precision. Another major disadvantage is that parameters for time-invariant variables, such as country location, are not estimated since they

do not change with subjects over time (Gunasekara et. al., 2014). However, time-invariant covariates may be interacted with time-varying exposures of interest, e.g. to investigate whether the effect of income on health varies by sex, poverty status or education level. There are no time invariant variables in this analysis. Similarly, fixed effects models are not useful for investigating the exposure-outcome association in respondents who do not change their exposure levels (e.g. the effect of persistent political stability on health), or appear in just one time period, because only observations where the exposure varies contribute to the fixed effects estimate (ibid.). All countries in the dataset have varying political stability scores on each index over time and the model uses the continuous variables rather than the classification so this disadvantage does not affect the results of the estimation.

4.3 Data

This study endeavours to explain the variation in a few health outcomes that capture various aspects of an economy. Life expectancy, maternal mortality rate, neonatal and infant mortality rates and HIV incidence are key health indicators that will be used as dependent variables capturing health outcomes. Regarding public health investment, the percentage of total government spending that is allocated to public health is the dependent variable in that model. Before imposing a particular methodology on the analysis, data exploration is done to determine the data characteristics and a method suggested based on the findings. The dataset is strongly balanced.

4.3.1 Data Sources

All data were extracted from World Development Indicators (WDI) with three additional political indices obtained from sources that provide data on democracy and political stability. WDI is the primary World Bank collection of development indicators gathered from officially recognized international sources. It presents the most current and accurate global development data available and includes national, regional, and global estimates.

Table 4.1 List of the variables data and its sources

Data	Source
Health outcome variables	
Life expectancy at birth	WDI - United Nations Populations Division
Maternal Mortality Ratio annual estimates	WDI - WHO Maternal Mortality trends
Infant mortality rate	WDI - WHO Levels and Trends in Child Mortality
HIV incidence	WDI - WHO UNAIDS estimates
HIV prevalence	WDI - WHO UNAIDS estimates
Socio-economic variables	
Real GDP per capita	WDI - World Bank national accounts data
Consumer Price Inflation (consumer prices)	WDI - World Bank national accounts data
Public health expenditure (% of total health expenditure)	WDI - WHO Global Health Expenditure
Female Literacy	WDI - UNESCO Institute of Statistics
Political variables	
Political stability and absence of violence/ terrorism	World Bank – World Governance Indicators
Political stability and absence of violence	International Country Risk Guide Political Risk Services
Polity	Polity IV

In order to fully capture the effect of income inequality, the models used rural population instead of physicians per capita. The two variables are highly correlated and therefore rural population was chosen as it had less missing data for the countries in the dataset.

4.3.2 Variable explanation

Dependent variables

a) Life Expectancy at Birth

Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. It is affected by factors such as heredity, physical condition, lifestyle, nutrition, and occupation.

b) Maternal Mortality Ratio

Maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. This measure is widely accepted as a key indicator of health and socioeconomic development.

$$\frac{\text{Number of maternal deaths}}{\text{Number of live births}} * 100,000 \quad (6)$$

c) Infant Mortality Rate

Infant mortality rate is the number of deaths of infants under one year old per 1,000 live births. The probability that a child born in a specific year or period will die before reaching the age of 1 year, if subject to age-specific mortality rates of that period, expressed as a rate per 1000 live births. This rate is often used as an indicator of the level of health in a country. IMR is calculated as:

$$\frac{\text{Number of children who died before their first birthday (0–11 months of age)}}{\text{Number of live births (years of exposure)}} \quad (7)$$

d) HIV incidence

Number of new HIV infections among uninfected populations ages 15-49 expressed per 100 uninfected people in the population in the year before the period.

e) Public health expenditure

Public health expenditure consists of recurrent and capital spending from government (central and local) budgets, external borrowings and grants (including donations from international agencies and nongovernmental organizations), and social (or compulsory) health insurance funds. For this study public health expenditure is expressed as a percentage of total health expenditure. Following from the Battaglini and Coate (2008) dynamic theory of public expenditure, looking at the percent allocated to health as a percent of the total budget held by

the elected officials is useful to determine the value of health in relation to all other government expenditure.

Independent variables

f) HIV prevalence rate

This is defined as the percentage of the population living with HIV. Prevalence measures the frequency of existing disease in a defined population at a specific time.

g) GDP per capita

GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. The analysis will use the log of GDP values for easy interpretation.

h) Inflation

Inflation is measured by the consumer price index. It reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. This was calculated using the Laspeyres formula:

$$\frac{\sum_i p_{i1} q_{i1}}{\sum_i p_{i0} q_{i0}} \qquad (8)$$

i) Female literacy rate

Adult literacy rate is the percentage of people ages 15 and above who can both read and write with understanding a short simple statement about their everyday life. Literacy rate is an outcome indicator to evaluate educational attainment. It can be also used as a proxy instrument to see the effectiveness of an education system; a high literacy rate suggests the capacity of an education system to provide a large population with opportunities to acquire literacy skills. Having literate women implies that they can seek and use information for the betterment of the

health, nutrition and education of their household members. The variable is expressed as a percentage of the female population above 15.

j) Polity

The POLITY IV (2000) project from the University of Maryland calculates various measures of how a country is governed for 181 countries going back as far as 1800. For each year and country, a Polity Score is assigned which ranges from -10 to +10, with -10 to -6 being assigned to autocracies, -5 to 5 to anocracies, and 6 to 10 to democracies.

k) Political stability

The SFI data runs from 2005 and would limit the time on my dataset. MEPV documents major wars and armed conflict and would not fully capture the political instability that does not result in armed conflict like protests or high turnover of government officials. Therefore these two indices were not used. The study uses the political stability index as published by International Country Risk Guide (ICRG) Political Risk Services (PRS) whose index comprises various attributes of a government and its neighbours. The study also uses the composite index WB WDI to check for the robustness of the ICRG estimates and to determine the sensitivity of the coefficients to measurement errors. Similar techniques of using two indices to check for robustness were used by Swaleheen (2009) and Altun (2016). Table 4.2 explains the definitions of the two indices used in this study.

Table 4.3 shows a matrix of the 11 SADC countries in the panel and their political stability classification by each variable over the 20 year period. The indices do not classify countries as stable or unstable therefore this study uses a threshold of 0.7 for ICRG where countries scoring less than 0.7 for a particular year are classified as unstable and those scoring 0.7 and above are classified as stable. For the WB indicator, 0 is used as the cut-off point. Countries scoring above zero in a given year are classified as stable and those scoring below zero are classified as unstable. We denote s for stable and u for unstable. The variables were however included in the regression equation as the continuous variables that they come in.

Table 4.2 Definitions of the two political stability variables

	International Country Risk Guide (ICRG)	**World Bank World Governance Indicator (WB)**
Definition	This index between (0 and 1) is constructed by calculating a weighted average of the indices below: **Government stability** - A measure of both of the government's ability to carry out its declared program(s), and its ability to stay in office. The risk rating assigned is the sum of three subcomponents: Government Unity, Legislative Strength, and Popular Support. **Internal conflict** - A measure of political violence in the country and its actual or potential impact on governance. The risk rating assigned is the sum of three subcomponents: Civil War/Coup Threat, Terrorism/Political Violence, and Civil Disorder. **External conflict** - A measure of both the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc) to violent external pressure (cross-border conflicts to all-out war). The risk rating assigned is the sum of three subcomponents: War, Cross-Border Conflict,	The index of Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. It is an index measured between -2.5 and +2.5 is a composite index of numerous political stability variables. **Economist Intelligence Unit Riskwire & Democracy Index** - This variable includes, orderly transfers of power, armed conflict, violent demonstrations, social unrest and international tensions / terrorist threat. **World Economic Forum Global Competitiveness Report** - This reports the cost of terrorism. **International Country Risk Guide** - As defined already. **Cingranelli Richards Human Rights Database and Political Terror Scale** - Political terror scale. **iJET Country Security Risk Ratings** - Security risk rating **Institutional Profiles Database** - Intensity of internal conflicts: ethnic, religious or regional, intensity of violent activities of underground political organizations and intensity of social conflicts (excluding conflicts relating to land). **Global Insight Business Conditions and Risk Indicators** -

	and Foreign Pressures. **Ethnic tensions** - A measure of the degree of tension attributable to racial, national, or language divisions. Lower ratings (higher risk) are given to countries where tensions are high because opposing groups are intolerant and unwilling to compromise.	This index is made up of: **Protests and riots** - The risk that the nature and impact of protests and riots (excluding those related to labour) cause damage to assets or injure or detain people, particularly if these disrupt normal movement, business operations, and activity. **Terrorism** -The risk that the activities of any non-state armed group or individual cause (or are likely to cause) property damage and/or death/injury through violence. This risk definition includes terrorism, which uses violence (or the threat of) to advance a political cause, and similar tactics used by "for profit" organised crime. **Interstate war** - This risk measures resultant impacts (death/property damage) and means, covering the spectrum from targeted military strikes against limited targets to full-scale war with the aim of changing the government and/or occupation. **Civil war** - The risk of intra-state military conflict, in the form of an organised insurgency, separatist conflict, or full- blown civil war, in which rebels/insurgents attempt to overthrow the government, achieve independence, or at least heavily influence major government policies.
	Correlation coefficient of the two indices: 0.93	

4.4 Exploratory Data Analysis

4.3.1 Trends in political stability

Table 4.3 Country stability classification by {ICRG; WB}*

Country / Year	Angola	Botswana	DRC	Madagascar	Malawi	Mozambique	Namibia	S.Africa	Tanzania	Zambia	Zimbabwe
1996	u; u	s; s	u; u	s; s	s; u	u; u	s; s	s; u	s; u	s; u	s; u
1998	u; u	s; s	u; u	s; s	s; u	s; s	s; s	s; u	s; u	s; s	u; u
2000	u; u	s; s	u; u	u; s	s; u	s; u	s; u	u; u	s; u	s; s	u; u
2002	u; u	s; s	u; u	u; u	u; s	s; s	s; s	u; u	s; u	u; u	u; u
2003	s; u	s; s	u; u	u; s	u; s	s; s	s; s	s; u	s; u	u; s	u; u
2004	s; u	s; s	u; u	u; s	s; s	s; s	s; s	s; u	s; u	s; s	u; u
2005	s; u	s; s	u; u	u; u	u; s	s; s	s; s	s; u	s; u	s; s	u; u
2006	s; u	s; s	u; u	u; s	u; s	s; s	s; s	s; s	s; u	s; s	u; u
2007	s; u	s; s	u; u	s; s	u; s	s; s	s; s	s; s	s; u	s; s	u; u
2008	s; u	s; s	u; u	s; u	u; u	s; s	s; s	u; s	s; u	s; s	u; u
2009	s; u	s; s	u; u	u; u	s; s	s; s	s; s	s; u	s; s	s; s	u; u
2010	s; u	s; s	u; u	u, u	s; s	s; s	s; s	u; u	s; s	s; s	u; u
2011	u; u	s; s	u; u	u; u	u; u	s; s	s; s	u; s	s; u	s; s	u; u
2012	u; u	s; s	u; u	u; u	u; u	s; s	s; s	u; u	s; s	s; s	u; u
2013	u; u	s; s	u; u	u; u	u; u	s; u	s; s	u; u	s; u	s; s	u; u
2014	u; u	s; s	u; u	u; u	u; s	s; u	s; s	u; u	u; u	s; s	u; u
2015	u; u	s; s	u; u	u; u	u; s	s; u	s; s	u; u	u; u	s; s	u; u

*All data for 1997, 1999 and 2001 are missing.

Table 4.3 shows the classifications of each of the SADC countries under observation in this study. Angola was mostly unstable according to the ICRG index with stability from 2003 to 2010 before returning to instability. The WB index classified Angola as unstable for all the years.

Botswana was classified by both indices as being politically stable from 1996 through 2015. Conversely, the DRC was classified by both indices as being politically unstable throughout the period of observation as a result of the civil strife in that country with rebel insurgences and the assassination of President Kabila. Madagascar was classified as stable by both indices in 1996 and 1998 which was followed by differences in stability classification between the two indices. The country was however classified as unstable from 2009 till 2015. Malawi also has mixed classifications by the two political stability indices with concurrence from 2008 where both indices classified the country as unstable followed by two years of stability then three years of instability then non-concurrence.

Mozambique was generally classified as stable after instability in 1996. In the last three years, the ICRG index classified the country as stable but the WB index classified the country as unstable. Namibia was classified as stable by both indices in all years except in 2000 when the WB index classified the country as unstable. South Africa and Tanzania have similar stability rankings by both indices without concurrence in most years. Both countries are classified as unstable in the last two years. Zambia was mostly stable with instability in 2002 during the drought. Finally, Zimbabwe was reported as unstable for most of the period under observation due to the economic decline in the country that resulted in political instability.

4.4.2 Summary statistics

Table 4.4 Summary statistics for each country for 1996-2015

Country	Angola			Botswana			Congo, D.R.		
Variables	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Life expectancy	48.20	42.50	52.67	56.76	48.61	64.49	53.85	49.00	59.02
Maternal mortality	734.20	477.00	1120.00	237.50	129.00	338.00	813.80	693.00	920.00
Infant Mortality	117.64	96.00	132.30	45.30	34.80	53.10	94.85	74.50	113.80
HIV incidence	0.23	0.19	0.25	2.15	0.94	4.68	0.12	0.03	0.23
HIV prevalence	1.83	1.10	2.20	24.15	22.20	26.00	1.52	0.80	1.90
GDP per capita	2460.72	421.38	5327.15	4930.59	2854.67	7504.85	263.75	100.69	456.05
Inflation	279.36	7.28	4145.11	7.84	3.06	12.70	112.91	1.63	513.91
Public health expenditure	58.80	42.41	72.26	58.96	42.41	72.26	22.63	3.09	47.11
ICRG political stability	0.69	0.51	0.75	0.84	0.76	0.91	0.44	0.23	0.54
WB political stability	-0.89	-2.31	-0.23	1.02	0.87	1.11	-2.23	-2.84	-1.98
Polity	-3	-6	-2	8	7	8	-3	-8	5

Country	Madagascar			Malawi			Mozambique		
Variables	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Life expectancy	61.08	55.43	65.48	51.13	43.56	63.80	51.07	46.56	55.37
Maternal mortality	485.30	353.00	612.00	735.30	613.00	952.00	758.55	489.00	1100.00
Infant Mortality	55.13	35.90	83.10	76.34	43.40	119.50	91.54	56.70	138.30
HIV incidence	0.05	0.02	0.10	1.17	0.38	2.30	1.22	0.71	1.52
HIV prevalence	0.44	0.30	0.60	13.43	9.10	16.70	9.46	4.80	11.20
GDP per capita	342.62	243.57	472.38	307.26	149.37	524.31	393.43	214.73	623.20
Inflation	9.49	-1.22	19.76	18.65	7.41	44.80	10.15	1.48	48.49
Public health expenditure	51.07	42.39	61.73	53.41	27.38	73.96	59.53	42.74	70.31
ICRG political stability	0.67	0.58	0.76	0.68	0.59	0.89	0.79	0.69	0.86
WB political stability	-0.21	-0.98	0.62	-0.03	-0.45	0.12	0.14	-0.51	0.63
Polity	6	0	9	6	4	6	5	4	5

Country	Namibia			South Africa			Tanzania		
Variables	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Life expectancy	59.06	54.11	64.92	55.12	51.56	60.61	56.57	48.75	65.49
Maternal mortality	335.05	265.00	391.00	113.35	60.00	154.00	665.20	398.00	944.00
Infant Mortality	42.96	32.80	49.40	46.45	33.60	54.70	60.26	35.20	93.80
HIV incidence	1.54	0.68	3.29	2.12	1.30	3.54	0.54	0.21	0.98
HIV prevalence	15.21	11.40	17.40	18.50	10.30	21.00	6.48	4.70	8.00
GDP per capita	3591.04	1716.90	5679.88	5054.38	2518.40	8049.95	523.32	217.48	957.93
Inflation	5.74	2.28	9.45	6.03	1.39	11.54	9.02	4.74	20.98
Public health expenditure	59.60	43.46	73.33	44.14	39.97	48.62	51.52	39.14	69.40
ICRG political stability	0.85	0.79	0.89	0.71	0.65	0.79	0.74	0.66	0.80
WB political stability	0.71	-0.25	1.20	-0.13	-0.54	0.22	-0.36	-0.85	0.09
Polity	6	6	6	9	9	9	-1	-1	-1

Country	Zambia			Zimbabwe		
Variables	Mean	Min	Max	Mean	Min	Max
Life expectancy	50.56	42.02	60.79	46.78	40.68	59.16
Maternal mortality	391.55	224.00	598.00	524.65	369.00	657.00
Infant Mortality	72.11	43.30	106.10	58.20	46.60	63.50
HIV incidence	1.32	0.85	1.92	1.66	0.88	3.74
HIV prevalence	14.27	12.90	15.80	19.24	14.70	26.00
GDP per capita	928.46	330.22	1839.52	610.47	327.20	931.20
Inflation	16.90	6.43	43.07	1496.46	-2.40	24411.03
Public health expenditure	49.26	41.17	58.00	37.28	7.43	62.30
ICRG political stability	0.76	0.61	0.89	0.63	0.44	0.78
WB political stability	0.27	-0.28	0.66	-0.99	-1.52	-0.46
Polity	5	1	7	-3	-6	4

Madagascar has the highest mean life expectancy of 61 years even though the whole dataset has a narrow range of between 40 and 66 years with an average of 53.65 years. Higher mean life expectancy is in Namibia, Botswana and Tanzania, all of which are mostly politically stable countries. Maternal mortality is highly variable with a minimum of 60 in South Africa and a maximum of 1120 in Angola. Infant mortality is much lower in comparison to maternal mortality with a maximum of 138.30. HIV incidence ranges from as low as 0.02 to 4.68% with corresponding HIV prevalence ranging from 0.3 to 26%. As far as GDP per capita goes, economic prosperity in the SADC region ranged from $149 in Malawi to $8050 in South Africa showing the vast differences in income in the region. Extreme values of inflation go as high as 24 411% in Zimbabwe where prices increased multiple times a day and as low as -1.22% in Madagascar. The percentage of government expenditure allocated to health ranges from 3% to 74% resulting in different health outcomes.

The ICRG political stability variable is between the {0; 1} bounds as stated by PRS with a minimum of 0.23 and a maximum of 0.91. The dataset shows the minimum value of the World Bank political stability variable as 2.84 yet the index is said to be between -2.5 and +2.5.

The next section shows two-way plots of each of the dependent variables and the explanatory variable of interest - political stability. The continuous data of the two political stability indices over the 20 year period are used in order to establish a relationship between each of the dependent variables and political stability (profile analysis). The key question is to determine whether there is a linear relationship between political stability and the health outcome of interest.

Table 4.5 Pearson Correlation matrix between political stability and health outcomes for each country

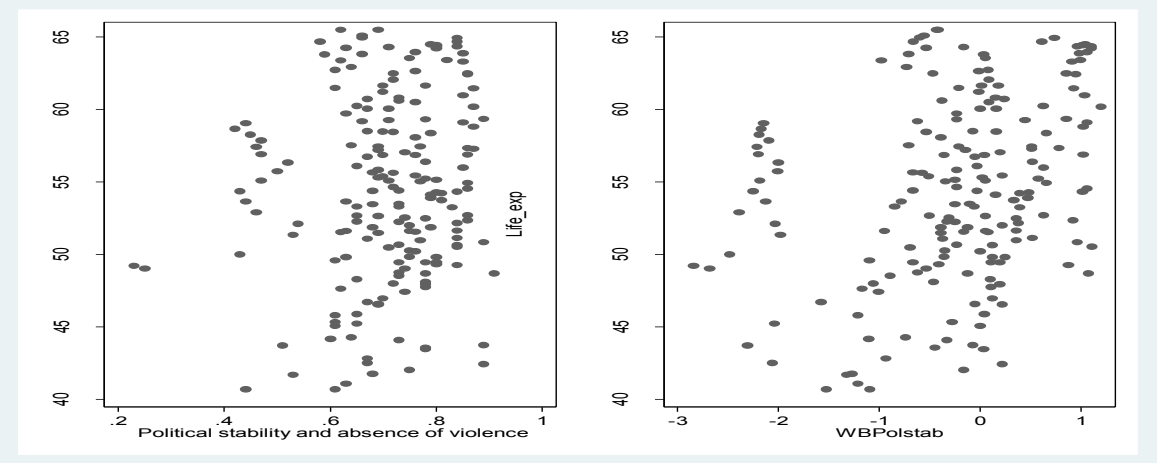
Country	Polstab index	Life expectancy	MMR	IMR	HIV incidence	Public health expenditure
Angola	ICRG; WB	0.36; 0.94	-0.40; -0.95	-0.13; -0.83	0.41; -0.15	0.05; 0.49
Botswana	ICRG; WB	-0.75; 0.31	0.73; -0.33	0.79; -0.32	0.56; -0.24	-0.41; 0.43
Congo, D.R.	ICRG; WB	0.46; 0.61	-0.53; -0.69	-0.45; -0.60	-0.49; -0.64	0.53; 0.66
Madagascar	ICRG; WB	-0.70; -0.71	0.71; 0.74	0.67; 0.72	0.35; 0.32	-0.56;-0.54
Malawi	ICRG; WB	-0.54; 0.26	0.66; -0.64	0.73; -0.55	0.71; -0.53	-0.57; 0.74
Mozambique	ICRG; WB	0.07; -0.11	-0.13; 0.08	-0.18; 0.02	0.43; 0.41	-0.21; -0.36
Namibia	ICRG; WB	0.35; 0.59	-0.25; -0.38	-0.18; -0.56	0.06; -0.46	-0.03; -0.32
South Africa	ICRG; WB	-0.47; -0.54	-0.40; 0.73	0.59; -0.34	0.12; -0.81	-0.50; 0.50
Tanzania	ICRG; WB	-0.24; 0.55	0.23; -0.54	0.19; -0.54	0.27; -0.49	-0.03; -0.28
Zambia	ICRG; WB	-0.11; 0.64	0.09; -0.69	0.13; -0.67	0.12; -0.65	-0.62; -0.13
Zimbabwe	ICRG; WB	0.37; 0.70	-0.37; -0.68	-0.25; -0.56	0.31; 0.26	-0.30; -0.16
All countries	ICRG; WB	0.13; 0.32	-0.42; -0.58	-0.29; -0.50	0.45; 0.40	0.52, 0.55

Author's own calculations from the data

Mozambique and Namibia have a few significant associations between the health outcomes and the political stability indices. For these countries there is also very little variability in the political stability indices and the health outcomes.

Life expectancy has a significant positive relationship with political stability for within country data but not for the full dataset. As political stability improves, life expectancy increases. However in Madagascar and South Africa, life expectancy has a strong negative correlation with political stability because their life expectancy was increasing over time despite a decrease in political stability. Table 4.5 is supported by the two–way scatter plots below that show the relationship between the health outcomes for the full dataset and political stability.

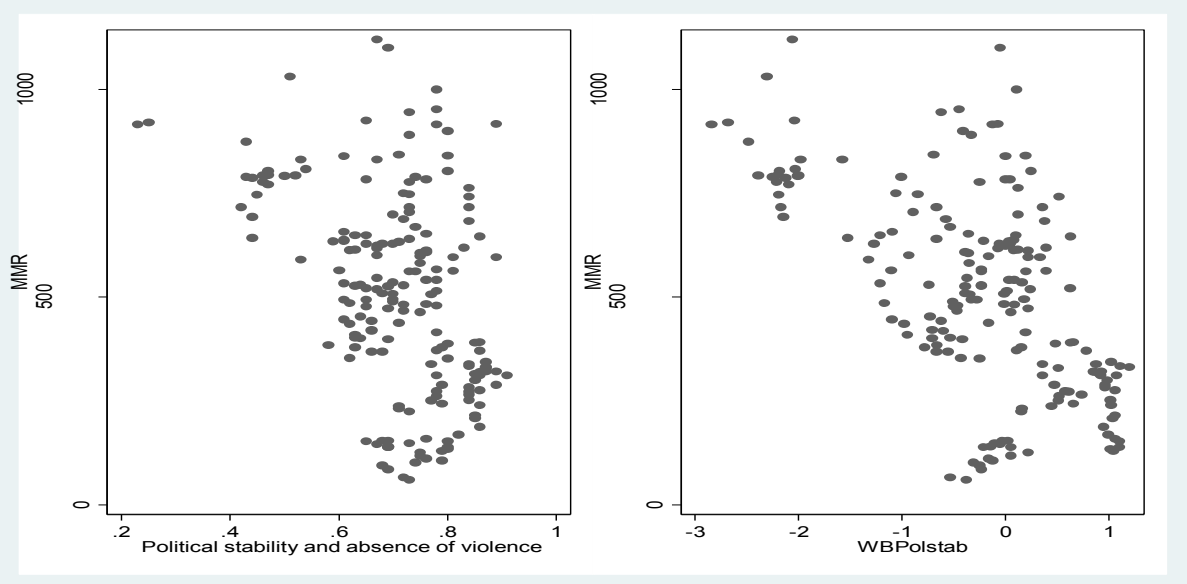
Figure 4.1 Scatter plot showing the relationship between Life expectancy and political stability



ICRG WB

Maternal mortality rate and infant mortality rate are significantly negatively correlated according to the World Bank political stability index in most countries and overall. Figures 4.2 and 4.3 also show these relationship patterns.

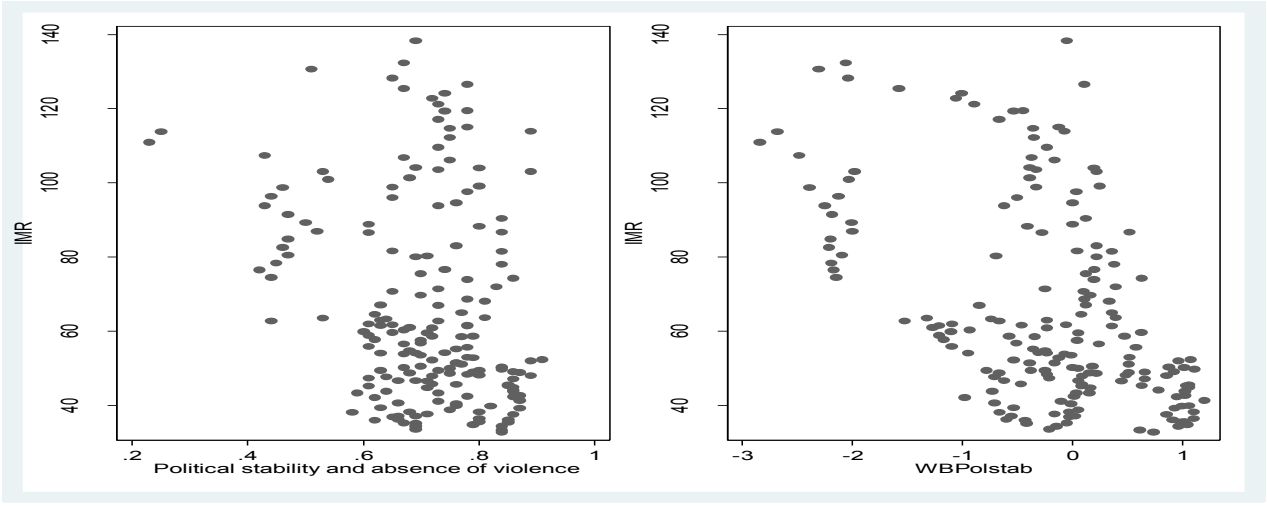
Figure 4.2 Scatter plot showing the relationship between maternal mortality ratio and political stability



ICRG WB

Figure 4.2 shows a negative and linear relationship between political stability and maternal mortality ratio.

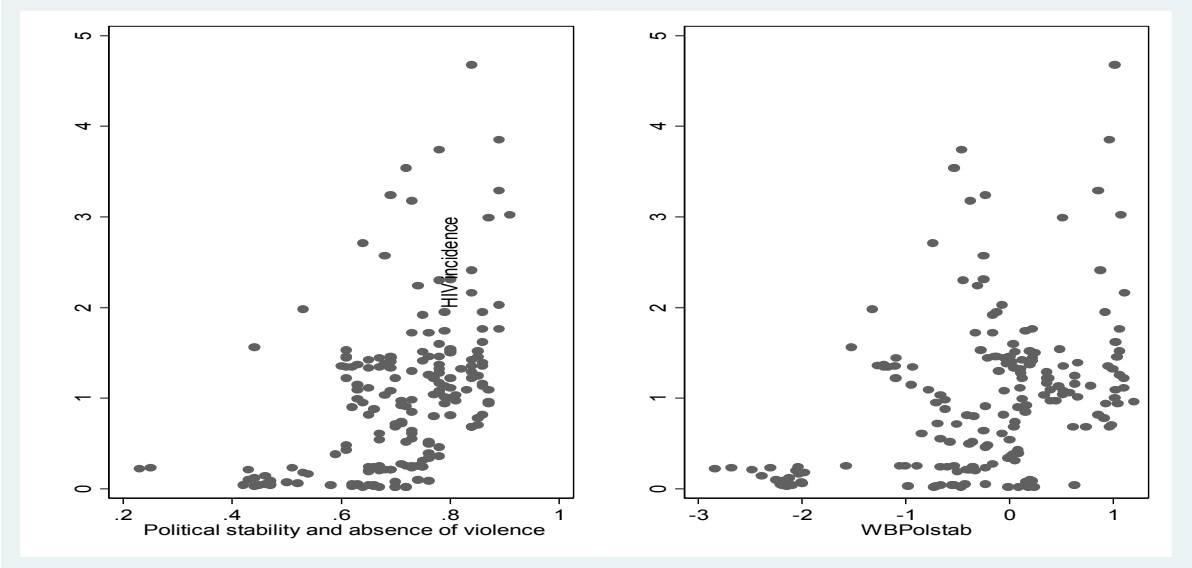
Figure 4.3 Scatter plot showing the relationship between infant mortality rate and political stability



ICRG WB

Figure 4.3 shows a negative and linear relationship between WB political stability and infant mortality rate.

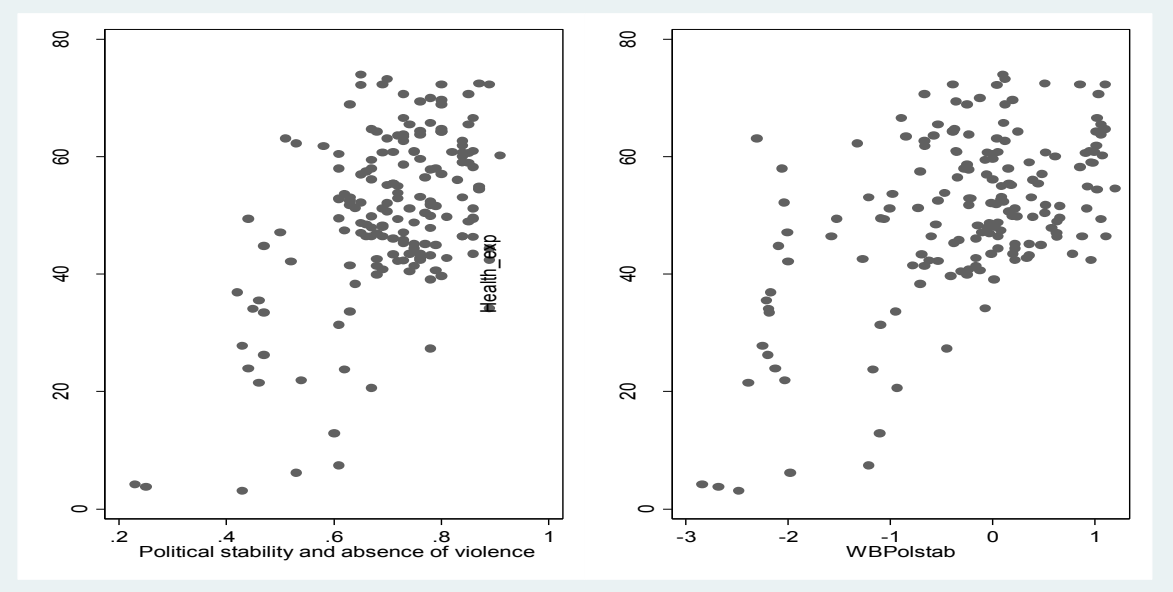
Figure 4.4 Scatter plot showing the relationship between HIV incidence and political stability



ICRG WB

Figure 4.4 shows a positive and exponential relationship between political stability and HIV incidence. Politically stable countries have higher HIV incidence. This may be unique to our dataset as noted in the profile analysis. In the dataset, South Africa, Namibia and Botswana have the highest HIV incidences and they also have the least political instability. These countries account for the extreme on the right of the graph.

Figure 4.5 Scatter plot showing the relationship between public health expenditure and political stability



ICRG WB

Figure 4.5 shows a positive and linear relationship between political stability index and public health expenditure.

Before embarking on the exercise of model building, we test for multicollinearity among the explanatory variables. This is done so that we do not include variables that are highly correlated in the model as this will distort the β coefficient.

Table 4.6 Correlation matrix of the explanatory variables

Variables	Log gdp	Gvt public health expenditure	WB Political stability	ICRG Political stability	Polity	Military expenditure	Inequality	Health expenditure per capita	Female Literacy	HIV prevalence
Log gdp	1.00									
Gvt public health expenditure	0.09	1.00								
WB Political stability	0.47	0.59	1.00							
ICRG Political stability	0.41	0.43	**0.93**	1.00						
Polity	0.56	0.14	0.06	-0.10	1.00					
Military expenditure	-0.50	0.06	0.09	0.18	-0.29	1.00				
Inequality	**-0.85**	**-0.85**	0.28	-0.03	-0.68	0.54	1.00			
Health expenditure per capita	**0.93**	0.07	0.28	0.15	0.64	-0.58	**-0.88**	1.00		
Female Literacy	**0.89**	0.19	0.44	0.33	0.52	-0.44	-0.81	**0.87**	1.00	
HIV prevalence	**0.91**	0.13	0.52	0.42	0.58	-0.53	**-0.73**	**0.83**	**0.71**	1.00

From this table 4.6, log GDP per capita is highly correlated with health expenditure per capita which is intuitive. Increased income results in increased expenditure on health. Inequality is negatively correlated with the health expenditure per capita and the log of GDP. The higher the rural population, the lower the GDP and therefore lower per capita health expenditure. Female literacy as a proxy for education is highly correlated with inequality and health expenditure per capita.

Other things being equal, an independent variable that is very highly correlated with one or more other independent variables will have a relatively large standard error. This implies that the partial regression coefficient is unstable and will vary greatly from one sample to the next (Allen, p.176, 1997). The presence of the multicollinearity here has no impact on the estimation of the model coefficients for the main variables of interest, political stability since the political stability indices do not correlate highly with any of the independent variables. The statistical significance of the primary relationship being studied here will therefore not be affected.

So this type of collinearity can simply be ignored. The two political stability variables are highly correlated between themselves but they are not correlated with the other variables, therefore the effect of political stability will be accurately measured due to this.

4.5 Data Quality and Methodology Limitations

Data quality in a country is dependent on a certain degree of political stability. Data may be unreliable or missing in years of political instability. Data quality in Africa is deemed to be poor in some countries as highlighted in Jerven and Johnston (2015). Data quality in the SADC region

is not very good. According to the UNESCO education data quality assessment exercise (2014) data quality, accessibility and integrity are especially weak and should be strengthened in Madagascar, Mozambique, Swaziland and Zimbabwe. Variables such as military spending are missing 46% of the values of the required 220 observations. They have been dropped from the analysis despite their importance. Overall, more data points would have given better estimations of the effect parameters but the age of the SADC states imposed a restriction on when the first data points could be obtained. The late independence of Namibia (1990) and South Africa (1994), pushed the earliest possible year for the panel study to the mid 1990's. Important variables like the Gini coefficient as a measure of inequality were excluded from the analysis due to difficulty in obtaining the variable and this was substituted by the percentage of the population that lives in the rural areas as a proxy.

Chapter 5: Results and Discussion

Heteroscedasticity and autocorrelation are controlled for in all the models and robust estimates of standard errors are obtained. Results for the log of health outcomes are presented in Table 5.1. All analyses were run using the ICRG political stability variable in one instance and the WB WGI political stability in another to explain the health outcomes. This allows us to account for differences observed in measuring political stability variables as highlighted earlier.

Furthermore the analysis tested for endogeneity in all the models calculating the correlation between the X variables and the error term and the results for each model are listed in Table 5.1. There is no endogeneity in any of the models. All the models are significant with F-test p-values <0.001. The hypothesis being tested by the F-tests is:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

$$H_1: At\ least\ one\ \beta_i \neq 0\ (the\ model\ is\ valid)$$

With p-values less than 0.01, we reject H_0 and conclude that all the models are valid.

The hypothesis being tested by the p-values for the political stability variable is:

$$H_0: \beta_1 = 0\ (political\ stability\ has\ no\ effect\ on\ the\ health\ outcome\ s)$$

$$H_1: \beta_1 \neq 0\ (political\ stability\ has\ an\ effect\ on\ the\ health\ outcome\ s)$$

5.1 Empirical results and Interpretation

5.1.1 Political stability and health outcomes

As mentioned earlier the regressions are run for each of the selected health-related outcomes. Model 1 uses the ICRG political stability index and Model 2 uses the WB WGI political stability index. ICRG political stability is statistically significant in explaining all the health outcomes and the WB WGI political stability is significant for the infant mortality and HIV incidence only. We control for HIV prevalence due to the harmful effects that the pandemic had in the SADC region during the period under study, as explained in Chapter 2. HIV prevalence proved to be

significant in explaining all the health outcomes, it has a negative effect on health outcomes while GDP, education and political stability have a positive effect. Higher incomes in stable environments promote longer lives. Controlling for inflation and the unemployment rate in addition to income did not improve the model. The two additional variables were not significant in any of the models and when they were added, income also became insignificant. Therefore the two economic variables have been left out of the health outcome models. The democracy measure polity was not significant in explaining any of the health outcomes but was significant in explaining the variability in public health expenditure.

5.1.1.1 ICRG political stability index (Model 1)

Holding all other variables constant, when the ICRG political stability index increases by 1 unit (more stability), life expectancy increases by 0.19% (p-value < 0.05), maternal mortality ratio decreases by 1.37% (p-value <0.01), infant mortality rate decreases by 2.01% (p-value <0.01) and HIV incidence decreases by 3.48% (p-value <0.1). GDP was highly significant in the models built for the health outcomes, countries with higher GDP have better health outcomes. When other covariates are held constant, the income elasticities of life expectancy, maternal mortality ratio, infant mortality rate and HIV incidence are 0.29% (p-value<0.01), -0.36% (p-value<0.01), -1.13% (p-value<0.01) and -2.05% (p-value<0.01) respectively. A percentage increase in HIV prevalence resulted in a 0.03% (p-value<0.01) decrease in life expectancy, a 0.1% (p-value<0.001) increase in the maternal mortality ratio, a 0.02% (p-value<0.01) increase in infant mortality and a 0.1% (p-value<0.01) increase in HIV incidence. Government health expenditure was not significant for maternal mortality and HIV incidence. The health investment elasticity of an additional percent of government investment on life expectancy is -0.002% (p-value<0.01) and -0.01% for infant mortality (p-value<0.001). Controlling for GDP per capita reduces the effect of government expenditure when public health expenditure was in the model without controlling for income.

5.1.1.2 WB political stability index (Model 2)

Holding all other variables constant, when the WB political stability index increases by 1 unit (more stability), infant mortality rate decreases by 0.27% (p-value <0.01) and HIV incidence decreases by 0.40% (p-value <0.1). Similar to what was previously observed, GDP was significant in all the models for the health outcomes. When other covariates are held constant, the income elasticities of life expectancy, maternal mortality ratio, infant mortality rate and HIV

incidence are 0.30% (p-value<0.01), -0.32% (p-value<0.01), -1.34% (p-value<0.01) and -1.92% (p-value<0.01) respectively. A percentage increase in HIV prevalence yielded the same coefficients as those obtained from the use of the ICRG index. Government health expenditure was only significant in explaining HIV incidence, the health investment elasticity of an additional percent of government investment on HIV incidence is -0.03% (p-value<0.01. Similarly, controlling for GDP per capita reduced the effect of government expenditure or made it insignificant depending on the health outcome. All standard errors are small suggesting very little variability within the coefficient estimates.

Table 5.1: Fixed effects model coefficients with robust errors for health outcomes

Response variable	Log Life expectancy		Log Maternal Mortality Ratio		Log Infant Mortality Rate		HIV incidence	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
HIV prevalence	-0.026***	-0.026***	0.104***	0.100***	0.022***	0.024	0.106***	-0.093***
	(0.001)	(0.004)	(0.004)	(0.013)	(0.002)	(0.017)	(0.027)	(0.050)
Log GDP	0.292***	0.303***	-0.357***	-0.323***	-1.126***	-1.340***	-2.050***	-1.929***
	(0.017)	(0.015)	(0.122)	(0.188)	(0.067)	(0.103)	(0.296)	(0.289)
Political stability	0.194**	0.003	-1.369***	0.015	-2.014***	-0.266***	3.477*	0.402*
	(0.11)	(0.01)	(0.478)	(0.140)	(0.203)	(0.073)	(1.854)	(0.189)
Female literacy (Education)	0.002***	0.002**	-0.002	-0.004	-0.005***	-0.004	0.006	-0.014**
	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)	(0.002)	(0.005)	0.006
Government public health expenditure	0.002***	-0.0001	0.005	0.013	-0.010***	0.001	-0.006	-0.031***
	(0.001)	(0.000)	(0.003)	(0.002)	(0.001)	(0.002)	(0.006)	(0.005)
Constant	3.59***	3.29***	6.65***	5.35***	5.56***	8.04***	5.93***	8.50***
	(0.126)	(0.092)	(0.359)	(0.800)	(0.119)	(0.468)	(1.679)	(1.187)
F-statistic	222.92***	435.5***	491.11***	330.15***	3082.82***	71.15***	24.59***	46.09**
R-squared (within)	0.95	0.93	0.95	0.82	0.95	0.87	0.82	0.75
Corr(e, x):Testing Endogeneity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.15

Notes: *** Significant at the 1% level, **significant at the 5% level, *significant at the 10% level. Robust standard errors in parentheses.

5.1.2 Political stability and public health expenditure

The results for this section are shown in Table 5.2. In trying to explain the effect of political stability on the decision to allocate public funds to health, holding all else constant, a 1 unit improvement in political stability results in an increase of 0.31% (p-value<0.01) in public health expenditure when using the ICRG index for political stability. The alternative WB measure is not statistically significant. A percentage increase in GDP has an elasticity of 0.31% (p-value<0.05) on public health allocation for ICRG estimation and 0.33% (p-value < 0.1) when the WB measure is used. Inflation reduces public health spending by 0.01% when it increases by 1 unit. This is intuitive because inflation erodes the value of money. Countries with higher education levels allocate higher percentages to public health, 0.01% (p-value<0.05) increase for both political stability measures. This may be due to the increased demand for health services and government accountability by an educated population. The data show that democratic countries allocate greater portions of the budget to health than non-democracies. A unit increase in the polity index, results in an increase of 0.02% (p-value<0.01) in public health expenditure when using the ICRG index holding all other variables constant.

The use of the WB index results in no significance of the inflation and democracy variables. When military expenditure is added to the model, it is significant and political stability ceases to be significant because of the high correlation between political stability and military expenditure. Adding health outcomes like HIV prevalence or life expectancy to try and explain public health expenditure did not yield a significant result due to multicollinearity among the explanatory variables. Health outcomes are highly correlated with education and GDP per capita.

Table 5.2: Fixed effects model coefficients with robust errors for health investment

Response variable	Gvt. public health exp. (% of total gvt exp.)	
	Model 1	**Model 2**
Log GDP	0.311**	0.325*
	(0.121)	(0.173)
Political stability	2.033***	0.243
	(0.587)	(0.155)
Inflation	-0.012**	-0.018
	(0.005)	(0.011)
Female literacy	0.008**	0.011**
	(0.004)	(0.004)
Democracy	0.023**	0.013
	(0.009)	(0.013)
Constant	5.68***	4.14***
	(0.353)	(0.590)
F-statistic	92.33***	14.69***
R-squared (within)	0.74	0.42
Corr(e, x):Testing Endogeneity	0.00	0.00

Following from the results, political stability is seen to be a significant determinant of health outcomes and public health provision. The results are in line with previous findings observed in the literature. Sedda (2015) finds political instability as an important factor determining the success of the malaria elimination programming in African countries where conflict destroys the infrastructure that is intended to reach sick patients. Using rather a qualitative approach, Ghobarah (2004), Dupas and Robinson (2012) and Wise (2015) argue that countries with political instability have bad health outcomes. The results also show the effect of income on health outcomes. The income elasticity of life expectancy, maternal mortality ratio, infant mortality rate and HIV incidence are 0.29% (p-value<0.01), -0.36% (p-value<0.01), -1.13% (p-value<0.01) and -2.05% (p-value<0.01) respectively. But these effects are higher than those of public health expenditure. This dissertation finds a statistically significant relationship between the percentage that the government allocates to public health and health outcomes but it is a negligible coefficient of 0.001% improvement after controlling for national income, education and political stability. Farag et al. (2013), Makuta and O'Hare (2015) also find this result when

controlling for governance for which political stability is sometimes used as a proxy. Rajkumar and Swaroop (2008) find that public spending has virtually no impact on health and education outcomes in poorly governed countries. This is relevant for policy in developing countries, where public spending on education and health is relatively low, and the state of governance is often poor (ibid.). In a study involving eight East African countries, Bein et.al, (2017) find a strong and positive association between total healthcare expenditures and total life expectancy and a negative relationship between healthcare expenditures and the number of neonatal, infant, and under-five deaths. These findings have important implications for enhancing the development effectiveness of public spending. Filmer and Pritchett (1999) find that public health expenditure is statistically insignificant once they control for income per capita and other covariates. Wagstaff and Claeson (2004) treated public health expenditure as endogenous and found that there is not a statistically significant relationship between public health expenditure and health outcomes. Wagstaff and Claeson (2004) go on to mention that the link between public health expenditure and health outcomes could be strengthened by improving governance however the interaction term between political stability and public health expenditure did not yield any statistical significance in the models. The analytical framework by Mosley and Chen (1984) which incorporates social, economic, biological and environmental variables in the production of health is an extension of the health production function by Grossman (1972). They summarise the relationship between health outcomes and health spending to be:

Socio-economic status → proximate determinants of health → risk of disease → health outcomes.

This model suggests that the socio-economic inputs such as public health expenditure, income (GDP) and level of education do not directly impact health outcomes but affect health indirectly through proximate determinants which may explain the low levels of significance of the health investment on outcomes.

Public health expenditure is explained by political stability, a country's level of democracy, GDP and inflation. The literature does not have a lot of information on the effect of political stability on public health spending but there is more information on the effects of GDP and democracy. Our results add to the literature and show that holding all else constant, a unit increase in political stability increases public health expenditure by 2.03%. Our results remain consistent with previous studies who identified GDP as the most important factor affecting public health

expenditure (Okunade, 2005; Murthy and Okunade, 2009; Gbesemente and Gerdtham, 1992). The school of thought that proffers a link between political stability and economic development finds that political instability negatively affects growth. (Feng, 1997; Zghidi, 2017) This suggests that the effect of political stability on health outcomes and investment may be direct and indirect.

Democracies are argued to provide better public services (McGuire and Olson, 1996; Niskanen, 1997; Besley and Kudamatsu, 2006). The data show that the effect of a unit increase in polity yields 0.02% increase in public health expenditure. Health outcomes such as life expectancy and infant mortality have also been investigated in how they affect healthcare expenditure but these were not significant in the models ran in this research. This is consistent with the findings from other studies where the epidemiology of the region is incorporated as a covariate through various proxies. Lu et al (2010) used HIV sero-prevalence as a proxy for health and found that it had no significant relationship with general government health expenditure as a share of GDP. Murthy and Okunade (2009) found that maternal mortality rate had no relationship with health expenditure in African countries.

Finally, different measures of political stability do not always yield significance in the model. This is largely due to the differences in calculating the two indices which shows the robustness of the estimates when there are measurement differences in the indices.

5.2 SADC country specific mechanisms

From Table 4.4, six countries are largely classified as unstable by both indices namely: Angola, the DRC, Madagascar, Malawi, South Africa and Zimbabwe.

The DRC conflict left the country poor. According to the WHO (2006) report on rebuilding health systems in the DRC, poverty, displacement, limited access to health services and bad environmental health conditions were exacerbating the high vulnerability of the population to poor health. Health access is limited due to insecurity, poor logistics and infrastructure, lack of medicines and low level of training of health workers. In this case, the government was left with very little resources for public service expenditure. They faced a budget constraint of having a finite amount of money for development and this, coupled with a bigger budget for infrastructural replacement and then service delivery hence the poor outcomes there were a result of lack of

access. This is the same situation in Angola and Mozambique where more than 30 years of war completely destroyed infrastructure including health care centres and roads.

The South Africa economic situation is the result of poor implementation of policy interventions, weaknesses in collective decision making and poor execution of policies and strategies, combined with the damaging effects of state capture and corruption. South Africa has suffered the effects of instability in the region (political or otherwise) and has seen an influx of refugees and economic migrants from countries such as Mozambique, Zimbabwe, Angola, the DRC and even as far afield as Cameroon and Nigeria. This has put pressure on the health system where the country was already facing challenges to health access. Similarly, Malawi suffered from an influx of Mozambican refugees and that put pressure on already weak health resources. Malawi's experience with Mozambican refugees upset the stability of its health care system, burdening resources and leading to degradation of health care for Malawians and refugees alike (Feder, 1998). Malawi and other African countries suffer from corruption that adversely affected the health system as funds allocated for public health were misused (Rispel, 2015).

Governments need to rid the state of corruption, ensure policy consistency and certainty, promote macroeconomic stability, address weaknesses at public institutions, and ensure better use of public resources in infrastructure, education and health. The credibility of institutions is the biggest problem as a result of corruption and the economy does not grow enough to support the population. The public health sector is under-funded, mismanaged and neglected, a phenomena evidenced more so in the Eastern Cape but also seen in other provinces (Mayosi et. al., 2014). Post 2005, the availability of ARVs reduced mortality figures and improved life expectancy once civil society and the international community had put pressure on the government to fund HIV treatment. HIV incidence is a function of the investment in treatment because the lack of treatment means the HIV infected can easily spread the virus. In addition, lower national income results in higher poverty which leads to HIV risky employment becoming attractive thus also spreading HIV.

In Zimbabwe, the late 1990s saw the country sending troops to the DRC. This cost the country money that was diverted from public sector provision. Subsequently, strikes broke out and political competition entered the scene. This spiraled into political instability which resulted in unrest that led to the controversial land reform. The violent land reform was retaliated by international trade sanctions which saw a decline in the local economy due to lack of foreign currency and reduced public spending as government revenue fell. The poor health outcomes therefore resulted from lack of investment in public infrastructure, increased risk of disease from

dilapidated social infrastructure and poor nutrition from reduced income. Donor funding that had been playing an important role in the sector, fled at the height of political instability further reducing the public sector investment in health.

Chapter 6: Conclusion and Recommendations

6.1 Conclusions

Factors that distinguish health economics from other areas include extensive government intervention, intractable uncertainty in several dimensions, asymmetric information, barriers to entry, externalities and the presence of a third-party agent. Weakened institutions and poor governance due to political instability has been shown to adversely affect health investments and therefore outcomes. The effects of political stability on health outcomes require much attention and results from such studies could inform policies differently. The temptation is usually to place interventions in different areas that are suffering from specific illnesses without addressing the root of the problem. This will result in band aid solutions as opposed to long term problem solving approaches that address political and governance-related problems. This Masters dissertation investigates the extent to which political stability affects health outcomes. Our results found strong relationships between political stability and health-related outcomes (life expectancy at birth, HIV incidence, maternal mortality, infant mortality and investment in the health sector.

6.2 Policy Recommendations

Recognising the social determinants of health has become an important aspect of global health policy. What has been less recognised is how health services and outcomes affect political and social outcomes. This follows from the hypothesized linkages that are proffered in Chapter 3. An understanding of these linkages can help the government plan for health related investment with the end goal of having a healthy population and to avert political instability in the future.

The health system can be seen as political currency. The population needs to be assured that if there is a health crisis, it can be addressed sufficiently by the government or an agent employed by the government. This assurance by the population brings political legitimacy to the current government as the outputs like a healthy nation and economic growth show the legitimacy of the government more than how they got into power. Therefore, consistency in public health provision, whether by a donor or another agent, could ensure that political instability does not arise from poor health outcomes. Beyond, political stability, this dissertation includes other

sources of political stability like inequality, ethnic divisions and political party infighting, and investigates the extent to which they affect health-related outcomes.

6.2.1 Political stability, public financing and governance

While comprehensive political stability and good governance are important goals, they cannot be seen as the only precondition for improved health outcomes. Provision of health services during periods of war may be difficult if not impossible. However, the areas experiencing the highest levels of maternal/neonatal mortality in Africa are mostly characterised by weak governance, corruption, lack of rule of law, civil conflict, degraded health infrastructure and insecure food supplies. These conditions can still allow for the provision of public goods as seen by the reduction in HIV incidence and decreasing mortality trends in all countries despite their political stability group as shown in the exploratory data analysis in section 4.1. This suggests that while good governance is helpful, the specific governance requirements of delivering healthcare may not require comprehensive governance capacity. Only specific technical interventions are necessary therefore this is a case of strategic rather comprehensive governance in which the minimal conditions of political stability and governance required for service delivery are met (Grindle, 2007).

6.3 Directions for Further Research

There is little information on the effect of political stability on health outcomes and health investment. The effect of wars has been documented but not subtle political instability as characterized by protests of government staff turnover. Health economics could benefit from multi-country longer time period studies on this relationship including intermediary relationships in order to assist with policy making in the health sector. The political economy of health is a important as the financial economics of health where nuances of politics and cultural norms could help countries reach the 2030 Millennium Development goals.

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Appendices

Appendix A - Correlation structures

Table A1 Correlation structure of life expectancy outcomes

	life_~p1	life_~p2	life_~p3	life_~p4	life_~p5	life_~p6	life_~p7
life_exp1	1.0000						
life_exp2	0.9894	1.0000					
life_exp3	0.9557	0.9883	1.0000				
life_exp4	0.8996	0.9531	0.9881	1.0000			
life_exp5	0.8283	0.8996	0.9552	0.9892	1.0000		
life_exp6	0.7534	0.8377	0.9093	0.9616	0.9911	1.0000	
life_exp7	0.6834	0.7756	0.8580	0.9234	0.9679	0.9924	1.0000
life_exp8	0.6238	0.7187	0.8062	0.8794	0.9342	0.9711	0.9927
life_exp9	0.5772	0.6695	0.7564	0.8317	0.8916	0.9372	0.9706
life_exp10	0.5440	0.6292	0.7104	0.7821	0.8420	0.8919	0.9340
life_exp11	0.5232	0.5980	0.6695	0.7334	0.7888	0.8389	0.8862
life_exp12	0.5103	0.5734	0.6334	0.6872	0.7355	0.7829	0.8322
life_exp13	0.5022	0.5537	0.6021	0.6452	0.6853	0.7283	0.7775
life_exp14	0.4972	0.5382	0.5756	0.6086	0.6405	0.6783	0.7255
life_exp15	0.4925	0.5242	0.5520	0.5759	0.6001	0.6324	0.6767
life_exp16	0.4840	0.5075	0.5269	0.5428	0.5600	0.5870	0.6279
life_exp17	0.4678	0.4835	0.4951	0.5036	0.5145	0.5363	0.5736
life_exp18	0.4411	0.4490	0.4530	0.4547	0.4598	0.4770	0.5108
life_exp19	0.4034	0.4040	0.4011	0.3969	0.3973	0.4108	0.4418
life_exp20	0.3582	0.3523	0.3438	0.3350	0.3321	0.3431	0.3722

Table A2 Correlation of MMR data over time

	mmr1	mmr2	mmr3	mmr4	mmr5	mmr6	mmr7
mmr1	1.0000						
mmr2	0.9988	1.0000					
mmr3	0.9956	0.9990	1.0000				
mmr4	0.9898	0.9954	0.9985	1.0000			
mmr5	0.9821	0.9894	0.9940	0.9984	1.0000		
mmr6	0.9694	0.9789	0.9855	0.9932	0.9981	1.0000	
mmr7	0.9547	0.9658	0.9741	0.9847	0.9926	0.9982	1.0000
mmr8	0.9394	0.9518	0.9615	0.9742	0.9844	0.9930	0.9979
mmr9	0.9229	0.9345	0.9440	0.9576	0.9688	0.9793	0.9870
mmr10	0.9059	0.9170	0.9263	0.9404	0.9526	0.9640	0.9732
mmr11	0.8947	0.9052	0.9140	0.9280	0.9401	0.9511	0.9605
mmr12	0.8879	0.8985	0.9070	0.9212	0.9330	0.9431	0.9521
mmr13	0.8780	0.8890	0.8976	0.9128	0.9255	0.9358	0.9451
mmr14	0.8713	0.8821	0.8900	0.9044	0.9162	0.9246	0.9321
mmr15	0.8596	0.8700	0.8774	0.8911	0.9019	0.9087	0.9149
mmr16	0.8551	0.8647	0.8712	0.8840	0.8935	0.8988	0.9037
mmr17	0.8449	0.8551	0.8620	0.8748	0.8839	0.8885	0.8923
mmr18	0.8361	0.8473	0.8548	0.8686	0.8788	0.8840	0.8881
mmr19	0.8214	0.8347	0.8442	0.8613	0.8750	0.8838	0.8911
mmr20	0.7959	0.8117	0.8236	0.8444	0.8620	0.8752	0.8865

Table A3 Correlation of IMR data over time

	imr1	imr2	imr3	imr4	imr5	imr6	imr7
imr1	1.0000						
imr2	0.9991	1.0000					
imr3	0.9957	0.9987	1.0000				
imr4	0.9891	0.9943	0.9984	1.0000			
imr5	0.9783	0.9859	0.9927	0.9979	1.0000		
imr6	0.9615	0.9713	0.9811	0.9899	0.9970	1.0000	
imr7	0.9362	0.9481	0.9607	0.9735	0.9859	0.9958	1.0000
imr8	0.9034	0.9173	0.9324	0.9489	0.9664	0.9831	0.9957
imr9	0.8667	0.8824	0.8997	0.9195	0.9415	0.9641	0.9841
imr10	0.8387	0.8554	0.8741	0.8957	0.9208	0.9475	0.9725
imr11	0.8124	0.8305	0.8507	0.8744	0.9019	0.9319	0.9607
imr12	0.7779	0.7979	0.8205	0.8471	0.8776	0.9109	0.9438
imr13	0.7569	0.7778	0.8016	0.8297	0.8618	0.8971	0.9322
imr14	0.7566	0.7775	0.8010	0.8288	0.8604	0.8951	0.9297
imr15	0.7541	0.7748	0.7982	0.8259	0.8574	0.8922	0.9269
imr16	0.7327	0.7542	0.7788	0.8080	0.8413	0.8782	0.9154
imr17	0.7164	0.7385	0.7641	0.7946	0.8295	0.8683	0.9077
imr18	0.7026	0.7248	0.7506	0.7815	0.8173	0.8575	0.8986
imr19	0.6895	0.7121	0.7383	0.7698	0.8064	0.8478	0.8903
imr20	0.6821	0.7049	0.7313	0.7631	0.8003	0.8422	0.8856

Table A4 Correlation of HIV incidence data over time

	hivin~e1	hivin~e2	hivin~e3	hivin~e4	hivin~e5	hivin~e6	hivin~e7
hivincide~e1	1.0000						
hivincide~e2	0.9914	1.0000					
hivincide~e3	0.9716	0.9939	1.0000				
hivincide~e4	0.9433	0.9772	0.9944	1.0000			
hivincide~e5	0.9222	0.9619	0.9854	0.9976	1.0000		
hivincide~e6	0.9008	0.9432	0.9715	0.9894	0.9966	1.0000	
hivincide~e7	0.8851	0.9270	0.9571	0.9779	0.9886	0.9973	1.0000
hivincide~e8	0.8738	0.9131	0.9432	0.9648	0.9777	0.9905	0.9978
hivincide~e9	0.8659	0.9008	0.9290	0.9496	0.9636	0.9796	0.9910
hivincide~10	0.8593	0.8883	0.9134	0.9323	0.9465	0.9646	0.9794
hivincide~11	0.8558	0.8777	0.8982	0.9138	0.9271	0.9467	0.9639
hivincide~12	0.8568	0.8745	0.8919	0.9049	0.9168	0.9359	0.9532
hivincide~13	0.8512	0.8651	0.8797	0.8919	0.9033	0.9232	0.9414
hivincide~14	0.8520	0.8661	0.8803	0.8918	0.9018	0.9196	0.9361
hivincide~15	0.8337	0.8570	0.8785	0.8982	0.9116	0.9323	0.9479
hivincide~16	0.8253	0.8540	0.8790	0.9021	0.9164	0.9368	0.9506
hivincide~17	0.8103	0.8430	0.8708	0.8974	0.9126	0.9332	0.9456
hivincide~18	0.7903	0.8297	0.8623	0.8930	0.9092	0.9294	0.9396
hivincide~19	0.7787	0.8253	0.8625	0.8963	0.9121	0.9299	0.9354
hivincide~20	0.7785	0.8294	0.8682	0.9022	0.9168	0.9313	0.9327

Table A5 Correlation of health expenditure data over time

	healt~p1	healt~p2	healt~p3	healt~p4	healt~p5	healt~p6	healt~p7
health_exp1	1.0000						
health_exp2	0.9589	1.0000					
health_exp3	0.9270	0.8920	1.0000				
health_exp4	0.9827	0.9570	0.9423	1.0000			
health_exp5	0.9150	0.9448	0.9082	0.9566	1.0000		
health_exp6	0.8012	0.8554	0.8198	0.8445	0.9290	1.0000	
health_exp7	0.6426	0.7169	0.7335	0.7113	0.8399	0.9359	1.0000
health_exp8	0.4377	0.4982	0.5630	0.5225	0.6495	0.7383	0.9110
health_exp9	0.3621	0.4183	0.4389	0.4435	0.6172	0.7102	0.8722
health_exp10	0.3807	0.3480	0.5192	0.4626	0.5028	0.6216	0.7874
health_exp11	0.3960	0.3394	0.3639	0.4419	0.2645	0.4256	0.5165
health_exp12	0.7170	0.5835	0.6336	0.7130	0.2425	0.3615	0.3402
health_exp13	0.4544	0.3588	0.2491	0.4692	-0.0211	0.0698	0.1055
health_exp14	0.4303	0.3131	0.3539	0.4560	0.0795	0.1233	0.2248
health_exp15	0.6859	0.6418	0.7125	0.7507	0.5757	0.5341	0.5857
health_exp16	0.5701	0.4679	0.5088	0.5849	0.3606	0.2800	0.3087
health_exp17	0.5696	0.3755	0.5135	0.5870	0.3075	0.1982	0.1820
health_exp18	0.7388	0.6624	0.6087	0.7604	0.5924	0.5369	0.4438
health_exp19	0.8415	0.8352	0.7408	0.8854	0.6329	0.5920	0.5707
health_exp20	.	.	.	.	.	.	.